

RESEARCH REPORT

TREE-RING DATING OF AN ARKANSAS ANTEBELLUM PLANTATION HOUSE

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ABSTRACT

As part of the Lakeport Plantation Restoration Project conducted by Arkansas State University, we examined tree-ring samples of baldcypress (*Taxodium distichum* L. Rich.) timbers from the Lakeport Plantation house in Chicot County, Arkansas. Our objectives for the study were to: (1) determine cutting dates of timbers used in the construction of the plantation house and an ancillary log shed in order to support or refute available historical and archaeological evidence for the construction date of the structures, and (2) provide tree-ring data to improve the spatial and temporal tree-ring record for the region. We determined that virtually all the cutting dates for the plantation house were confined to the dormant season of 1858–1859 suggesting that cutting and construction occurred at approximately the same time. We positively dated a total of 25 samples against the exactly-dated master chronology based on living baldcypress trees at Black Swamp, Arkansas, and compiled a 346-year chronology extending from 1537 to 1883. These findings provide absolute quantitative evidence of the age and construction history of one of the most important antebellum buildings in Arkansas and additional background on the material culture of the “cotton aristocracy”.

Keywords: dendroarchaeology, dendrochronology, tree-ring dating, Lakeport Plantation, baldcypress, *Taxodium*, Chicot County, Arkansas.

INTRODUCTION

Lakeport Plantation house, which has been listed on the National Register of Historic Places since 1974 (Figure 1), is located just west of the Mississippi River in Chicot County, Arkansas (Figure 2). Based on the available historical, architectural and archaeological evidence, experts believed that construction of the Lakeport Plantation house occurred between 1858 and 1860 (DeBlack 1995, 2000), but the exact date of construction was not clear. If the structure was in fact built before the Civil War, it would be the only large antebellum plantation house still standing in Arkansas. At the request of The Lakeport Plantation Restoration Project at Arkansas State University, we undertook a tree-ring

analysis of the construction timbers to date the construction of the main house and an ancillary log shed.

The use of tree-ring dating techniques to determine the age of timber structures represents one of the first applications of the science of dendrochronology in the United States (*e.g.* Douglass 1929). Although dendroarchaeological techniques have been frequently used to study prehistoric structures in the Southwestern US (*e.g.* Nash 1999), the successful application of tree-ring dating or “dendroarchaeology” in the Eastern US has generally been focused on historic-era log structures.

Lassiter (1938) was one of the first researchers to use dendroarchaeology in the Eastern US. His study was not focused on dating historic structures, but he did sample a number of log buildings in eastern Tennessee as part of a tree-

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Figure 1. The east elevation of Lakeport Plantation House, following a full restoration. Dendroarchaeological sampling took place in November 2002. (Photograph courtesy of Lakeport Plantation: lakeport.astate.edu).

ring study of stream flow. Forty years later, Stahlé (1978, 1979) carried out a massive dendroarchaeological campaign focused on historical log buildings in Arkansas. More recently, the technique has been successfully applied to a variety of historic-era log and timber structures in the Eastern US including Independence Hall in Philadelphia, Pennsylvania (Cook and Callahan 1992), Republic-era log buildings in Texas (Therrell 2000), a number of structures in Tennessee (Grissino-Mayer and van de Gevel 2007; Lewis *et al.* 2009; Mann *et al.* 2009; Slayton *et al.* 2009), and other structures in the Southeast (*e.g.* Bortolot *et al.* 2001; Stine *et al.* 2003; Wight and Grissino-Mayer 2004; Grissino-Mayer *et al.* 2010). A more complete discussion of dendroarchaeological research in the southeastern US can be found in Grissino-Mayer (2009).

In addition to establishing “*terminus post quem*” dates, that is the year in or after which structures have been built, dendroarchaeology can aid in the study of remodeling and other alterations to buildings including the use of salvaged timbers from older structures and the replacement of timbers. Other important aspects of archaeological tree-ring samples are the potential to use historical samples to extend both the length of tree-ring chronologies based solely on living trees and to provide long tree-ring records in areas where old living trees do not survive. These capacities are frequently quite valuable in the

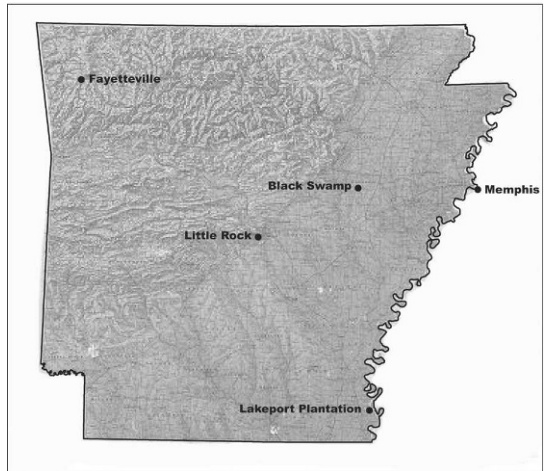


Figure 2. Map of Arkansas showing the location of Lakeport Plantation (southeastern corner), and the Black Swamp baldcypress site (east central) that was used to date tree-ring samples from Lakeport. Both tree-ring sites lie in the Mississippi River Delta region about 130 miles (209 km) apart.

eastern US where, if available, living trees are typically only 200 to 300 years old and the addition of archaeological samples may greatly extend the available tree-ring record (Therrell 2000).

HISTORY OF THE STUDY SITE

Lakeport Plantation house (Figure 1) was built to display the wealth and power of Mr. Lycurgus Johnson, a nephew of Vice President Richard M. Johnson, and one of the wealthiest men in Arkansas prior to the Civil War. At the time of the construction of the house, in the late 1850s, he owned over 4,000 acres (1,619 ha) and 155 “slaves” (DeBlack 2000). Lycurgus was the eldest son of Joel Johnson, a prosperous miller from Scott County, Kentucky, who came to the Arkansas Territory in 1831 and spent the following 15 years establishing a plantation in Chicot County, near the Lakeport landing on the Mississippi River. Lycurgus left the family’s home in Kentucky and joined his father in Chicot County in the 1830s to establish his own plantation downriver from Lakeport.

Upon his death in 1846, the elder Johnson’s sizable estate of 3,600 acres (1,457 ha) and 96 enslaved individuals was to be divided among his

six children including Lycurgus, the eldest son (DeBlack 2000). However, a lengthy court battle over the disposition of the estate prevented Lycurgus and the other heirs from gaining control of Joel's plantation until 1857. This suggests that construction of the Lakeport Plantation house did not begin prior to this time (DeBlack 1995).

The house is an L-shaped, two-story, structure of 17 rooms built almost entirely of baldcypress (*Taxodium distichum* L. Rich.), in a modified Greek Revival style (Figure 1). The front of the house faces east towards the Mississippi River and has a two-story portico with square columns supporting each floor and is topped by a triangular pediment gable. The first floor is raised about 4 feet (1.2 m) above the ground to prevent flooding (DeBlack 1995, 2000).

Lycurgus Johnson was likely well prepared to begin construction of such an impressive house in 1859 as the price of cotton had achieved record levels in 1856 and continued to remain high in 1860. The good times would not last however. During the Civil War Chicot County was devastated by Union troops and widespread looting (Jones 2000). Fortunately, the Lakeport Plantation house remained essentially unharmed throughout this period despite the fact that at one point Union soldiers took all of the plantation's horses and cattle (DeBlack 1995).

Following the war, Johnson's fortune was dramatically reduced by the loss of more than \$100,000 in value represented by the people he formerly held as slaves and virtually all other trappings of wealth. However, Johnson still owned a great deal of land and by 1870 was again relatively prosperous, though cotton production at Lakeport was only about half that of 1860 (DeBlack 1995). Johnson died in 1876 and his son Victor, a prominent local doctor, sold the plantation to the Sam Epstein family around 1930. The plantation house was occupied by Alvin Ford, the plantation manager until 1972, and was gifted by the Epstein family descendants to Arkansas State University in 2001. In addition to serving as a historical museum, the plantation remains in cotton cultivation as it has since 1830.

Originally, two brick outbuildings and other auxiliary buildings were also adjacent to the

plantation house. At the time of our sampling, the site included a hewn log shed north of the main house (Figure 1). Although apparently not on its original site, it was suggested that this log building might also date to the antebellum period, if not to the initial occupation of the property.

METHODS

We sampled the main house and log shed in November 2002. We obtained 0.4 inch (10 mm)-diameter tree-ring core samples and small cross-sections from 47 building timbers from the attic of the house (Table 1) and 14 cross-sections from 11 hewn logs and three floorboards in the log shed (Table 2). All of the tree-ring specimens from the house and all but three samples (the floorboards) from the log shed were cut from baldcypress trees believed to have been growing in the immediate vicinity of the property. We specifically sampled timbers with the objectives of retrieving specimens displaying bark or "waney edge", indicating the true outer surface of the tree, and collecting samples with the greatest number of annual rings. We also documented the architectural provenience of each specimen (Tables 1 and 2).

We sanded all specimens to a high polish to reveal the minute anatomy of the annual growth rings (*e.g.* Orvis and Grissino-Mayer 2002; Figure 3). After plotting the pattern of wide and narrow rings on each sample, we used the skeleton plot method (Stokes and Smiley 1968) to exactly crossdate samples from the historical Lakeport structures against a previously developed, baldcypress chronology from the Rex Hancock-Black Swamp Wildlife Management Area, near Cotton Plant, AR, about 130 miles (209 km) north of Lakeport (Stahle and Cleaveland 1980; Figure 2). The temporal length of this chronology extends well beyond the potential construction date of the Lakeport house (Stahle and Cleaveland 1996).

For each of the samples that we were able to exactly crossdate against the Black Swamp chronology, we measured the annual rings on the dated specimens to the nearest 0.001 mm with a microscope and stage micrometer and analyzed the numerical time-series with the computer program COFECHA to check the accuracy of

Table 1. Tree-ring data from the Lakeport Plantation House, Chicot County, Arkansas. All samples were collected from baldcypress timbers in the attic over the main house [B = bark; OS = outside surface (bark probably present); vv = a non-cutting date; TR = terminal ring is I = incomplete (cut during growing season) or C = complete (cut during dormant season); X = true cutting date; NC not a true cutting date]. Dated specimens are listed by order of the outer ring date (column 3). University of Arkansas Museum Accession Number is 02-210. Collected November 2002.

Sample ID	Provenience	Dating	Ring Type	TR	Cutting Date?
LPH02A	Center post, south		B		
LPH03A	Rafter, north hip, 4th from west		B		
LPH05A	Rafter, north hip, 10th from west		B		
LPH07A	Rafter, east hip, 24th from south		B		
LPH08A	Rafter, east hip, 25th from south		B		
LPH09A	Same tree as LPH08A		B		
LPH10A	Rafter, east hip, 20th from south		B		
LPH11A	Rafter, east hip, 18th from south		B		
LPH12A	Rafter, east hip, 17th from south		B		
LPH14A	Rafter, west hip, 2nd from south		B		
LPH15A	Rafter, west hip, 8th from south		B		
LPH16A	Rafter, west hip, 10th from south		B		
LPH18A	Rafter, west hip, 19th from south		B		
LPH24A	Cap board over joists, south bay		B		
LPH26A	Cap board over joists, south bay		B		
LPH29A	Stud, east wall, 4th from north		OS		
LPH31A	Stud, east wall, 7th from north		OS		
LPH32A	Stud, east wall, 15th from north		OS		
LPH34A	Stud, east wall, 17th from north		OS		
LPH36A	Plate, east hip, rafter 9–10 from north				
LPH37A	Plate, east hip, rafter 9–10 from south				
LPH38A	Rafter fragment				
LPH43A	Roofing board over rafters, east hip				
LPH44A	Roofing board over rafters, east hip		OS		
LPH45A	Roofing board over rafters, east hip		OS		
LPH01A	Center post, north	1616–1760	vv		
LPH27A	Cap board under north center post	1649–1822	OS	I	X
LPH39A	Vertical framing by north center post	1681–1842	vv		NC
LPH40A	Vertical framing by east wall	1743–1852	vv		NC
LPH41A	Vertical framing by east wall	1674–1853	vv		NC
LPH04A	Rafter, north hip, 5th from west	1730–1858	B	?	X
LPH06A	Rafter, north hip, 11th from west	1813–1858	B	C	X
LPH13A	Rafter, east hip, 16th from south	1816–1858	B	C	X
LPH17A	Same tree as LPH16A	1811–1858	B	?	X
LPH19A	Joist, south bay, 16th from west	1818–1858	B	C	X
LPH20A	Joist, south bay, 21st from west	1616–1858	OS	C	X
LPH21A	Joist, central bay, 7th from west	1814–1858	B	C	X
LPH22A	Joist, south bay, 29th from west	1604–1858	OS	C	X
LPH23A	Joist, north bay, 10th from west	1815–1858	OS	C	X
LPH28A	Rafter jack, west hip	1759–1858	OS	I	X
LPH30A	Stud, east wall, 5th from north	1763–1858	OS	C	X
LPH33A	Stud, east wall, 16th from north	1705–1858	OS	?	X
LPH35A	Plate, east hip, rafter 8–9 from south	1675–1858	B	C	X
LPH42A	Roofing board over rafters, east hip	1709–1858	OS	?	X
LPH47A	Roofing board over rafters, east hip	1803–1858	OS	C	X
LPH25A	Cap board over joists, south bay	1684–1859	OS	C	X
LPH46A	Roofing board over rafters, east hip	1834–1883	OS	?	X

Table 2. Tree-ring data from the Lakeport Plantation Log Shed, Chicot County, Arkansas. Specimens LPS01A through LPS11A are baldcypress logs. Dated specimens are listed by order of the outer ring date (Column 3). None of the samples from the shed preserved the true outermost bark surface of the timber, so none of the dates reported below are actual cutting dates. University of Arkansas Museum Accession Number is 02-211. Collected November 2002.

Sample ID	Provenience	Dating
LPS01A	North wall, log 4 from bottom	
LPS02A	North wall, log 5 from bottom	
LPS04A	North wall, log 8 from bottom	
LPS05A	South wall, log 1 from sill	
LPS07A	South wall, log 3 from sill, a and b	
LPS08A	South wall, log 4 from sill	
LPS09A	South wall, log 5 from sill	
LPS10A	South wall, log 6 from sill	
LPS12A	Tongue and groove floor board, pine	
LPS13A	Tongue and groove floor board, pine	
LPS14A	Tongue and groove floor board, pine	
LPS11A	South wall, log 7 from sill	1537–1736
LPS06A	South wall, log 2 from sill, a and b	1591–1737
LPS03A	North wall, log 7 from bottom	1569–1802

the visual crossdating and measurement (Holmes 1983; Grissno-Mayer 2001). To make additional comparisons between the dated Lakeport series and the Black Swamp master chronology, we used the computer program ARSTAN (Cook 1985) to develop a residual tree-ring chronology from the Lakeport samples. This chronology is based on standardized dimensionless ring-width measurements (mean = 1.0) that were detrended to remove low-frequency variance trend associated with age-related decline in growth rate. We used a double-detrending process, whereby each series was first fitted with a negative exponential or straight-line curve, followed by a cubic smoothing spline of “n” percent (65%) of the series length (e.g. Cook 1985).

We also examined each dated sample to determine whether the outermost ring was a possible cutting date and whether the ring was complete or incomplete, indicating the season of cutting (Tables 1 and 2).

RESULTS

Of the 47 samples collected from the plantation house, twenty-two separate timbers were

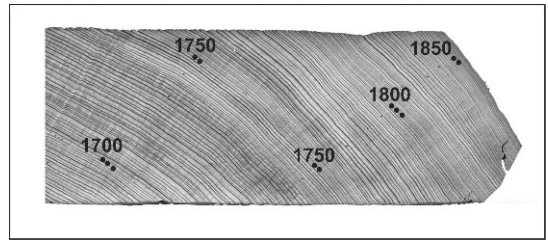


Figure 3. The polished cross-sectional surface (ca. 2 × 5 inches [51 × 127 mm]) of a timber from the Lakeport Plantation house (LPH35A; Table 1). Note that this sample includes the curved outermost surface of the tree when felled (wane edge) indicating that the baldcypress tree from which the timber was cut was felled after the growing season of 1858. The centuries are marked with three black dots. The mid-centuries (e.g. 1850) are marked with two black dots.

dated including one cutting date at 1822, a cluster of 14 cutting dates at 1858, one at 1859, and one at 1883. Three of the remaining samples appeared to be near-cutting dates close to 1858 (Table 1). The logs in the shed were partially covered with siding, and we were unable to identify any timbers that retained the true outer surface, or bark ring. We were only able to date three samples from the log shed and were not able to determine the cutting dates of these trees (Table 2).

Correlation analyses performed using the program COFECHA confirm the cross-synchronization among the visually dated tree-ring time series from the main house and log shed (Table 3). The correlation values reported in Table 3 refer to the match between each individual specimen and its common period of overlap with the master dating chronology for the Lakeport collection, excluding the specimen being tested from the computation of the master chronology. The highly significant correlation between most of the dated specimens and the Lakeport master chronology provides strong confirmation of the visual dating (Table 3). Although overall average correlation with the master chronology was good, several series particularly those from the log shed displayed low correlation with the master. However, visual dating of the series was reasonably good and comparisons between these series and both the Lakeport master chronology and the Black Swamp chronology using COFECHA gave no indication that the dating was incorrect.

Table 3. Correlation analysis of the dated tree-ring specimens from the Lakeport Plantation house and shed arranged by ID number (see Tables 1 and 2). A few series (e.g. LPH01A, LPH46A) show poor correlation with the Lakeport master chronology, but based on the skeleton plot analysis, we are confident of the dating.

Seq.	Series	Measured Interval	No. Years	No. Segmts	No. Flags	Corr. with Master	p value <
1	LPS03A	1570–1801	232	10	4	0.406	0.0001
2	LPS06A	1592–1736	145	6	3	0.379	0.0001
3	LPS11A	1538–1735	198	7	3	0.370	0.0001
4	LPH01A	1617–1760	144	6	6	0.190	0.0226
5	LPH04A	1730–1858	129	5	0	0.658	0.0001
6	LPH06A	1814–1858	45	1	0	0.732	0.0001
7	LPH13A	1817–1858	42	1	0	0.684	0.0001
8	LPH17A	1812–1858	47	1	0	0.610	0.0001
9	LPH19A	1819–1858	40	1	0	0.557	0.0002
10	LPH20A	1617–1858	242	10	1	0.529	0.0001
11	LPH21A	1815–1858	44	1	0	0.721	0.0001
12	LPH22A	1605–1858	254	10	4	0.386	0.0001
13	LPH23A	1816–1858	43	1	0	0.687	0.0001
14	LPH25A	1685–1858	174	7	0	0.560	0.0001
15	LPH27A	1650–1821	172	6	2	0.437	0.0001
16	LPH28A	1760–1858	99	4	0	0.580	0.0001
17	LPH30A	1764–1858	95	4	0	0.599	0.0001
18	LPH33A	1706–1858	153	6	0	0.704	0.0001
19	LPH35A	1676–1858	183	7	0	0.662	0.0001
20	LPH39A	1682–1742	61	2	0	0.430	0.0005
21	LPH40A	1744–1835	92	4	0	0.676	0.0001
22	LPH41A	1675–1820	146	5	1	0.623	0.0001
23	LPH42A	1710–1858	149	6	0	0.696	0.0001
24	LPH46A	1835–1882	48	1	1	0.273	0.06
25	LPH47A	1804–1858	55	2	0	0.394	0.0029
Total/mean			3032	114	25	0.521	

Statistical and visual comparisons between some of the series (e.g. LPH40 and LPH 41) suggest that at least some of the samples could have been sawn from the same tree. Obviously, it is unlikely that each of the samples represent unique individual trees, however it is not possible to positively determine which samples are from the same tree, and this issue should not materially impact the tree-ring dating of the house.

We compared a composite residual chronology developed from all 25 of the dated Lakeport Plantation baldcypress samples with the residual chronology of baldcypress from Black Swamp, and confirmed that the exact calendar dating of the full Lakeport record extended from 1537 to 1883. Because of the relatively poor correlation displayed between some of the Lakeport samples and the Lakeport master chronology in the COFECHA analysis, we also developed a residual chronology that included only the samples from the plantation house, which

showed interseries correlation values >0.4 but found that this chronology was in fact less well-correlated with the Black Swamp residual chronology than the full Lakeport chronology (not shown).

The well-replicated portion of the full Lakeport chronology is compared with the master chronology from Black Swamp in Figure 4. Note the many instances of agreement between the chronologies during the period of comparison, especially in years of below-average tree growth. Historical records indicate that the 1850s drought that is apparent in the Lakeport chronology was quite injurious to the cotton crop. The year 1854 was described as "...the hottest and driest summer" in 20 years by one Chicot County resident (DeBlack 1995).

DISCUSSION

The tree-ring cutting dates shown in Table 1 indicate that construction of the Lakeport Plan-

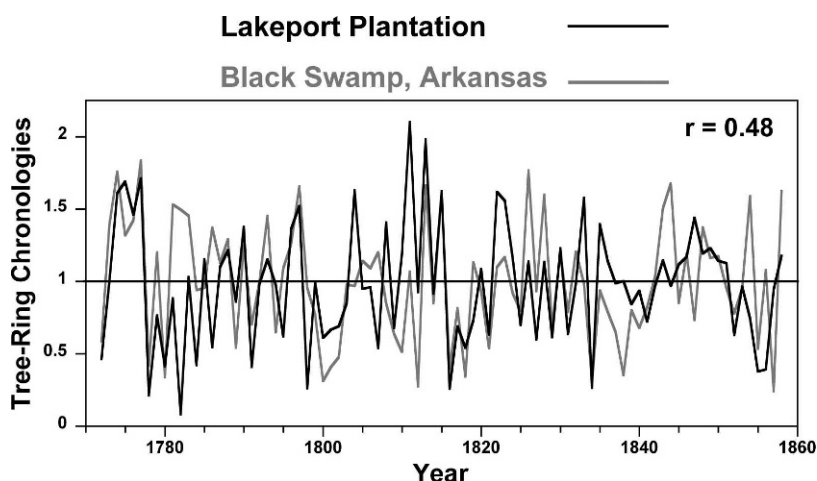


Figure 4. A time-series comparison, from 1772–1858, of the well-replicated portion of the Lakeport Plantation residual chronology (black line) with a portion of the Black Swamp residual chronology (gray line; Stahle *et al.* 1980), against which the Lakeport samples were crossdated. The correlation between the two chronologies is $r = 0.48$, $n = 87$ years, $t = 5.04$, $p < 0.0001$. The y-axis indicates dimensionless tree-growth indices (mean = 1.0).

tation house was definitely not completed before the growing season of 1858. Fourteen cutting dates cluster at 1858, and one cutting date occurred in 1859. The cutting date at 1822 is difficult to explain. Presuming that it is truly a bark-ring date, the timber might have been cut from an already dead tree, or was perhaps reused from an older structure. The cutting date at 1883 was obtained from a roofing board nailed above the rafters, and probably dates a roof repair event in the 1880s.

Taken together, these cutting dates indicate that the bulk of the tree-felling activity apparently occurred during the dormant season of 1858 or early 1859. The fact that at least one building timber came from a living tree containing a complete 1859 ring suggests that the structure could not have been completed before May or June of 1859. Given the demanding nature of cotton agriculture during the growing and harvesting season, it seems likely that the felling of timber was carried out in the late fall and winter, after the cotton harvest.

These tree-ring dating results provide strong confirmation of the historical analyses on the Lakeport Plantation by DeBlack (1995) who suggested that construction of the main house began in 1858 following the conclusion of litigation related to the property in 1857. Deblack

(1995) also noted that Lycurgus Johnsons' county tax assessment sharply increased in 1860, suggesting that the house was completed that year.

None of the samples from the log shed represent cutting dates. The outermost dated ring is 1802, but the logs were likely felled much later in the 19th Century. The available evidence suggests that the shed structure is not contemporaneous with the plantation house. For example, most of the samples from the shed could not be dated (Table 2), and the correlation of the three dated samples with the Lakeport master chronology (Table 3) is lower compared with most of the samples from the house. Furthermore, the inner dates of the shed samples are generally much earlier than samples from the house (Tables 1 and 2). These characteristics suggest that this timber came from a different population of trees than did the material used in the house construction. Also, in comparison to the plantation house, the shed is rather crudely constructed and apparently was moved to the location near the house at some more recent time.

CONCLUSIONS

The objective of this study was to perform a tree-ring analysis of the construction timbers of the main house and an ancillary log shed at

Lakeport Plantation to supplement the historical, architectural and archaeological evidence, which suggested that construction of the house occurred between 1858 and 1860. The cutting dates determined in our study of the Lakeport plantation house clearly indicate that virtually all of the timber used to build the house was felled sometime after the growing season of 1858 and before spring 1859. Although several other lines of historical research indicate a construction date close to the one determined by our tree-ring analyses, without clear historical documentation that the house was in fact constructed in 1858–1859, dendrochronology provides the most reliable method of determining when the timber was felled and therefore the earliest date that the structure could have been built. And while the limitations of the tree-ring data, (e.g. the unknown number of trees represented in the collection), should be carefully considered by future users of the data, these data represent a valuable new tree-ring record for the region.

Enslaved laborers from the plantation undoubtedly carried out the felling and processing of the enormous volume of timber that went into the Lakeport Plantation house. Unfortunately, we may never know much about the people who actually built this house. Luckily, the Lakeport house, after withstanding the vagaries of time including the looting and burning of much of the area during the Civil War (e.g. Jones 2000) became an official project of the National Trust for Historic Preservation in 2002 and has been completely restored. It is an Arkansas State University Heritage Site, which is open to the public and serves as a historical museum and educational center. As part of the preservation mission of the site, research on the enslaved people who labored on the construction of the house is being conducted and will hopefully provide a fuller picture of their contribution to this impressive structure. Indeed, one of the educational foci of the center is examining the role of African-Americans in the agricultural and cultural development of the region. We are pleased to have played a small role in the preservation and interpretation of such an important artifact in Arkansas' cultural heritage.

The samples collected from the Lakeport house are permanently archived in the University of Arkansas Museum (Accession #02-210) and the tree-ring width measurements used in this study have been contributed to the International Tree-Ring Data Bank (Stahle and Therrell 2009).

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