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Cover Page Footnote

This research was supported by the Powhatan Historic State Park. We would like to thank Dorian Burnette for statistical assistance and Park Superintendent Kristyn Watts for her aid in the historical interpretation of the Ficklin-Imboden log house.

Tree-Ring Dating of the Ficklin-Imboden Log Structures, Powhatan Historic State Park, Arkansas

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Running Title: Tree-Ring Dating of the Ficklin-Imboden Log Structures

Abstract

Powhatan Historic State Park in Powhatan, Arkansas preserves and interprets five historical structures from 19th century Arkansas, including the Ficklin-Imboden Log House. This structure, which is actually two separate log buildings with uncertain construction dates and functions, is believed to be the earliest surviving structure at Powhatan Historic State Park and is on the National Register of Historic Places. Powhatan Historic State Park contracted with the University of Arkansas Tree-Ring Laboratory to develop a more accurate dating and interpretation of the log structures. Dendrochronology (tree-ring dating) was used to determine the true felling dates of bald cypress (*Taxodium distichum*) logs in both buildings. Core specimens were extracted from 22 wall logs and 16 were dated with dendrochronology. The measured ring width data were used to develop a chronology for the buildings that was then correlated against other absolutely dated tree-ring chronologies from the region.

The strong correlation among the ring width time series from both structures provided evidence that the trees from which the logs were cut grew contemporaneously in the same area. The derived mean ring width chronology is highly correlated with tree-ring reconstructions of the Palmer Drought Severity Index (PDSI) across Arkansas and the central US from 1726 to 1846 and with other regional tree-ring chronologies, particularly one created from living bald cypress trees at Allred Lake in southeast Missouri. All possible correlation analyses between the continuous Ficklin-Imboden chronology and the Allred Lake chronology, advancing one year at a time over the past 808 years (1185–1992), indicate that the highest correlation ($r = 0.45$) is observed precisely where the log specimens were dated based on microscopic analysis and skeleton plot crossdating. The derived cutting dates extended from 1843 to 1846, with logs in both structures cut as late as 1846. Because the structures are in situ and the wall logs have not been extensively repaired or replaced,

the cutting dates indicate that the structures were likely erected simultaneously during or soon after the growing season of 1846. This date is slightly earlier than the current interpretation by Powhatan Historic State Park, but still consistent with the documentary evidence that Andrew Imboden and his wife used the building as a home by 1851.

Introduction

After the Louisiana Purchase in 1803, many non-French European settlers immigrated into modern-day northeast Arkansas. Some pushed farther west into the interior Ozark Plateau and beyond, but many chose to settle in what is now Lawrence County, Arkansas. A business man named John Ficklin arrived in present-day Powhatan in 1837 and established a ferry on the Black River in 1839 (Land Deed Book F 1845-1849, Court Deed Book C 1834-1844). In 1838, Ficklin's nephew, John Lindsey, moved to the area and is credited with designing the town plan for Powhatan in 1849 (Historic Structures Report, 1991). In these early years of western expansion, river travel was the most efficient way of transporting goods and people, and the Black River was no exception. The ferry landing at Powhatan helped make the town a regional center of trade and commerce. Multiple structures were erected in early Powhatan, including schools, churches, businesses, a courthouse, and the Ficklin-Imboden log house (Figure 1).

The Ficklin-Imboden log house is one of the earliest examples of a residential dwelling in Lawrence County, and is believed to be the oldest surviving structure in the town of Powhatan. The original construction date is thought to be ca. 1850. The property that the house and attached log room are located on once belonged to Andrew Imboden, and it is the opinion of park interpreters that the building was used as a first home with his wife, Lusinda Ficklin, niece of John Ficklin, by 1851 (Deed of Sale 1850). Original documents from this time, including census records and land deeds, provide some information on the construction, ownership, and

Figure 1. The Ficklin-Imboden log house is depicted in this historic photograph of the log structure (left) and the Lawrence County Courthouse (right) taken in ca. 1940 (photo courtesy of K. Watts). Both structures have been stabilized and restored as part of Powhatan Historic State Park

original purpose of the two log structures, but the actual date of construction is not known. This study uses dendrochronology to determine felling dates for the hewn wall logs in the Ficklin-Imboden house. These felling dates, obtained from the unhewn ‘waney’ edge of the logs, combined with original town records, deeds, census information, and historical maps, will help clarify when the structure was built, who owned the property at the time of construction, and how the Ficklin-Imboden house fits into the early history of Powhatan. This more detailed chronological information will also contribute to the interpretive mission of Powhatan Historic State Park.

Materials and methods

Tree-ring core specimens were collected non-destructively from 10 wall logs in the southernmost structure of the Ficklin-Imboden House and 12 wall logs from the northernmost structure, under contract with Powhatan Historic State Park. All 22 specimens were identified as bald cypress (*Taxodium distichum*). All wall logs were hewn on the interior and exterior face, but the top and bottom of most logs as they rest in the wall preserve the original bark surface of the tree (i.e., half-hewn logs; Stahle 1979).

The 12 mm diameter cores were collected with an electric drill and specialized coring bit. The sampling procedure began with a careful inspection to determine which logs would likely yield long ring series potentially suitable for tree-ring dating. Where possible the cores were taken from areas of the logs with

evidence of outer bark surface. After thorough visual inspection of the structures and the archive records, we found no evidence that the structures were extensively remodeled or moved from their original construction sites. Therefore, any dates derived from the wall logs should provide insight into the original construction of the structures and not some subsequent remodeling or log replacement episode.

Each specimen was mounted and polished according to standard techniques (Stokes and Smiley 1968). The Douglass method of crossdating (Douglass 1941, Stokes and Smiley 1968) using skeleton plots was used to exactly date the specimens. The specimens were measured to 0.001 mm on a stage micrometer. The computer program COFECHA was used to check the accuracy of the tree-ring dating and measurement (Holmes 1983; Grissino-Mayer 2001) and to conduct sequential correlation analyses of the derived Ficklin-Imboden chronology against the 808-year long bald cypress chronology based on living trees from the Allred Lake site in southeastern Missouri (Stahle 2018). The computer program ARSTAN (Cook 1987, Cook and Peters 1997, Cook *et al.* 2007a) was used to detrend and standardize each ring width series and then compute the mean ring-width index chronology for the Ficklin-Imboden log structures, i.e., the raw ring width measurements were power transformed and then detrended with an age-based spine, the mean index chronology was computed with a biweight robust mean of the standardized indices from each core, and the variance of the computed chronology was detrended by fitting a 100-year spine to the absolute values of the chronology (see Stahle *et al.* 2016 for further details and citations; Cook 1987; Cook and Peters 1997). The bald cypress tree-ring chronology developed from Allred Lake, Missouri (Stahle 2018) was used with COFECHA for all possible correlation analyses over the past 808 years to check the crossdating identified with the skeleton plot method (e.g., Grissino-Mayer 2001). The tree-ring reconstructions of the summer Palmer Drought Severity Index (PDSI) available in the North American Drought Atlas (NADA; Cook *et al.* 2007) were also used to confirm the dating of the Ficklin-Imboden log structures and to map the spatial pattern of correlation between the Ficklin-Imboden chronology and the exactly dated moisture reconstructions during the late 18th and early 19th centuries (e.g., Stahle *et al.* 2016).

Results

Cores were obtained from 22 wall logs in the two structures (Table 1). However, only 16 samples could be

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conclusively dated, including 8 from the south structure and 8 from the north structure. The 6 specimens that were not dated were low quality due to pest damage and contained few annual rings.

One cutting date at 1843 and ten cutting dates at 1845 and 1846 were identified. Some of the other 5 logs may also have been cut in 1845 or 1846 (Table 1), but the outer rings were too compressed to determine the exact outer date with certainty. We concluded that both structures were built with logs cut in 1845 and 1846.

Most cutting dates in 1846 had complete terminal rings (Table 1). This indicated the logs were mostly cut after the growing season of 1846 but before the growing season of 1847 (the radial growth of bald cypress in the southeastern United States typically occurs from March to July; Stahle *et al.* 2012). The single felling date at 1843 suggested that cutting began at least 3 years before the structures were erected. The wall logs therefore

appear to have been cut from 1843–1846 and stockpiled prior to the actual erection of the log buildings. Because cutting dates in 1846 were identified in both the north and south structures, it appears that the two structures were erected simultaneously, most likely in late 1846 or soon thereafter. All dated wall logs from both structures were measured, detrended, and standardized and are illustrated in Figure 2.

The Ficklin-Imboden chronology is only 121 years long (1726–1846) and some of the log samples do not span this entire period (Table 1). Nonetheless, the historic chronology is significantly correlated with other tree-ring chronologies from the region, and with the tree-ring reconstructions of the summer PDSI that have been produced in the NADA (Cook *et al.*, 2007b). The spatial pattern of correlation with the reconstructed PDSI is illustrated in Figure 3 which includes strong positive correlation over Arkansas and adjacent states.

Table 1. Tree-ring dating results from the Ficklin-Imboden Log House, Powhatan, Arkansas, are arranged chronologically by the date of the outermost ring. Core specimens were all extracted from bald cypress (*Taxodium distichum*) wall logs. Column Headers: ID = specimen identification number; PROVENIENCE = location of timber specimen (“SW” = south wall of building; “L8” = wall logs were counted consecutively from the lowest log); BARK = true outermost ring is or is not present on the core (OS = outer surface [likely bark ring]; B = bark); INNER DATE = innermost dated ring on the specimen; OUTER DATE = outermost dated ring on the specimen; TR = terminal ring (C = complete [cut during dormant season]; I = incomplete [cut during the growing season, if a true cutting date]); CUT DATE = outer date represents the true cutting date of the tree (yes or no).

ID	PROVENIENCE	BARK	INNER DATE	OUTER DATE	TR	CUT DATE
Southern Structure						
PSP04A	SW L8	OS	1745	1837	I	No
PSP01A	WW L8	—	1735	1844	C	No
PSP03A	WW L10	OS	1758	1845	C	Yes
PSP08A	WW L5	OS	1742	1845	C	Yes
PSP09A	WW L6	B	1771	1845	C	Yes
PSP02A	WW L9	OS	1780	1846	C	Yes
PSP05A	EW L10	OS	1740	1846	C	Yes
PSP07A	WW L2	OS	1791	1846	C	Yes
Northern Structure						
PSP13A	EW L1	—	1726	1841	C	No
PSP14A	EW L4	OS	1725	1842	C	No
PSP20A	WW L2	—	1739	1844	I	No
PSP12A	SW L3	B	1740	1843	C	Yes
PSP18A	NW L5	OS	1730	1845	C	Yes
PSP17A	NW L4	OS	1733	1846	C	Yes
PSP22A	WW L5	B	1757	1846	I	Yes
PSP15A	EW L5	OS	1754	1846	C	Yes

Ficklin-Imboden Log Structures Powhatan State Park, Arkansas 16 Baldcypress Wall Logs

Figure 2. The detrended and standardized ring-width indices from the 16 dated and measured wall logs from the Ficklin-Imboden log structures are plotted (black time series) with the mean (red time series). Note the strong time series matching among the various cores, especially during 1762, 1778, 1789, 1792, 1809, 1810, 1820, and 1834, which were years of inferred dryness over the central U.S. The average correlation among the 16 cores is $RBAR = 0.46$.

Figure 3. The Ficklin-Imboden chronology is correlated with the gridded tree-ring reconstructions of summer PDSI available in the NADA (Cook *et al.* 2007). Note the strong correlation over Arkansas and adjacent states.

For a time series comparison, tree-ring reconstructed PDSI was extracted from the NADA and averaged for the central Arkansas region (within 34–35°N and 91.5–93.5°W; e.g., Stahle *et al.* 2016). The Ficklin-Imboden chronology is plotted with summer PDSI from 1726–1846 in Figure 4a, and from 1755–1843 in Figure 4b when the historic chronology is replicated with at least 10 logs per year. There is generally good agreement between these series despite the fact that the Ficklin-Imboden chronology is only 121 years long.

The mean index chronology for the Ficklin-Imboden structures correlates significantly with tree-ring reconstructed summer PDSI for central Arkansas, especially from 1755–1843 when the historic chronology is best replicated ($n \geq 10$ for each year). This time series agreement is plotted in Figure 4ab. The correlation between the regional PDSI and the Ficklin-Imboden time series is $r = 0.50$ ($p < 0.001$; 1755–1843).

For a statistical test of the dating, the best replicated continuous 89 years of the Ficklin-Imboden historic

Figure 4. (a) The Ficklin-Imboden chronology (red) is compared with the tree-ring reconstructed summer PDSI for central Arkansas (black) from 1726–1846. (b) The best replicated portion of the Ficklin-Imboden chronology (red) is plotted with the PDSI (black) for 1755–1843 and the two series are correlated at $r = 0.50$.

chronology (1755–1843) was compared with all possible continuous 89-year intervals from 1185 to 1992 against the 808-year long bald cypress chronology from Allred Lake in southeast Missouri (Stahle 2018) using the computer program COFECHA. The highest single correlation computed when comparing the Ficklin-Imboden chronology with the Allred Lake series was $r = 0.45$ at the exact chronological position (1755–1843) determined visually using the skeleton plot method.

Discussion

The 11 cutting dates determined from the wall logs of the Ficklin-Imboden log structures ranged from 1843 to 1846. The single cutting date from 1843 indicates that cutting began at least three years prior to construction, and logs were likely stockpiled prior to the actual construction of the buildings. Logs cut in 1846 were identified in both structures, indicating that they were likely built simultaneously, contrary to the current

interpretation which asserts that the northernmost building was a significantly later addition.

Little is known about the early history of Block 4, Lot 6, where the Ficklin-Imboden House was constructed, prior to 1847. Andrew Balfour received the land from Governor Thomas Drew in 1847 (Deed of Sale 1847) and Balfour sold the land to John Ficklin's nephew John Lindsey in 1848 (Deed of Sale 1848). Though Ficklin died in 1846 while returning from the Mexican-American War (Tipton 2001), he had been involved in the settlement of Powhatan, as evidenced by his establishment of Ficklin Ferry. One possibility is that the Ficklin-Imboden House was under construction at his direction while he was away to facilitate the development of the town. After his death, the land was put up for sale by the governor and sold to Balfour. Lindsey later bought the land and continued his uncle's work of establishing Powhatan, Arkansas. Additional archival and archaeological research might help clarify the early history of the Ficklin-Imboden house and the town of Powhatan.

Conclusions

Tree-ring dates on 16 timbers in the Ficklin-Imboden house indicate that the trees used as wall logs in both the north and south structures were felled primarily in 1845 and 1846. These results largely confirm the available historical information and indicate that the Ficklin-Imboden house is the oldest still standing structure at Powhatan Historic State Park. The current interpretation indicates that the larger southern room was the main living quarters and the smaller north structure was a later kitchen addition. However, the tree-ring dates indicate that these two structures were likely built simultaneously using logs stockpiled for perhaps 2 to 4 years. Archival and archaeological research might help clarify the functions of each log structure and the earliest history of the town of Powhatan. The new tree-ring dates do support the interpretation that the Ficklin-Imboden log buildings were occupied by Andrew Imboden and his wife by 1851.

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