Tree-Ring Dating of the Jean Hasbrouck House in New Paltz, New York

By

Edward R. Cook
Paul J. Krusic
William J. Callahan

Introduction

The Jean Hasbrouck house is one of the original houses built by the Hasbrouck family who founded the Village of New Paltz in 1677. It is one of six early colonial houses owned and operated as historic house museums by the Huguenot Historical Society, also located in New Paltz. The construction of the "Jean house" is thought to have begun as early as 1694, with its current configuration thought to have been finished by 1712. In 1714, Jean Hasbrouck died, leaving the house to his son. These dates derive from the analysis and interpretation of historical records. However, there is some uncertainty concerning the actual construction history of the Jean house that can not be resolved from the available historical information alone. For this reason, the Huguenot Historical Society arranged for Edward R. Cook, Paul J. Krusic, and William J. Callahan to conduct a dendrochronological study of the Jean house in order to establish a more precise construction history. This report describes the results of that study.

Methods

Dendrochronology is the science of dating and analyzing annual growth rings in trees. Its first significant application was in the archaeological dating of the ancient Indian pueblos of the southwestern United States (Douglass 1921, 1929). Andrew E. Douglass is considered the "father" of dendrochronology, and his numerous early publications concentrated on the application of tree-ring data for archaeological dating. Douglass established the connection between annual ring width variability and annual climate variability, which is responsible for the establishment of precisely dated wood material (Douglass 1909, 1920, 1928; Stokes and Smiley 1968; Fritts 1976; Cook and Kariukstis 1990). Since 1921, dendrochronological methods, first developed by Douglass, have been perfected and employed throughout North America, Europe, and much of the temperate forest zones of the globe (Edwards 1982; Heikkenen and Edwards 1983; Holmes 1983; Stahle and Wolfman 1985; Krusic and Cook 2001). In Europe, where the dating of buildings and artifacts is as much a profession as a science, the history of tree-ring dating is tremendous (Baillie 1982; Eckstein 1978; Eckstein 1984).

During the Spring of 2002, Edward R. Cook, Paul J. Krusic, and William J. Callahan visited the Jean Hasbrouck house and conducted the dendrochronological sampling that is the basis of this report. A total of 13 oak cores were collected from major timbers in all major sections of the basement. In addition, 14 pine samples were collected from selected attic timbers, and 3 pine samples were extracted from large exposed ceiling beams in the ground floor section of the house. Considerable care was taken to locate and take wood samples with bark (or wany) edges in order to determine the exact year in which the trees were cut. This provides the most precise estimate of the construction date of the house in question.

The wood core samples were processed following well-established methods of dendrochronology. They were taken to our Tree-Ring Lab where they were carefully glued onto grooved mounting sticks. The wood cores were than sanded to a high polish to reveal the annual tree rings clearly. The rings were than measured to a precision of ± 0.001 mm. The actual cross-dating procedure involved the use of a computer program called COFECHA (Holmes 1983), which uses a sliding correlation method to identify probable cross-dates between tree-ring series. Experience has shown that this method of cross-dating is superior to that based on the skeleton plot method (Stokes and Smiley 1968) for oaks growing in the northeastern United States. It is also very similar to the highly successful CROS program used by Irish dendrochronologists to cross-date European oak tree-ring series (Baillie 1982).

We used COFECHA to first establish internal or relative cross-dating among the house timbers. This step is critically important because it locks in the relative positions of the timbers with each other and indicates whether or not the dates of those specimens with outer bark rings are consistent. Having done this, we compared the internally cross-dated series with independently established tree-ring chronologies from old living trees and historical tree-ring material. All of the "dating masters" used are completely independent of the samples taken from the Jean house.

Results

The results of the dendrochronological sampling are summarized in three figures (**A1-A3**) contained in the **Appendix** of this report, with details on the dating of each timber given in **Tables 1** and **2**. **Figure A1** shows the oak dating results. Seven of the 13 oak timber samples could be confidently dated, with 6 having outer "cutting dates" of 1721 because of the clear presence of bark edges. The 1721 date comes from all four quadrants of the basement (see **Fig. A1**), which suggests only a single construction phase in the existing house. This result is contrary to the historical documentation noted in the **Introduction**, which suggested an earlier construction phase beginning around 1694 and the completion of the existing house in 1712. Given that Jean Hasbrouck died in 1714, the 1721 date also indicates that the existing house was probably built by his son, perhaps to accommodate an expanding family.

The 1721 construction date appears to contradict the earlier construction history derived from historical documents. However, one remaining tree-ring date from the basement suggests that the existing house was actually built on the site of a pre-existing structure. A fireplace lintel in the old hearth section of the basement (JH18; see **Fig. A1**) yielded an anomalously early outer date of 1677. Given the shaping applied to the oak timber used for the lintel, we can not be certain that 1677 is date when the tree was felled. However, the wood surface where the sample was taken appears to be reasonably close to an outer bark edge because of the probable existence of sapwood in the sample. Thus, we suggest that the fireplace lintel is the remaining part of a structure that was built before 1721, perhaps even in 1694 if the historical documentation is correct.

Interestingly, the remaining six undated basement oak timbers have distinctly different tree-ring characteristics, with fewer rings (average: 68 rings) and faster growth (average: 1.93 mm) compared to those that were successfully dated (average: 179 rings and 0.99 mm). However, five of the six undated timbers do cross-date amongst themselves, and they have a common, albeit unknown, cutting date because their bark-edge rings align perfectly. Given that these five undated timbers are located in three of the four quadrants of the basement along side the 1721 dated timbers (see **Fig. A1**), it is plausible that they were cut at the same time for that construction phase. However, the noted differences in growth rate and number of rings between the dated and undated timbers indicates that the latter trees were harvested from a different site with decidedly different growth conditions (say floodplain vs. upland), and the oak species may be different as well (say red oak vs. white oak). In any case, with only 68 annual rings on average from the undated oak timbers, it is extremely difficult to date them with any confidence.

The locations of the 14 attic and 3 ground floor pine samples are shown in **Figs. A2** and **A3**. The species of pine appears to be red pine, a very unusual species to be found now in the Hudson Valley. All of the pine samples were processed in the identical manner as the oak samples, and 10 out of 13 cross-dated amongst themselves with the outermost rings aligning to within ±1 year in most cases. This indicates that the pines were cut around the same time for the construction of the Jean House. Unfortunately, none of the pine tree-ring series cross-dated with any existing conifer or oak dating masters, including four long conifer tree-ring chronologies from the nearby Shawangunk Mountains. This negative result clearly indicates that the pine species used in the Jean house (most likely

red pine) has a decidedly different growth pattern compared to all other tree species used for cross-dating, due perhaps to different site conditions or genetically different ways of responding to climate. Presently, no old living red pines are known to exist in the Hudson Valley, which limits our ability to further test the Jean house pines for cross-dating. However, given the very firm 1721 cutting date of the basement oaks, the upper levels of the house probably used pine timbers cut around the same time.

Figure 1 below shows the degree of cross-dating between the Jean house oak tree rings and a regional oak dating master based on a combination of living trees and historical tree-ring data. This is the best result among six completely independent dating masters used for dating the Jean house oak tree rings. The oak dating masters cover areas from eastern Massachusetts to northern Virginia. Yet, ALL six produced the same 1721 date with a statistical significance of less then 1 in 1000 ($p<0.001$). Therefore, there can be no doubt whatsoever concerning the validity of the 1721 cutting date for the Jean house basement oaks.

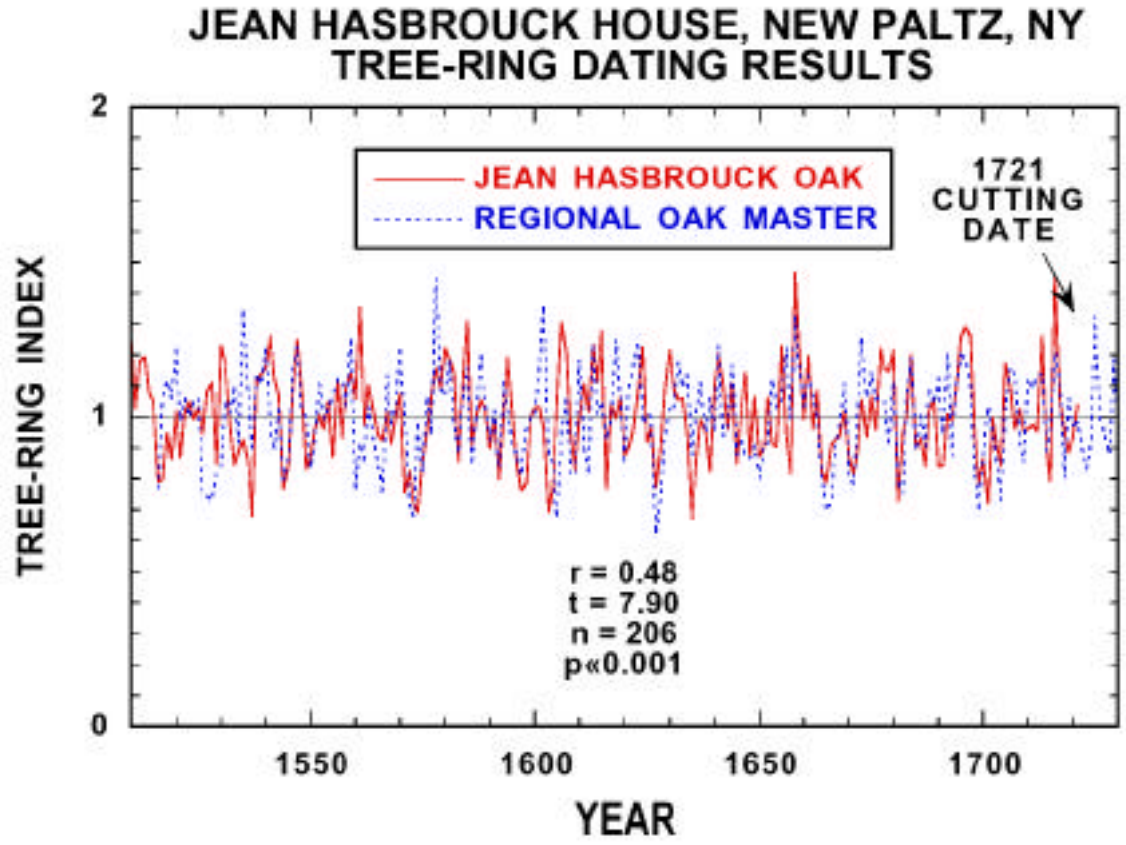

Figure 1. Comparison of the Jean Hasbrouck house historical oak chronology with an regional oak dating master. The two oak series have a correlation that is significant at much less then the 0.001 level, or 1 in 1000 of being wrong. Five other independent regional oak dating masters produced the same 1721 date with a significance <0.001 as well.

Table 1. OAK TREE-RING DATING OF THE JEAN HASBROUCK HOUSE					
SAMPLED OAK TIMBERS					
ID	DESCRIPTION	RADII	RINGS	DATING	BARK EDGE
JH12	CELLAR JOIST, SEE FIG. A1 FOR ITS EXACT LOCATION	1	208	1514-1721	YES
JH14	CELLAR JOIST, SEE FIG. A1 FOR ITS EXACT LOCATION	1	104	1618-1721	YES
JH15	CELLAR JOIST, SEE FIG. A1 FOR ITS EXACT LOCATION	1	52	NO DATE	YES
JH16	CELLAR JOIST, SEE FIG. A1 FOR ITS EXACT LOCATION	1	169	1740-1831	YES
JH17	CELLAR JOIST, SEE FIG. A1 FOR ITS EXACT LOCATION	1	178	1544-1721	YES
JH18	CELLAR FIREPLACE LENTIL, SEE FIG. A1 FOR ITS EXACT LOCATION	1	229	1449-1677	SAPWOOD
JH19	CELLAR JOIST, SEE FIG. A1 FOR ITS EXACT LOCATION	1	79	NO DATE	YES
JH20	CELLAR JOIST, SEE FIG. A1 FOR ITS EXACT LOCATION	1	193	1529-1721	YES
JH21	CELLAR JOIST, SEE FIG. A1 FOR ITS EXACT LOCATION	1	97	1625-1721	YES
JH30	CELLAR JOIST, SEE FIG. A1 FOR ITS EXACT LOCATION	1	71	NO DATE	YES
JH31	CELLAR JOIST, SEE FIG. A1 FOR ITS EXACT LOCATION	1	77	NO DATE	YES
JH40	CELLAR JOIST, SEE FIG. A1 FOR ITS EXACT LOCATION	1	61	NO DATE	YES
JH41	DOOR FRAME BY FIREPLACE LINTEL, SEE FIG. A1 FOR ITS LOCATION	1		CHESTNUT NO DATE	SAPWOOD

Table 2. PINE TREE-RING DATING OF THE JEAN HASBROUCK HOUSE SAMPLED PINE TIMBERS (ALL "DATES" ARE RELATIVE*)					
ID	**DESCRIPTION**	**RADII**	**RINGS**	**DATING**	**BARK EDGE**
JH01	ATTIC RAFTER, SEE FIG. A2 FOR ITS EXACT LOCATION	1	101	898-998*	YES
JH02	ATTIC RAFTER, SEE FIG. A2 FOR ITS EXACT LOCATION	1	65	935-999*	YES
JH03	ATTIC RAFTER, SEE FIG. A2 FOR ITS EXACT LOCATION	1	60	NO CROSS-DATE	YES
JH04	ATTIC RAFTER, SEE FIG. A2 FOR ITS EXACT LOCATION	1	44	NO CROSS-DATE	YES
JH05	ATTIC RAFTER, SEE FIG. A2 FOR ITS EXACT LOCATION	1	54	945-998*	YES
JH06	ATTIC WEST WALL PLATE, SEE FIG. A2 FOR ITS EXACT LOCATION	1	173	827-999*	YES
JH07	ATTIC RAFTER, SEE FIG. A2 FOR ITS EXACT LOCATION	1	48	NO CROSS-DATE	YES
JH08	ATTIC RAFTER, SEE FIG. A2 FOR ITS EXACT LOCATION	1	83	NO CROSS-DATE	YES
JH09	ATTIC RAFTER, SEE FIG. A2 FOR ITS EXACT LOCATION	1	49	NO CROSS-DATE	YES
JH10	ATTIC RAFTER, SEE FIG. A2 FOR ITS EXACT LOCATION	1	73	NO CROSS-DATE	YES
JH11	ATTIC RAFTER, SEE FIG. A2 FOR ITS EXACT LOCATION	1	57	942-998*	YES
JH13	ATTIC RAFTER, SEE FIG. A2 FOR ITS EXACT LOCATION	1	47	952-998	YES
JH22	ATTIC EAST WALL PLATE, SEE FIG. A2 FOR ITS EXACT LOCATION	1	129	871-999	YES
JH23	ATTIC EAST RAFTER, SEE FIG. A2 FOR ITS EXACT LOCATION	1	68	NO CROSS-DATE	YES
JH33	GROUND FLOOR LEVEL, SEE FIG. A3 FOR ITS EXACT LOCATION	1	120	878-997	YES(?) SAPWOOD
JH34	GROUND FLOOR LEVEL, SEE FIG. A3 FOR ITS EXACT LOCATION	1	159	840-998	YES(?) SAPWOOD
JH35	GROUND FLOOR LEVEL, SEE FIG. A3 FOR ITS EXACT LOCATION	1	149	847-995	YES(?) SAPWOOD

Appendix

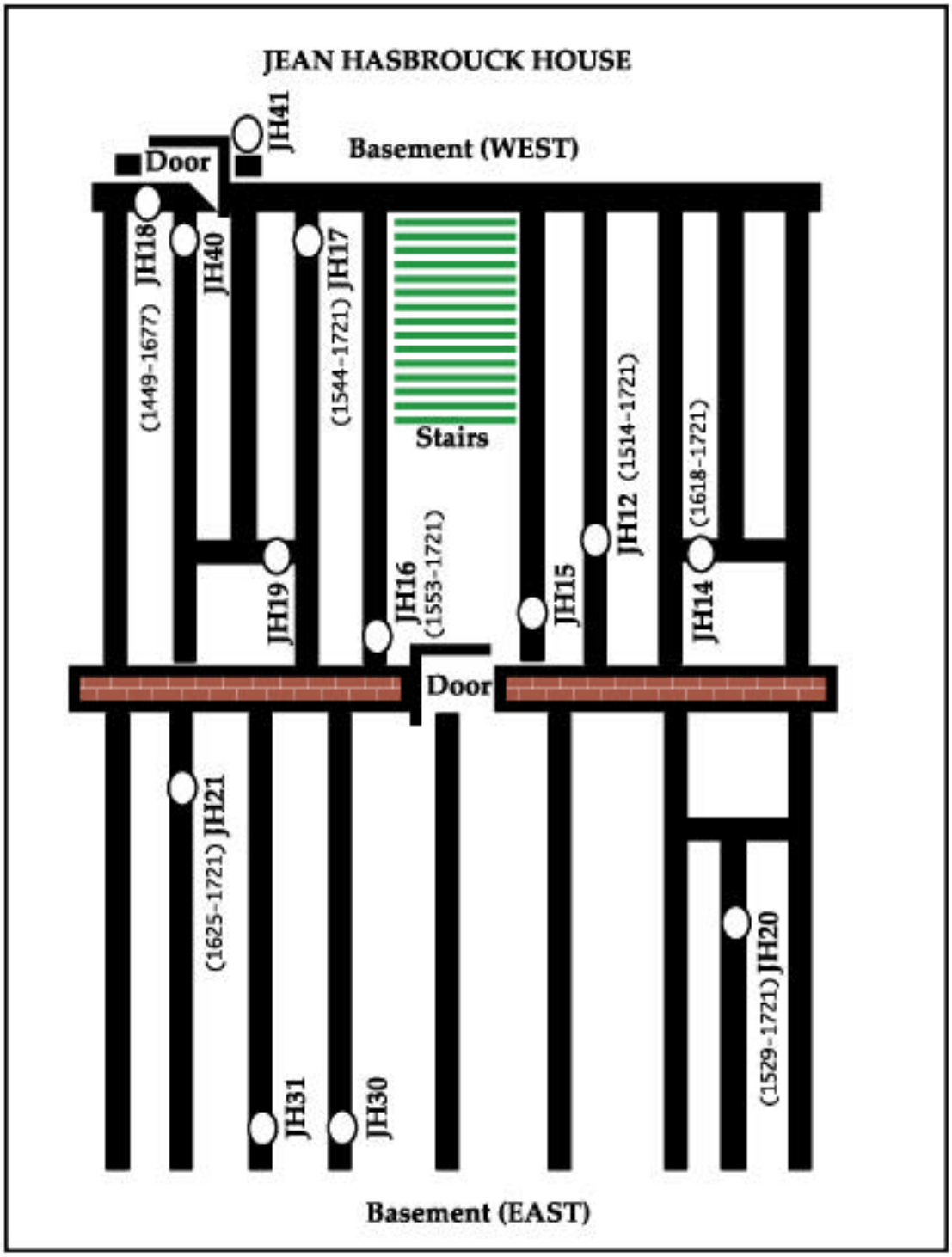

Figure A1. The sampling locations of the oak timbers in the basement of the Jean Hasbrouck house in New Paltz, New York. Dates are included for those timbers that were successfully dated using tree-ring analysis.

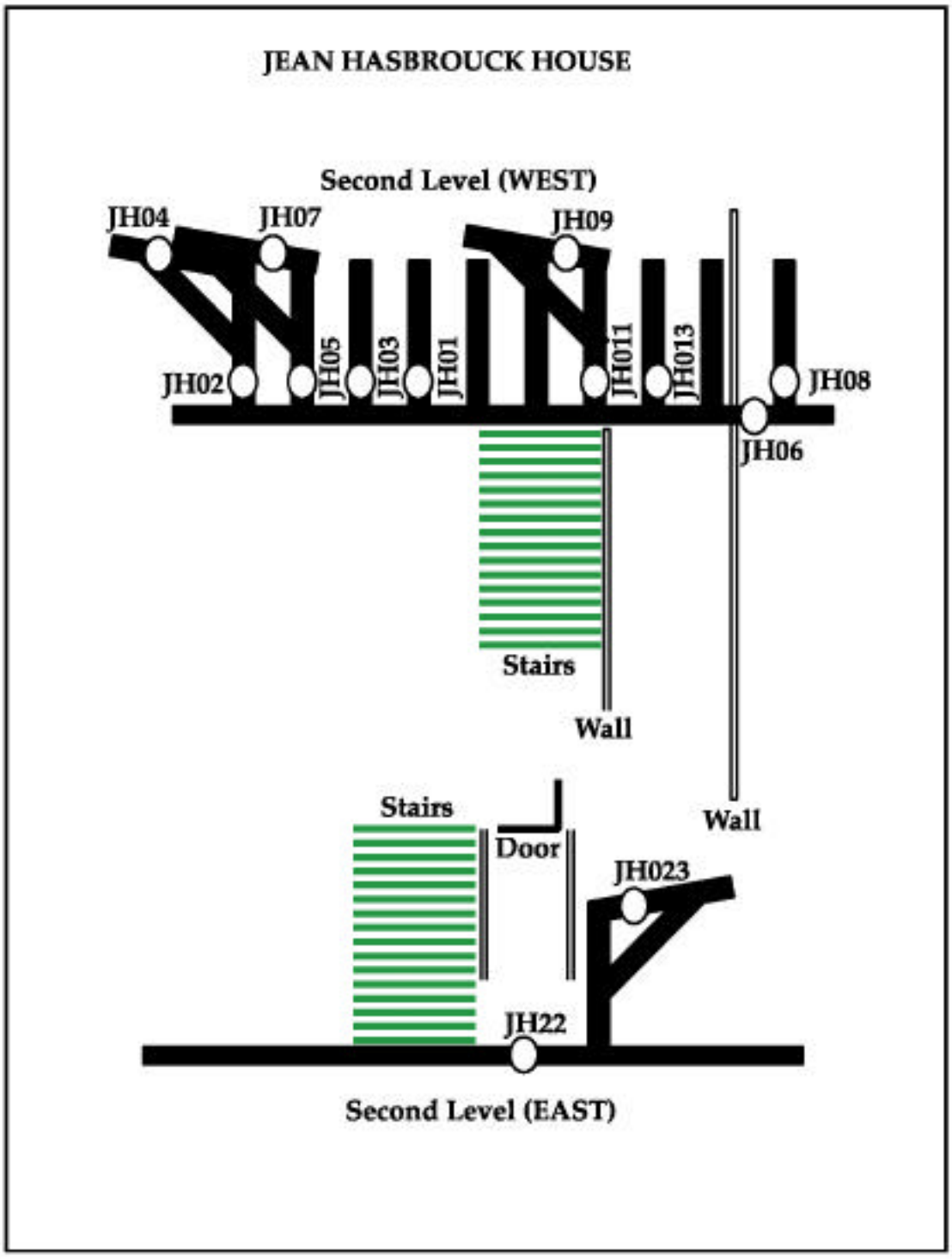

Figure A2. The sampling locations of the pine timbers in the east and west attics of the Jean Hasbrouck house in New Paltz, New York.

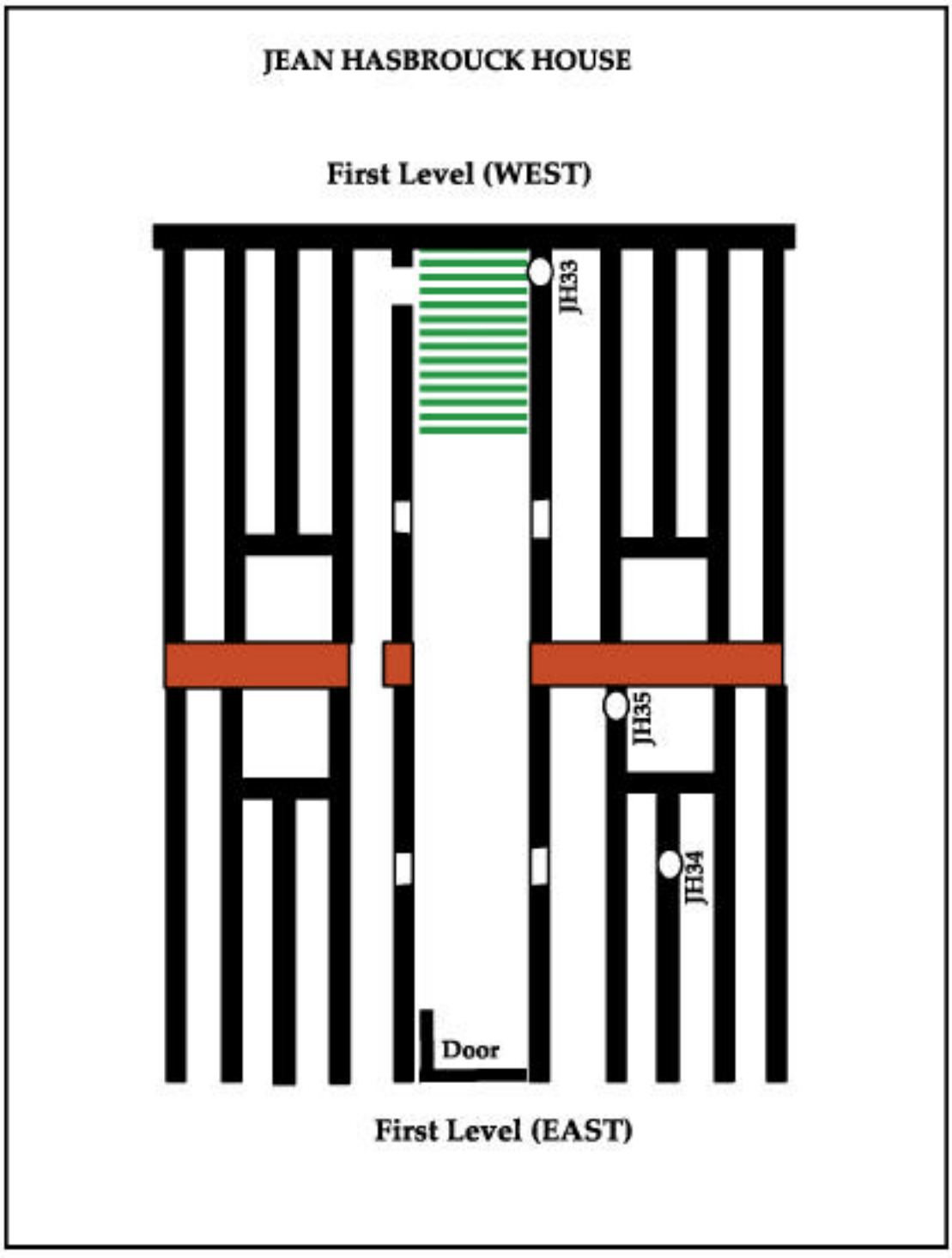

Figure A3. The sampling locations of the pine timbers on the ground floor (first level) of the Jean Hasbrouck house, New Paltz, New York.

References

Baillie, M.G.L. 1982. *Tree-Ring Dating and Archaeology*. Croom Helm, London and Canberra. 274 pp.

Cook, E.R. and L. Kariukstis, eds. 1990. *Methods of Dendrochronology: Applications in the Environmental Sciences*. Kulwer, The Netherlands.

Douglass, A.E. 1909. Weather cycles in the growth of big trees. *Monthly Weather Review* 37(5): 225-237.

Douglass, A.E. 1920. Evidence of climate effects in the annual rings of trees. *Ecology* 1(1):24-32.

Douglass, A.E. 1928. Climate and trees. *Nature Magazine* 12:51-53.

Douglass, A.E. 1921. Dating our prehistoric ruins: how growth rings in trees aid in the establishing the relative ages of the ruined pueblos of the southwest. *Natural History* 21(1):27-30.

Douglass, A.E. 1929. The secret of the southwest solved by talkative tree-rings. *National Geographic Magazine* 56(6):736-770.

Eckstein, D. 1978. Dendrochronological dating of the medieval settlement of Haithabu (Hedeby). In: *Dendrochronology in Europe*, (J. Fletcher, ed.) British Archaeological Reports International Series 51: 267-274

Eckstein, D. 1984. *Dendrochronological Dating (Handbooks for Archaeologists, 2)*. Strasbourg, European Science Foundation.

Edwards, M.R. 1982. Dating historic buildings in lower Maryland through dendrochronology. In: *Perspectives in Vernacular Architecture*. Vernacular Architecture Forum.

Fritts, H.C. 1976. *Tree Rings and Climate*. Academic Press, New York. 567 pp.

Heikkenen, H.J. and M.R. Edwards. 1983. The years of construction and alteration of two buildings, as derived by the key-year dendrochronology technique. In*: Conservation of Wooden Monuments*., (R.O. Byrne, J. Lemire, J. Oberlander, G. Sussman and M. Weaver eds.) ICOMOS Canada and the Heritage Foundation, Ottawa: 173-185.

Holmes, R.L. 1983. Computer assisted quality control in tree-ring dating and measurement. *Tree-Ring Bulletin* 43:69-78.

Krusic, P.J. and E.R. Cook. 2001. *The Development of Standard Tree-Ring Chronologies for Dating Historic Structures in Eastern Massachuesetts: Completion Report*. Great Bay Tree-Ring Laboratory, May 2001, unpublished report.

Stahle, D.W. and D. Wolfman. 1985. The potential for archaeological tree-ring dating in eastern North America. *Advances in Archaeological Method and Theory* 8: 279-302.

Stokes, M.A. and T.L. Smiley. 1968. *An Introduction to Tree-Ring Dating*. University of Chicago Press, Chicago 110 pp.