

*A Dendrochronological Analysis of
the General Schuyler House,
Schuylerville, Saratoga County, New York.*



**Dr. Edward R. Cook
William J. Callahan, Jr.
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Introduction

This is the final report on a dendrochronological analysis of the General Schuyler House, which stands at 4 Broad Street, Schuylerville, Saratoga County, New York 12871 (43°05'45"N 73°33'54"W). In an effort to establish a more precise chronology of the structure's history, historic architect Clay Palazzo of John G. Waite Associates, Albany, NY, acting on behalf of the tutelary Saratoga National Historical Park, requested that dendrochronologists William Callahan and Dr. Edward Cook perform a tree-ring analysis of selected representative structural timbers.

Callahan visited the site on 18 & 19 November 2021, and collected samples for dendrochronological analysis. Of 15 field samples taken, all 15 were deemed methodologically and conditionally of sufficient quality for submission for laboratory analysis. The submitted samples were all of pitch pine (*Pinus rigida*).

Every effort was made on site to locate bark or waney edges on the sampled timbers in order to ascertain the absolute cutting date, or dates, of the trees used in the construction. After the completion of this analysis, the core and cut samples and their associated measurement series will be permanently archived at the Tree Ring Research Laboratory, Lamont-Doherty Earth Observatory, Columbia University, under the sample reference numbers listed in Table 1, column 1.

Dendrochronological Analysis

Dendrochronology is the science of analyzing and dating annual growth rings in trees. Its first significant application was in the dating of 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 to archaeological dating. Douglass established the connection between annual ring width variability and annual climate variability which allows for the precise dating of wood material (Douglass 1909, 1920, 1928; Stokes and Smiley 1968; Fritts 1976; Cook and Kariukstis 1990). The dendrochronological methods first developed by Douglass have evolved and been employed throughout North America, Europe, and much of the temperate forest zones of the globe (Edwards 1982; Holmes 1983; Stahle and Wolfman 1985; Cook and Callahan 1992, Krusic and Cook 2001). In Europe, where the dendrochronological dating of buildings and artifacts has long been a routine professional support activity, the success of tree-ring dating in historical contexts is noteworthy (Baillie 1982; Eckstein 1978; Bartholin 1979; Eckstein 1984).

The wood samples collected from the General Schuyler House were processed in the laboratory by Dr. Edward Cook following well-established dendrochronological methods. The core samples were carefully glued onto grooved mounts and were sanded to a high polish to reveal the annual tree rings clearly; cut samples were similarly surfaced. The rings widths were measured under a microscope to a precision of ± 0.001 mm. The cross-dating of the obtained measurements utilized a revised and modernized COFECHA computer program (Holmes 1983), which employs a sliding correlation to identify probable cross-dates between tree-ring series. In all cases, the robust non-parametric Spearman rank correlation coefficient was used for determining cross-dating. Experience has shown that for trees growing in the northeastern United States, this method of cross-dating is greatly superior to the traditional skeleton plot technique (Stokes and Smiley 1968), now disused. It is also very similar to the highly successful CROS program employed by, for instance, Irish dendrochronologists to cross-date European tree-ring series (Baillie 1982).

COFECHA is used to first establish internal, or relative, cross-dating amongst the individual timbers from the site itself. This step is critically important because it locks in the relative positions of the timbers to each other, and indicates whether or not the dates of those specimens with outer bark rings are consistent. Subsequently, one or more internally cross-dated series are compiled from the individual site samples, and these are compared in turn with independently established tree-ring master chronologies compiled from living trees and dated historical tree-ring material. All of the regional “master chronologies” are based on completely independent tree-ring samples.

During the Schuyler House study, species specific, regional composite master chronologies from living trees and historical structures from northern and central New York state, and other near-lying regions, were referenced primarily. All dating results were verified finally by subsequent comparison with other independent dating masters from surrounding regions. In each case, the datings as reported here were confirmed as correct.

Results and Conclusions

To achieve these datings required attention during analysis to the previously recorded structural context of the samples (see **Table 1**, column 3). The contextual association of samples from within the structure, the redundancy of the indicated relative cross-datings, and the eventual existence of bark/waney edges demonstrating cutting year provides the essential constraints necessary for establishing cross-dating, both within a site and with absolute chronological masters. The strength of the cross-dating of the samples is indicated by the Spearman rank correlations in the seventh column (“CORREL”) of **Table 1**. These statistical correlations, produced by the COFECHA program, indicate how well each sample cross-dates with the mean of the others in the group. The individual correlations vary slightly in statistical strength, but all are in the range that is expected for correctly cross-dated timbers from buildings in the eastern United States.

The outermost ring on a waney, bark-edged sample identifies the absolute cutting year. Absence of the bark edge (interchangeably called the wane) on a sample indicates that the outermost extant ring is not the year of cutting, but some potentially identifiable year preceding the cutting. In the absence or loss of wane, field observations of wood anatomical factors often permit close approximation of the number of missing rings, and thereby reasoned estimation of the cutting date. In particular the presence of sapwood, a physiologically active wood found immediately within the bark on the outer portion of the trunk, is an indication that the original wane was near.

For instance, several of the timbers were judged to have bark/wane when initially examined, which was subsequently lost in varying degrees during extraction due to the physical stress of coring and/or surface degradation. Such surface loss (generally extending for less than an inch) is not unusual when timbers have been exposed for several centuries. Importantly, it is not evidence that these timbers have lost their structural bearing integrity.

The results of the dendrochronological dating of the timbers collected from the Schuyler House are summarized in **Table 1** and **Figures 1**. A total of 15 samples from 14 timbers were analyzed in the laboratory: all were pitch pine (*Pinus rigida*.). All 15 provided absolute dates. Of the 15 dated samples, 6 had bark/wane indicating the precise cutting year. All of the other 9 samples had outermost extant rings lying chronologically congruent with the indicated cutting year; field notes indicate that several of these had bark and/or wane present at the start of sampling, lost together with some few rings due to surface degradation during extraction.

In aggregate, the evidence of the datings of the tested material from the multiple floors and the crawl space of the kitchen wing section and the cellar of the main house suggests a singular construction phase for those building sections. Completed ring growth for the year 1776 indicates that most or all of the trees were harvested during growth dormancy of 1776/77, i.e. that the trees were cut after 1776 growth ended and before 1777 growth started, i.e. approximately between November 1776 and February 1777. See **Table 1**, column 6. None of the samples exhibited cutting dates later than indicated above.

It was common practice during this historical period that timbers intended for major structural usage were cut during forest growth dormancy, i.e. were harvested during the period between the cessation of wood growth of one calendar year and prior to growth start in the next. Timbering when done manually and when transport was primarily horse drawn was simpler during a season when forest undergrowth was greatly suppressed and ground surfaces easier to navigate, especially if snow covered. This was true for both commercial and private timbering, both large scale and small.

Though trees were sometimes cut a year or two in advance, either in preparation for a construction and/or for sale, initial usage of these materials likely took place not long after harvesting, for in situ inspection of the timbers indicated that most if not all were worked very soon after cutting, in keeping with historical woodworking practices and traditional carpentry techniques. It must be remembered, however, that re-usage of timbers is possible without leaving any clear evidence of subsequent preparatory workings, and that other construction phases prior to or subsequent to the dates identified by this investigation cannot be excluded absolutely and should be considered when purporting the site's construction history.

Table 1. Dendrochronological dating results for the wood samples taken from the Schuyler House, Saratoga County, New York. For WANEY, +BE means the bark edge was present and thought to be recovered at the time of sampling; -BE means that the bark edge was not recovered or was completely missing on the timber. If -BE, SP refers to the likelihood that sapwood rings are present. If so, the outer date will be close to the cutting date. All correlations are Spearman rank correlations of each series against the mean of all of the others of the same species. If the outermost recovered +BE ring is completely formed, it is indicated as “comp”, meaning that the tree was felled in the dormant season following that last year of growth. “Incomp” means that the outermost ring was not fully formed, meaning that the tree was felled during the spring/summer growing season.

ID	SPECIES	DESCRIPTION	WANEY	RINGS	DATING	CORREL
GSHXNY 01	Pitch Pine	Kitchen wing, 2 nd floor attic, rafter, 1 st from W end	+BE ^a	131	1644 1774	0.532
GSHXNY 02	Pitch Pine	Kitchen wing, 2 nd floor attic, rafter, 1 st from E wall, E side	+BE comp	128	1649 1776	0.599
GSHXNY 03	Pitch Pine	Kitchen wing, 2 nd floor attic, column, N side, 3 rd from E wall	-BE	127	1622 1748	0.537
GSHXNY 04	Pitch Pine	Kitchen wing, 2 nd floor attic, rafter, 1 st pair from E wall, S side	+BE comp	119	1658 1776	0.617
GSHXNY 05	Pitch Pine	Kitchen wing, 2 nd floor attic, column, S side, 3 rd from W wall	+BE comp	121	1656 1776	0.689
GSHXNY 06	Pitch Pine	Kitchen wing, 1 st floor, beam, 1 st from W wall	-BE ^b	142	1548 1689	0.462
GSHXNY 07	Pitch Pine	Kitchen wing, 1 st floor, beam, 4 th from W wall	+BE comp	99 (32) ^c	1745 1776	0.573
GSHXNY 08	Pitch Pine	Kitchen wing, crawl space under, beam, 2 nd from N side	-BE ^d	66	1679 1744	0.542
GSHXNY 09	Pitch Pine	Kitchen wing, crawl space under, beam, 2 nd from N side	+BE ^d comp	95	1682 1776	0.571
GSHXNY 10	Pitch Pine	Main house, cellar, beam, S section, 2 nd from S wall	BE ^e comp	170	1607 1776	0.491
GSHXNY 11	Pitch Pine	Main house, cellar, beam, S section, 4 th from S wall	BE? ^e	59	1605 1663	0.541
GSHXNY 12	Pitch Pine	Main house, cellar, beam, central section, 8 th from S wall	BE? ^e	172	1589 1760	0.519
GSHXNY 13	Pitch Pine	Main house, cellar, beam, N section, 9 th from S wall	BE? ^e	112	1608 1719	0.600
GSHXNY 14	Pitch Pine	Main house, cellar, beam, N section, 10 th from S wall	BE? ^e	63	1640 1702	0.554
GSHXNY 15	Pitch Pine	Main house, cellar, beam, N section, 12 th from S wall	BE? ^e	130	1594 1723	0.447

^a Core taken outward from timber interior, with minimal wane at exit point, maybe not preserved when mounted and measured.

^b Chamfered beam, false wane surface

^c Only outermost 32 rings date strongly with the site master; inner rings suffer from severe growth distortion of unknown origin.

^d GSHXNY08 and GSHXNY09 are taken from same beam; GSHXNY09 has complete outer rings and wane surface.

^e Whitewashed beam, wane interpretation difficult/uncertain.

Table 1. Dendrochronological dating results for all samples taken from the Schuyler House located near Schuylerville, Saratoga County, New York. For interpreted felling dates of the trees used for construction, +BE means that the bark edge was present and believed to be recovered at the time of sampling; -BE means that the bark edge was not recovered or was completely missing on the timber. If -BE, +SP refers to the likelihood that sapwood rings are present. If so, the outer date will be close to the cutting date. All correlations are the Spearman rank correlations of each series

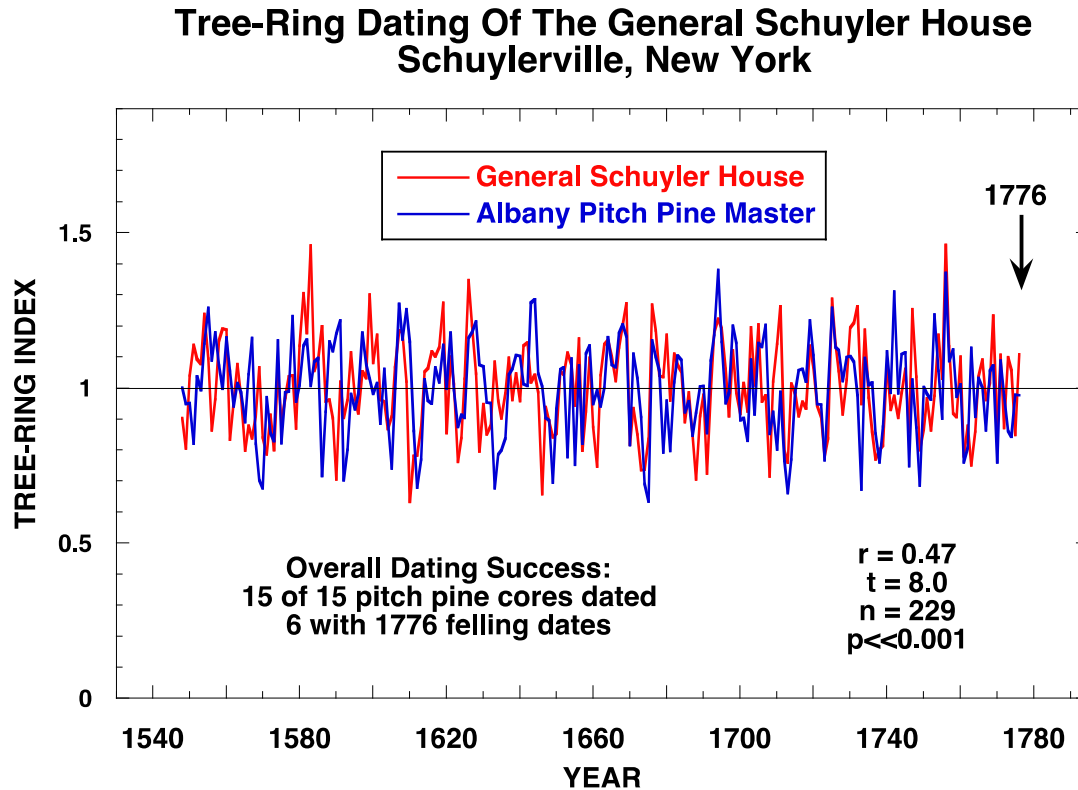


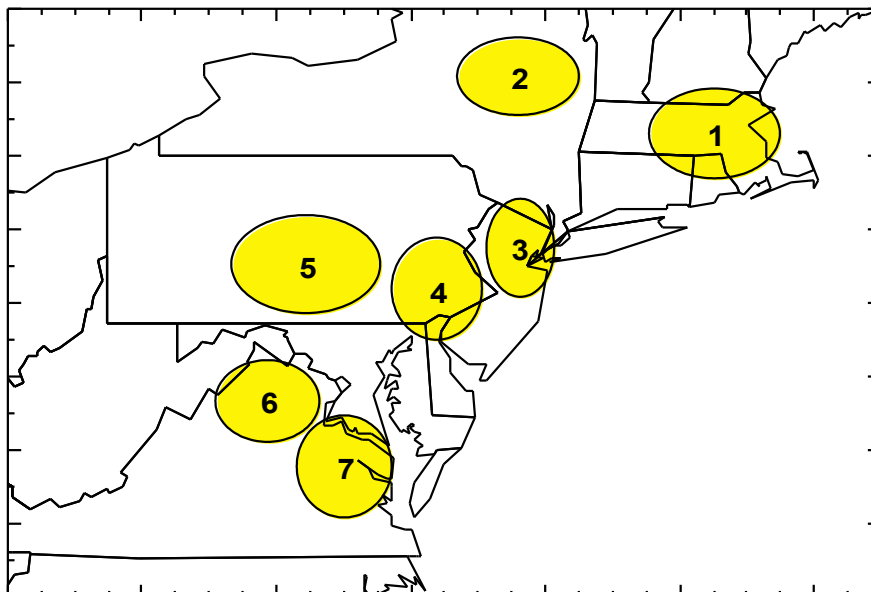
Figure 1. Comparison of the composited pitch pine chronology from the timbers of the Schuyler House, Schuylerville, New York against an independent, historical pitch pine master chronology from northern New York.

The strength of cross-dating indicated ($t=8.0$) is statistically very strong ($t>>3.5$) and the 1776 ring was completely formed, thus indicating that the timbers used to construct the General Schuyler House were felled sometime between the end of the 1776 growth season and before the start of the 1777 growth season.

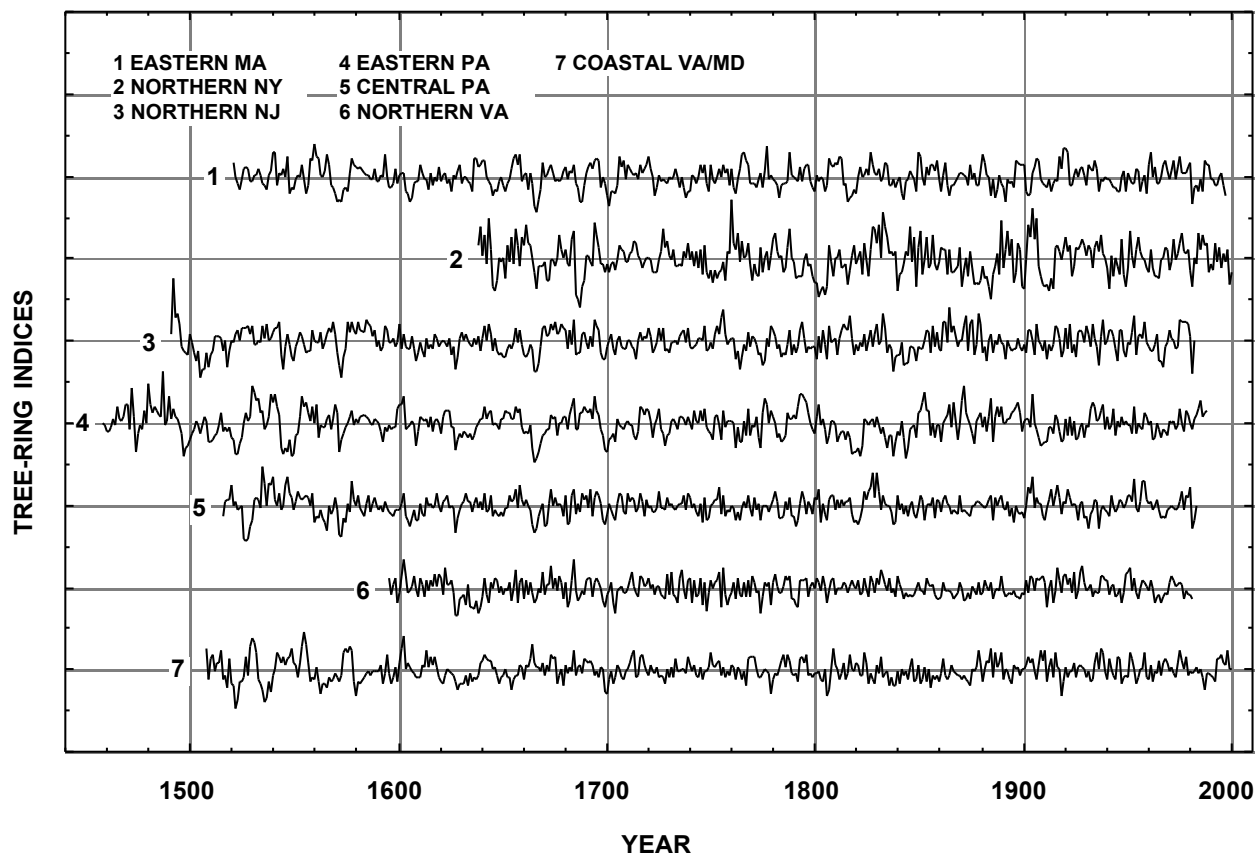
The Spearman rank correlation between the series ($t=8.0$) associated with the correlation between the Schuyler House compiled pitch pine series and a regional pitch pine historical master chronology ($r=0.47$) is strongly secure ($p<<0.01$) for a 229-year overlap. For that reason, the dates presented here for the sampled pitch pine elements of the structure are robustly valid, and the statistical chance of the cross-dates being incorrect is exponentially far less than 1 in 1000.

The "r-factor" is the Spearman rank correlation coefficient, a measure of relative statistical agreement between two groups of measurements or data. It can range from +1 (perfect direct agreement) to -1 (perfect opposite agreement). The "t-value" is Student's distribution test for determining the unique probability distribution for "r", i.e. the likelihood of its value occurring by chance alone. As a rule, a $t=3.5$ has a probability of circa 1 in 1000, or 0.001, of being invalid. Higher "t" values as in this case indicate exponentially increasing, stronger statistical certitude.

MODERN/HISTORICAL OAK CHRONOLOGIES REGIONAL LOCATIONS OF SAMPLES



MODERN/HISTORICAL OAK TREE-RING CHRONOLOGIES



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Edward Cook was born in Trenton, New Jersey, in 1948. He received his PhD. from the Tucson Tree-Ring Laboratory of the University of Arizona in 1985, and has worked as a dendrochronologist since 1973. Currently director of the Tree-Ring Laboratory at the Lamont-Doherty Earth Observatory of Columbia University, he has comprehensive expertise in designing and programming statistical systems for tree-ring studies, and is the author of many works dealing with the various scientific applications of the dendrochronological method.

William Callahan was born in West Chester, Pennsylvania, in 1952. After completing his military service he moved to Europe, receiving his MA from the University of Stockholm in 1979. He began working as a dendrochronologist in Sweden in 1980 at the Wood Anatomy Laboratory at the University of Lund, and returned to the United States in 1998. A former research associate of Dr. Edward Cook at the Tree-Ring Laboratory of Lamont-Doherty, he has extensive experience in using dendrochronology in dating archaeological artifacts and historic sites and structures.

Some regional historical dendrochronological projects completed by the authors:

Abraham Hasbrouck House, New Paltz, NY	Frederick Muhlenberg House, Trappe, PA
Allen House, Shrewsbury, NJ	Nottingham DeWitt House, NY
Belle Isle, Lancaster County, VA	Old Barn, Madison VA
Bowne House, Queens, NY	Old Caln Meeting House, Thorndale, PA
Carpenter's Hall, Philadelphia, PA	Old Parsonage, Kinderhook NY
Charpentier House, Philadelphia PA	Old Swede's Church, Philadelphia, PA
Christ's Church, Philadelphia, PA	OTB House, West Nyack, NY
Clifton, Northumberland County, VA	Panel Paintings, National Gallery, Washington, DC
Conklin House, Huntington, NY	Pennock House & Barn, London Grove, PA
Customs House, Boston, MA	Penny Watson House, Greenwich, NJ
Daniel Boone Homestead, Birdsboro, PA	Podrum Farm, Limekiln, PA
Daniel Pieter Winne House, Bethlehem, NY	Powell House, Philadelphia, PA
Ditchley, Northumberland County, VA	Pyne House, Cape May, NJ
Ephrata Cloisters, Lancaster County, PA	Radcliff van Ostrade, Albany, NY
Fallsington Log House, Bucks County, PA	Reese's Corner House, Rock Hall, MD
Ferris House, Old Greenwich, Fairfield County, CT	Rippon Lodge, Prince William County, VA
Fawcett House, Alexandria, VA	Rochester House, Westmoreland County, VA
Gadsby's Tavern, Alexandria, VA	Rockett's, Doswell VA
Garrett House, Sugartown PA	Rural Plains, Hanover County, VA
Gilmore Cabin, Montpelier, Montpelier Station, VA	Sabine Hall, Richmond County, VA
Gracie Mansion (Mayor's Residence), New York, NY	Shirley, Charles City County, VA
Grove Mount, Richmond County, VA	Sisk Cabin, Culpeper VA
Hanover Tavern, Hanover Courthouse, VA	Stiles Cabin, Sewickely PA
Harriton House, Bryn Mawr, PA	Spangler Hall, Bentonville, VA
Hills Farm, Accomack County, VA	Springwater Farm, Stockton, NJ
Hollingsworth House, Elk Landing, MD	St. Peter's Church, Philadelphia, PA
Indian Banks, Richmond County, VA	Strawbridge Shrine, Westminster, MD
Indian King Tavern, Haddonfield NJ	Sweeney-Miller House, Kingston, NY
Independence Hall, Philadelphia, PA	Thomas & John Marshall House, Markham, VA
John Bowne House, Forest Hills, NY	Thomas Grist Mill, Exton, PA
Kirnan, Westmoreland County, VA	Thomas Thomas House, Newtown Square, PA
Linden Farm, Richmond County, VA	Ticonderoga Pavilion, Ticonderoga, NY
Log Cabin, Fort Loudon, PA	Tuckahoe, Goochland County, VA
Lower Swedish Log Cabin, Delaware County, PA	Tullar House, Egremont MA
Lummis House, Ipswich MA	Updike Barn, Princeton, NJ
Marmion, King George County, VA	Varnum's HQ, Valley Forge, PA
Martin Cabin, New Holland PA	Verville, Lancaster County, VA
Menokin, Richmond County, VA	West Camp House, Saugerties, NY
Merchant's Hope Church, Prince George County, VA	Westover, Charles City County, VA
Millbach House, Lebanon County, PA	White Plains House, King George, VA
Monaskon, Lancaster County, VA	Wilton, Westmoreland County, VA
Morris Jumel House, Jamaica, NY	Yew Hill, Fauquier County, VA