A Dendrochronological Analysis of the "Palatine Parsonage", Germantown, Columbia County, New York.

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Introduction

This is the final report on the dendrochronological analysis of a structure known as the "Palatine Parsonage" (also variously known as the "German Reformed Sanctity Church Parsonage" and the "First Reformed Church Parsonage") which stands at 51 Maple Avenue, Germantown, Columbia County, New York 12526 (42°08'30"N 73°52'57"W). The house and grounds are owned by the Town of Germantown and are the headquarters of the Town of Germantown History Department.

In an effort to establish a more precise history of the building, the Town and the History Department requested that dendrochronologists William Callahan and Dr. Edward Cook perform a tree-ring analysis of selected representative structural timbers. Callahan visited the site and collected samples for the dendrochronological analysis of the timbers on 9 September, 2017.

Of the 11 field samples taken, 9 were deemed of sufficient quality for submission for laboratory analysis. Eight of the submitted samples were of oak (Quercus sp.) and one was of pine (Pinus sp.). The two samples taken but not submitted were judged after extraction to be methodologically and/or conditionally unsuitable and were discarded.

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 this analysis, the core 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 Palatine Parsonage were processed in the Tree-Ring 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. The rings widths were measured under a microscope to a precision of ±0.001 mm. The cross-dating of the obtained measurements utilized the 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). 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. 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.

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

Results and Conclusions

The results of the dendrochronological dating of the Palatine Parsonage timbers are summarized in **Table 1** and **Figure 1**. A total of 9 samples were analyzed in the laboratory, with 7 of the samples providing firm dendrochronological dates. One oak sample and the singleton pine sample (PGCCNY09) did not provide statistically viable dates. 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 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 thus 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 stood near.

Table 1. Dendrochronological dating results for the oak samples taken from the Palantine Parsonage, Germantown, Columbia 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 may 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 oak 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**
PGCCNY 01	Oak	West cellar, ceiling joist, 1st from west wall/fireplace	-BE	107	1617 1723	0.58
PGCCNY 02	Oak	West cellar, ceiling joist, 2nd from west wall/fireplace	-BE, +SP (BE close)	92	1660 1751	0.52
PGCCNY 03	Oak	West cellar, ceiling joist, 3rd from west wall/fireplace	-BE	74	1648 1721	0.59
PGCCNY 04	Oak	Center cellar section, center joist	+BE	51	1713 1763	0.31
PGCCNY 05	Oak	East cellar, ceiling joist, 3rd from east wall	+BE	84	1649 1732	0.45
PGCCNY 06	Oak	East cellar, ceiling joist, 2nd from east wall; (re-used timber)	+BE?	81	1665 1746	0.54
PGCCNY 07	Oak	East cellar, lintel over door, east wall; (re-used timber)	-BE	36	No Date	-.--
PGCCNY 08	Oak	Center cellar, beam on/above east cellar wall	-BE?, +SP (BE close)	116	1644 1763	0.37
PGCCNY 09	Pine	2nd floor, central passage, joist over west wall	BE???	58	No Date	-.--

Of the 7 oak samples that cross-dated well between themselves, and also dated well against the local historical oak dating master (see **Table 1**, column 6), two had field verified bark edge at the time of sampling (PGCCNY04, 05). Evidence of sapwood remained on several of the non-wane samples, supporting a potential reasoned cutting date for the timbers in question. Several of the timbers showed obvious signs of previous usage. Initial usage of all of the materials took place not long after harvesting, for *in situ* inspection indicated that most if not all were worked soon after cutting, in keeping with historical woodworking and carpentry techniques.

Analysis of the degree of development of the outermost wane rings indicates that cutting of the bark-edged timbers occurred during the regional period of winter dormancy following the end of the growth season, i.e. cutting took place during approximately November to February when no tree growth occurs (see **Table 1**). The latest, outermost extant ring on any of the analyzed oak samples is 1763: one field identified as having wane (PGCCNY04), and a second very likely being wane-edged (PGCCNY08). This/these oaks were harvested during dormancy between 1763/1764. Another bark-edged timber (PGCCNY05) was cut during dormancy 1732/33, a date somewhat anomalous within the total set, and which may represent re-use or re-purposing. Arguably, the outermost extant rings of several other non-wane timbers must lie close to or even at their various cutting years (eg. PGCCNY02, 06), although their condition did not permit conclusive determination of the existence of wane to be made in the field, and thus their cutting dates cannot be specified precisely.

The chronological incongruency in the collective set of datings of the selected timbers makes declaration of the absolute construction date(s) problematic. This incongruency may be evidence of multiple construction phases for the Palatine Parsonage as it exists today, or it may be evidence of a comprehensive construction phase that reused and/or repurposed an assortment of available timbers, i.e. that the builders deliberately employed whatever was on hand and suitable to their immediate needs, including materials from an existing structure on site or exploited from razed buildings in the vicinity.

There does appear to be evidence in the dated materials that some construction activities took place in the middle to late part of the 1760's, at least within a portion of the building. Of course, construction may have also occured earlier and/or proceeded for some few years later than the dates indicated by the selected timbers, and other construction phases prior or subsequent to the dates identified by this investigation cannot be discounted. There may be a weak circumstantial indication of some "date clustering" by location within the separate portions of the cellar, though it must be stressed that this point is not rigorously empirical and therefore remains highly speculative. The re-use of individual timbers in any or all of phases of construction severely complicates analysis of the site's history, and must be considered prominently during final interpretation.

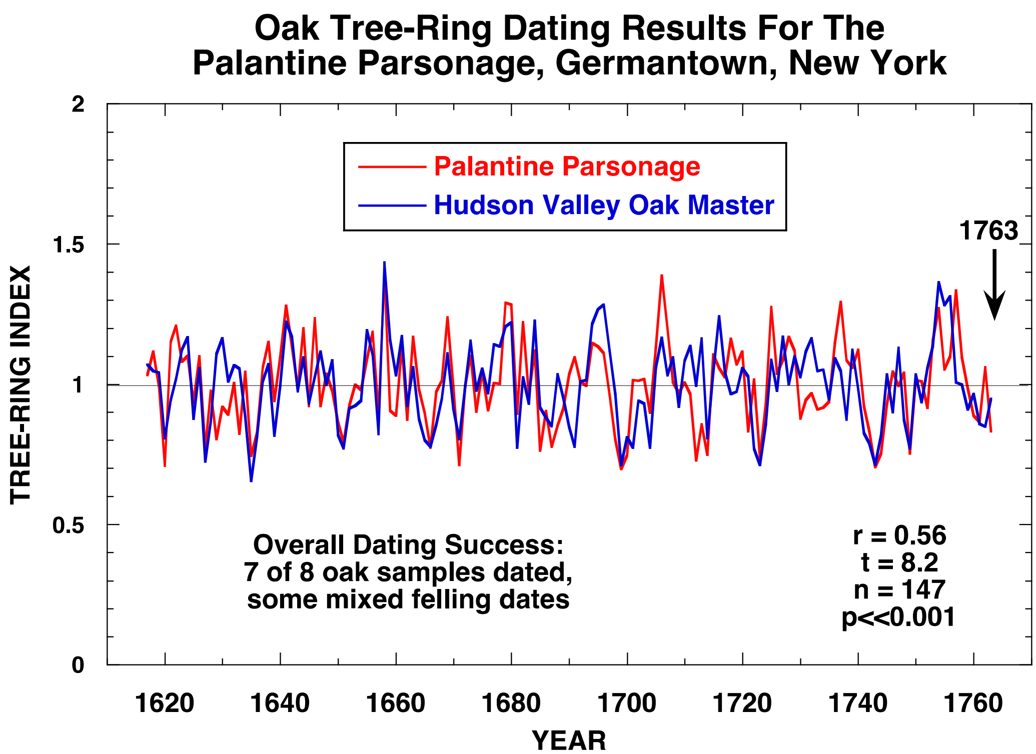
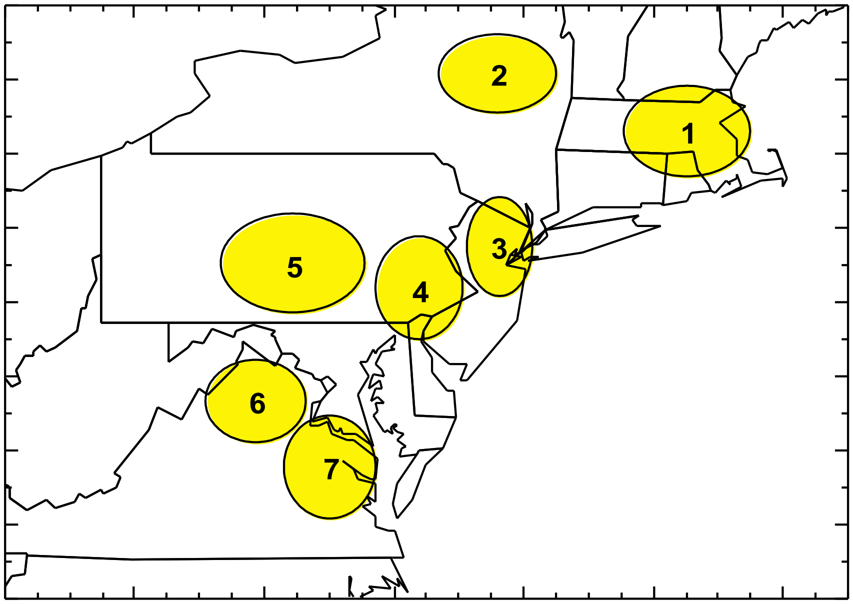


Figure 1. Comparison of the cross-dated, site compiled pine chronology for The Palatine Parsonage against a historical oak dating master for the Albany region. The Spearman rank correlation between the series (r=0.56) is highly significant (p<0.001) with an overlap of 147 years and a t-statistic of 8.2.

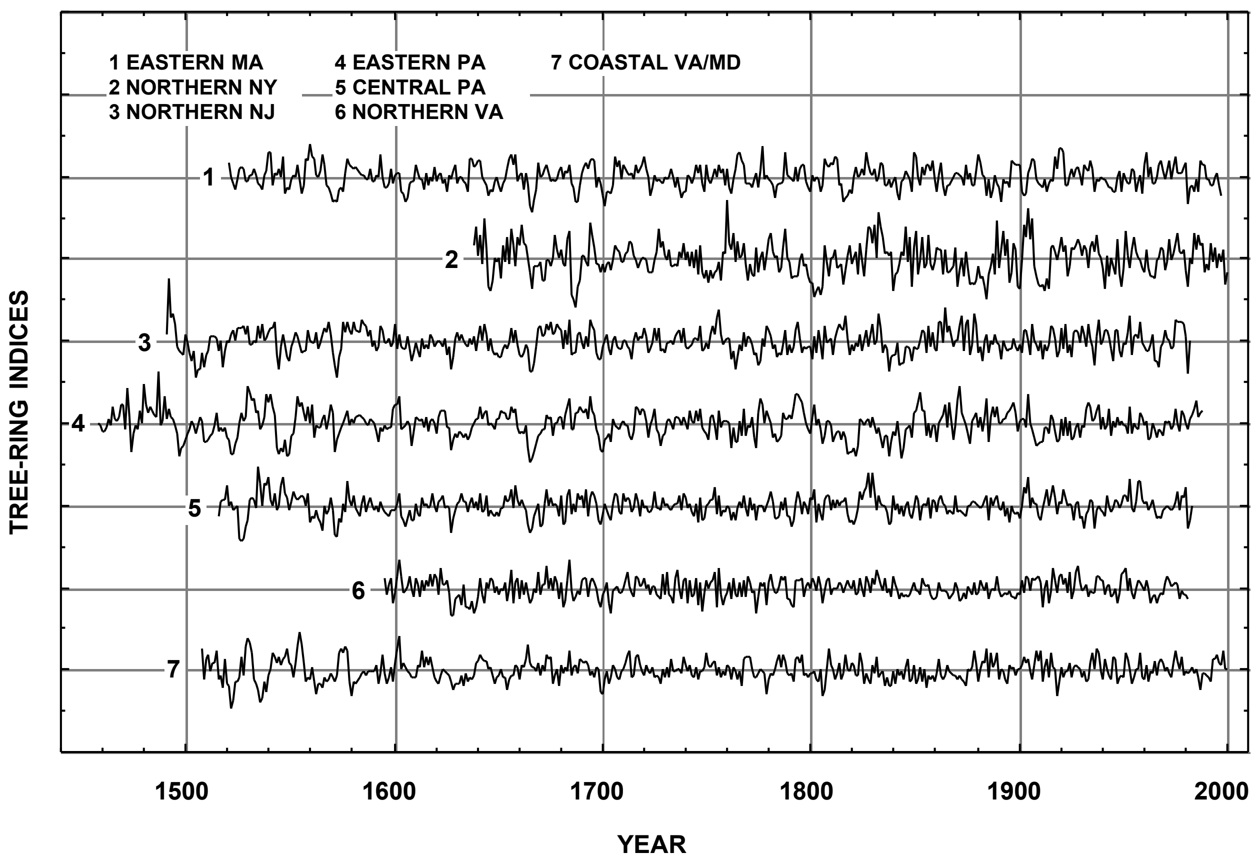
The "r-factor" is the Spearman rank correlation coefficient, a measure of relative statistical agreement between two groups of measurements or data. It can range from +1 (perfect direct agreement) to -1 (perfect opposite agreement). The "t-value" is Student's distribution test for determining the unique 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 about 1 in 1000, or 0.001, of being invalid. Higher "t" values indicate exponentially increasing, stronger statistical certitude.

The t-statistics (t=5.4) associated with the correlation between the Palatine Parsonage oak series and the regional oak master chronology (r=0.56) is statistically very significant ($p<<0.001$) for a 147-year overlap.For that reason, there can be no doubt that the dates presented here for the sampled oak elements of the structure are robustly valid, and that the statistical chance of the cross-dates being incorrect is exponentially far less than 1 in 1000.

MODERN/HISTORICAL OAK CHRONOLOGIES
REGIONAL LOCATIONS OF SAMPLES



MODERN/HISTORICAL OAK TREE-RING CHRONLOGIES



Some Selected References

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

Baillie, M.G.L. 1995. *A Slice Through Time: Dendrochronology and Precision Dating.*B.T. Batsford, Ltd., London

Bartholin, T.S. 1979. "Provtagning för dendrokronologisk datering och vedanatomisk analys." *Handbook i archeologiskt fältarbete, häfte 2.* 1-15 Riksantikvarieämbetets dokumentationsbyrå, Stockholm.

Cook, E.R. and Callahan, W.J. 1987. *Dendrochronological Dating of Fort Loudon in South-Central Pennsylvania*. Limited professional distribution.

Cook, E.R. and Callahan, W.J. 1992. *The Development of a Standard Tree-Ring Chronology for Dating Historical Structures in the Greater Philadelphia Region.* Limited professional distribution.

Cook, E.R., Callahan, W.J. and Wells, Camille 2007. *Dendrochronological Analysis of Rural Plains, Mechanicsville, Hanover County,Virginia.* Limited professional distribution..

Cook, E.R. and Callahan, W.J. 2008. *Dendrochronological Analysis of Freer-Low House,Huguenot Street, New Paltz, Ulster County,NewYork.* Limited professional distribution.

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.

Eckstein, D. and Bauch, J. 1969. "Beitrag zur Rationisilerung eines dendrokronologischen Verfahrens und zur Analyse seiner Aussagesicherheit." *Forstwissenschaftliches Centralblatt* 88, 230-250.

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.

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 Massachusetts: Completion Report*. Great Bay Tree-Ring Laboratory, May 2001.

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.

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