


Spring 2025      Thursdays 1:45 pm – 4:45pm      B7 Meyerson / ACL Duhring Wing  
Instructor: Andrew Fearon, FAIC      [afearon@design.upenn.edu](mailto:afearon@design.upenn.edu)      cell 917-450-611  
TA: Qingrou (Doreen) Dai      [dqingrou@design.upenn.edu](mailto:dqingrou@design.upenn.edu)       #woodseminar

### Course Description:

Globally, spanning ancient history to present day, most structures found in the built environment rely upon wood as a primary material for both structural and finish components. An understanding of the physical properties as well as the historic application of this organic material provides the basis for formulating solutions for a broad spectrum of contemporary conservation issues. As the scope of preserving wooden structures and wooden architectural elements is continually expanded, new methods and technology available to the conservator together allow for an evolving program – one that is dependent upon both consistent review of treatments and further study of craft traditions. This course seeks to illustrate and address material problems typically encountered by stewards of wooden built heritage; among them structural assessment, bio-deterioration, stabilization, and replication techniques. Through a series of lectures and labs on subjects of wood science, diagnostics, entomology, engineering, and archaeology, theoretical and practical approaches to retaining wooden materials will be examined with the goal to inform the decision-making process of future practicing professionals.

### Course Requirements:

As a seminar, all students are expected to participate equally beginning with prompt attendance of all lectures, labs, and site visits. Required reading will be assigned on a weekly basis and posted to Canvas in preparation for lectures. Three short quizzes will help students commit concepts to memory as well as allow the instructor to quantify the effectiveness of the coursework. Students will have ample time to submit quizzes and may work in teams of two to complete them. Research / Practicum projects will be assigned individually or to groups of 2-4 students. A final group practicum project deliverable is to be submitted at the end of the semester. A one paragraph progress report for each of the research / practicum projects along with any questions are to be submitted via email by **Sunday 5pm each week**. All work must follow the universities standards for academic integrity listed at the following link: [http://www.upenn.edu/academicintegrity/ai\\_codeofacademicintegrity.html](http://www.upenn.edu/academicintegrity/ai_codeofacademicintegrity.html)

### Grading Summary:

Attendance 30 % (2% per class, late 1%)

Quiz One – Wood Properties, Anatomy and Pathology 15 %

Quiz Two – Wood Construction and Heritage Methodology 15 %

Quiz Three- Built Wooden Heritage Conservation, Treatment and Preventive Measures 15 %

Practicum / Research Project 25 %

Course Schedule:

#1      1/16/25      Lecture / Lab 1:45 pm B7 / ACL      Andrew Fearon, *Architectural Conservator*

Course Overview

Andrew Fearon will provide a seminar overview with discussion of course content, reading materials, quizzes, site practicum projects and grading.

LAB: Edge tool sharpening and hand plane demonstration.

#2      1/23/25      Lecture / Lab 1:45 pm B7/ ACL      Andrew Fearon, *Architectural Conservator*

Conservation of Exterior Architectural Wood

The condition assessment of exterior woodwork as part of a building's maintenance cycle with related treatment formulation will be presented through case studies. Decay fungi identification, preservative systems, replication repair, conservation fill materials and techniques, window glazing, paint, and exterior coatings will be discussed.

LAB: Demonstration of traditional window construction with 19<sup>th</sup> century sash plane.

#3      1/30/25      Lecture / Lab 1:45 pm B7/ ACL      Andrew Fearon, *Architectural Conservator*

Wood: Chemical Composition to Macro-structure with Basic Identification Techniques

An introduction to wood species, growth and structure examined on a macro-scale will be explored through an interactive lecture. This class will serve as a recitation for those who have completed the 2024 conservation science course.

LAB: Extraction and preparation of samples from architectural fragments will be demonstrated. Use of stereoscopes, surfacing and non-destructive in-situ techniques will be exercised.

***Quiz One Posted - Wood Identification and Physical Properties***

**Practicum Submission 1: Identifying Team Members and Sub-project due Sunday Feb 2nd at 5 pm**

#4      2/6/25      Lecture / Lab 1:45 pm B7/ ACL      Andrew Fearon, *Architectural Conservator*

Wood Anatomy and Micro-structure with Advanced Identification Techniques

An overview of wood microstructure and related anatomical features used in identification will be presented with the use of the compound microscope.

LAB: Mounting thin sections from wood samples and advanced microscopy techniques will be demonstrated.

#5      2/13/25      Lecture / Lab 1:45 pm B7/ ACL      Andrew Fearon, *Architectural Conservator*

Insects and Wooden Materials

The primary wood destroying insect species typically encountered in wooden built heritage will be identified. The importance of Integrated Pest Management (IPM) in termite control, including the inspection, treatment of termites, and monitoring baiting programs vs. liquid chemical eradication will be discussed. Methods for identifying evidence of carpenter bees, carpenter ants, powder-post beetles, examining challenges and species behavior will be illustrated with a collection of hand-held specimens.

LAB: The UPenn Tom Parker Entomology collection will be explored.

***Quiz One due Sunday Feb 16th at 5pm***

#6 2/20/25 Lecture / Lab 1:45 pm B7/ ACL Andrew Fearon, *Architectural Conservator*

Wood Diagnostics: Technology and In Situ Evaluation of Timber

An overview of diagnostic technologies for assessing wooden structures will be presented and evaluated. In-situ applications of resistograph drilling, thermography and moisture content mapping will be compared by quantitative and qualitative attributes. An introduction to in-situ grading of timber will be provided.

LAB: Resistograph drilling, moisture content meters and use thermal cameras will be demonstrated and exercised.

**Practicum Submission 2: Workplan, Schedule and Outline (Table of Contents) due Sunday February 23<sup>rd</sup> at 5pm**

#7 2/27/25 Site Visit One: Pavillion in the Trees 12:45 pm - 3:45 pm Fairmount Park  
Meet with Laura S. Griffith, *Deputy Director of Association for Public Art* to discuss the built chronology along with past, present and future goals for the conservation of Pavillion in the Trees. Please dress warmly and wear sturdy shoes.

#8 3/6/25 Lecture / Lab 1:45 pm B7/ ACL Andrew Fearon, *Architectural Conservator*

Conservation of Interior Architectural Woodwork

The conservation of interior woodwork including investigation, environmental monitoring, analysis, and treatment will be presented through case studies.

LAB: An ultra-violet light demonstration will be conducted to identify and distinguish coatings on architectural fragments and prepared samples. Use of an Elsec Environmental monitor and Hobo RH / T data loggers will be demonstrated and exercised.

***Quiz Two Posted – Wood Construction and Heritage Methodology***

#9 3/13/25 NO CLASS (Spring Break)

**Practicum / Research Submission 3: 50% DRAFT due Sunday March 16<sup>th</sup> at 5pm**

#10 3/20/25 Lecture 1:45 pm B7/ ACL Richard Ortega, PE, AIA, FAPT, *Engineer / Architect*

Timber Structures: Construction, Structural Assessment and Intervention

Guest lecturer Richard Ortega will present structural design, analysis, and evaluation of timber structures for the purpose of rehabilitation. Traditional wood construction including the anatomy of the timber frame will be discussed including related case studies of structural interventions. Methods of traditional repairs vs. introduction of steel components will be illustrated.

#11 3/27/25 Site Visit 2: Shofuso / Pavilion in the Trees 12:45 pm – 3:45pm Fairmount Park  
Please dress warmly and wear sturdy shoes.

***Quiz Two due Sunday March 30th 5pm***

#12 4/3/25 Lecture / Lab 1:45pm B7/ ACL Andrew Fearon, *Architectural Conservator*

Wood, Archaeology and Forensics

A survey of past and current approaches to the treatment of archaeological wood will be covered providing an understanding of wooden materials in the most fragile of conditions. Investigation techniques such as the application of wood fastener chronologies will be illustrated in detail. Wood forensic analysis incorporating various technology derived diagnostic features will be illustrated through an examination of Arthur Koehler's 1930s investigation of evidence used to convict Bruno Hauptmann in the Lindbergh Kidnapping Case.

LAB: Tools marks from hand planes will be analyzed recreating forensic analysis from the Lindbergh case.

***Quiz Three Posted - Built Wooden Heritage Conservation, Treatment and Preventive Measures***

#13 4/10/25 Lecture 1:45 pm B7 / ACL Meyerson Hall TBD

The Reconstruction of the Timber Roof Structure of Notre Dame Cathedral 2019-2025

**Practicum / Research Submission 4 (90 % Draft Submission) due Sunday April 13<sup>th</sup> 5pm**

#14 4/17/25 **Final Presentation of Practicum Projects** B7 Meyerson Hall

#15 4/24/25 Independent Group Meetings / Office hours

***Quiz Three due April 27th 5pm***

**Practicum / Research Submission 5 (100% Final) due Sunday May 4<sup>th</sup> 5pm**

## SEMINAR COURSE READING LIST

The seminar reading list is designed to provide the most essential information relevant to coursework and professional practice. As time is limited for graduate students in the HSPV program, it is recommended participants spend only 20-30 minutes a week with readings then revisit the material for quizzes. The English Heritage 2012 publication of *Practical Building Conservation: TIMBER* may be used as a general reference and any equivalent material from this publication may be substituted for required reading where applicable. Recent published papers on wooden heritage conservation along with international doctrines may found at [www.icomoswood.org](http://www.icomoswood.org). Bibliographies should be developed during the course as they are required for individual research projects.

Required\*\* (PDF) PDF available on course folder or canvas

General Texts and Timber Conservation Methodology

Larsen & Marstein, **Conservation of Historic Timber Structures**

English Heritage, **Practical Building Conservation: Timber**

Charles, **Conservation of Timber Buildings**

Ridout, **Timber Decay in Building: The Conservation Approach to Treatment**

1. Wood Identification, Structure, Species and Anatomy

Core, **Wood Structure and Identification** (Syracuse Wood Science Series 6)

Hather, **The Identification of Northern European Woods**

Hoadley, **Identifying Wood**, Chapters 1- 4\*\* (PDF)

Hoadley, **Understanding Wood**

Hough, **The Woodbook**: The Complete Plates (Taschen 25th Anniversary Reprint of 1888-1913 specimen collection *The American Woods*)

International Association of Wood Anatomists. 1964. **Multilingual glossary of Terms used in Wood Anatomy**. Zurich: IAWA Committee on Nomenclature. 186 pp.

Panshin, A. J. and de Zeeuw, C., **Textbook of Wood Technology** (3rd ed., Vol. 1)

Richter, H.G., D. Grosser, I. Heinz and P.E. Gasson, eds. 2004. **IAWA List of Microscopic Features for Softwood identification**. *IAWA Journal* 25(1):1-70.

Shmulsky and Jones, **Forest Products and Wood Science** (6th Edition)

Wheeler, E.A., P. Bass and P.E. Gasson, eds. 1989. **IAWA List of Microscopic Features for Hardwood Identification**. *IAWA Bulletin* 10(3):219-332.

Wiedenhoeft, **Identification of Central American Woods**, US Forest Products Lab Download  
[https://www.fpl.fs.fed.us/documnts/pdf2011/fpl\\_2011\\_wiedenhoeft009.pdf](https://www.fpl.fs.fed.us/documnts/pdf2011/fpl_2011_wiedenhoeft009.pdf)

**The Wood Handbook** Download  
[http://www.fpl.fs.fed.us/products/publications/several\\_pubs.php?grouping\\_id=100&header\\_id=p](http://www.fpl.fs.fed.us/products/publications/several_pubs.php?grouping_id=100&header_id=p)

Reference Databases and Online Resources

<http://insidewood.lib.ncsu.edu> (North Carolina State University Database)

<http://bio.kuleuven.be/sys/iawa/> (International Association of Wood Anatomists)

<https://www.wood-database.com/wood-finder/> ( the wood database)

1. Wood as a Structural Material, Construction and Intervention

Visser, **A Field Guide to New England Barns and Farm Buildings** pages 3-39 \*\* (PDF)

Sobon, **Historic American Timber Joinery** \*\* (PDF)

Lewandoski, **Historic American Timber-Frame Steeples-2** (PDF)

Fischetti, **Historic American Timber-Frame Steeples- 5** (PDF)

Fischetti, **Structural Investigation of Historic Buildings: A Case Study Guide to Preservation Technology for Buildings, Bridges, Towers and Mills** (2009 Book)

Levin, **Historic American Roof-Trusses -2- Queen Post Trusses \*\*** (PDF)

Audel's, **Carpenter and Builder's Guides Vol. 1-4**

Zwerger, **Wood and Wood Joints: Building Traditions in Europe Japan**

Sato & Nakahara. **The Complete Japanese Joinery**

Sloane, **A Museum of Early American Tools**

Harris, **Discovering Timber-Framed Buildings**

Henrichsen, **Historic Wooden Architecture in Japan: Structural Reinforcement and Repair** (PDF)

Holan, **Norwegian Wood**

Ssu-ch'eng, **Chinese Architecture**

## 2. Biodeterioration, Insects and Wood Pathology

Zabel and Morrell, **Wood Microbiology: Decay and Prevention \*\*** (PDF)

Clausen, **The Wood Handbook** Chapter 14 (pg 9–14) Biodeterioration of Wood \*\* (PDF)

Louisiana State University, **Guide for Integrated Pest Management of Termites \*\*** (PDF)

University of California, **Termites: Integrated Pest Management in and around the Home** (PDF)

Penn State University, **Eastern Subterranean Termites** (PDF)

Parker, **Wood Destroyer Handout** (PDF)

Feilden, **Conservation of Historic Buildings**, Chapter 10 (PDF)

## 3. Conservation of Exterior Architectural Wood

Clausen, **The Wood Handbook** Chapter 14 – Biodeterioration of Wood \*\* (PDF)

Shmulsky and Jones, **Forest Products and Wood Science** Chapter 10 (6th Edition)

Williams, **Borate Wood-Protection Compounds: A Review of Research and Commercial Use \*\*** (PDF)

Williams, **The Wood Handbook**, Chapter 7, Weathering of Wood \*\* (PDF)

Lebow and Anthony, **Guide for Use of Wood Preservatives in Historic Structures \*\*** (PDF)

Tutton and Campbell, **Doors: History, Repair and Conservation**

Leeke, **Making Window Sash** (PDF)

Gibney, **Restoring Window Sash** (PDF)

EPA, **The Lead-Safe Certified Guide to Renovate Right** (PDF)

Vandal, **How to Make a Molding Plane** (PDF)

Wilbur, **Carving Architectural Detail in Wood** (book)

Pearce, **Windows: History Repair and Conservation**

Gthesen, **Gamle Vinduer: Restoration of Historic Windows**

## 4. Interior Architectural Woodwork

Hanlon, **The Deinstallation of a Period Room** (PDF)

National Trust **Manual of Housekeeping**, Chapter 18: Woodwork \*\* (PDF)

Moxon, **The Art of Joinery** (PDF)

Tutton and Campbell, **Staircases: History, Repair and Conservation**

GCI, **Methodology for the Conservation of Polychromed Wooden Altarpieces** (PDF)

Reinberger, **Utility and Beauty: Robert Welford Composition Ornament in America**

Lahikainen, **Samuel McIntire, Carving an American Style**

Howe, **Cincinnati Art Carved Furniture and Interiors**

HABS, **Historic American Doors**

5. Wood Finishes: Investigation and Fabrication

Bulian & Graystone, **Wood Coatings, Theory and Practice**

Fearon, **Copal Resin and the Practice of Oil Varnishing** \*\* (PDF)

Velji, **Shellac's Amazing Journey** \*\* (PDF)

Clarke, **Traditional French polish** (PDF)

Buck/Olley, **UV Varnish Chart** \*\* (PDF)

Mussey, **Cabinet-Makers guide of 1827** (reprint)

Stalker and Parker, **A Treatise on Japaning and Varnishing** -1688 (PDF)

Moss, **Paint in America: The Color of Historic Buildings**

Walch/Koller et al, **Baroque and Rococo Lacquers**

WAG\_AIC, **Painted Wood: History and Conservation**, Chapters 1 and 4 (PDF)

Mascheilien-Kleiner **Ancient Binding Media and Adhesives**

6. Diagnostics

Deutsch & Kohler **Assessment of Timber Structures** part 1 and 2\*\* (PDF)

Anthony, **Non-Destructive Evaluation: Wood** (PDF)

Anthony, **A Grading Protocol for Structural Lumber and Timber in Historic Structures** (PDF)

Anthony, **An Assessment of a Structural Failure in a Historic Truss Using Digital Radiography** (PDF)

Fischetti, **Structural Investigation of Historic Buildings: A Case Study Guide to Preservation Technology for Buildings, Bridges, Towers and Mills** (2009 Book)

Rosina, **Applying Infrared Thermography to Historic Wood Frame Buildings in North America** (PDF)

Minnesota DOT, **Inspection of Timber Bridges** (PDF)

7. Nail Chronologies and Fasteners / Hardware

Wells, **Nail Chronology: The Use of Technology Derived Features** \*\* (PDF)

Nelson, **Nail Chronology as an Aid to Dating Old Buildings** (PDF)

Fontana, **The Tale of the Nail on the Ethnological Interpretation of Historic Artifacts** (PDF)

White, **Observations on the Development of Wood Screws in North America** (PDF)

Streeter, **Some Signed American Iron Rim Locks** (PDF)

8. Dendrochronology

Stokes, **An Intro to Tree Ring Dating** Chapter 1 \*\* (PDF)

Speers, **Fundamentals of Tree-Ring Research** Chapter 5\*\* (PDF)





*Pavilion in the Trees, Fairmount Park, Philadelphia, January 2025 (photo: Andrew Fearon)*

## 2025 Wood Seminar Practicum

### Pavilion in the Trees: Assessment and Conservation Management Plan

#### Project Scope of Work (teams of 2-4 max)

Team 1: Contextual Research, Martin Puryear, background, artist's vision and exploration of the Tree-house form with influences of Shinto Japan and Lapland, the pluralism of the utilitarian "amenity" in the landscape. Oral history recordation and potential interviews with artists, contractors, and architecture firms. (4 max) **Research, Documentation, Chronology and Archival**

Team 2: Documentation (Compile Existing Drawings, new CAD, rectified, ortho-photography or 3D modeling) (4 max) **Photography and Drafting / Modeling**

Team 3: Structural analysis, in-situ grading, landscape hydrology, vegetation, access. (4 max) **Assessment with Recommendations**

Team 4: Weathering, Biodeterioration, IPM, preservatives, UV Protection. (4 max) **Assessment with Recommendations**

Team 5: Thermography and Moisture Content Mapping (IR Cam and moisture meter) (2 max) **Assessment with Recommendations**

Team 6: In-situ Non-Destructive Wood Identification / Microscopy (2 max) **Analysis and Documentation**



## Pavilion in the Trees (1981-1993), Martin Puryear (1941-), Fairmount Park, Philadelphia

Kierin Timberlake and Harris, *Architects*

Bob Taylor, Custom Millwork, Contractor

Association for Public Art (Fairmont Park Art Association), *Client*

Fairmount Park Conservancy, *Conservation / Maintenance*

### From Association for Public Art Website

Martin Puryear's *Pavilion in the Trees* is an amenity located near the Horticulture Center in West Fairmount Park. Conceived in 1981, the public artwork was developed as part of the Fairmount Park Art Association's (now the Association for Public Art) *Form and Function* program. The original model included a steep set of stairs, but the artist decided to substitute a sloping ramp for aesthetic and safety reasons.

Puryear – whose retrospective exhibition was shown at the Philadelphia Museum of Art in 1992 – worked with architect Samuel Harris, at the time with the firm Kieran Timberlake and Harris, to realize the project, which was supported by the Pew Charitable Trusts, the National Endowment for the Arts, and the Pennsylvania Council on the Arts. Inspired by the universal childhood longing for a tree house, *Pavilion* consists of an open structure supported by a series of posts.

All the wood species – western red cedar, heart white oak, heart redwood – were selected for their natural durability. A sixty-foot walkway leads across a natural basin to an observation platform – a square deck covered by a latticed canopy – that rises twenty-four feet above the ground. Situated high among the treetops, the work has become a much-favored place to relax and contemplate nature from a bird's-eye view.

**Directions Video by Car or Public Transportation:** <https://www.youtube.com/watch?v=hcHji3SWrh4>

### Artist Biography from Architectural League of New York

One of the nation's most celebrated contemporary artists, Puryear is known for his devotion to craft and thoughtful exploration of history and culture.

Raised in Washington, DC, he graduated from Catholic University in 1963. After spending two years in Sierra Leone with the Peace Corps, Puryear studied at the Swedish Royal Academy of Art, then earned an MFA at Yale. He later taught in Nashville, Maryland, and Chicago and earned a Guggenheim fellowship to study architecture and garden design in Japan.

His many accolades include a MacArthur Foundation fellowship, a Gold Medal in Sculpture from the American Academy of Arts and Letters, and a National Medal of Arts. Major retrospectives of his work have been mounted at MoMA, the Art Institute of Chicago, and other institutions.

Puryear's public artworks include:

- *Big Bling*, a large-scale installation first presented in Madison Square Park in 2016
- *Slavery Memorial*, a 2014 sculpture at Brown University recognizing the school's links to the slave trade
- *Bearing Witness*, a monumental bronze sculpture installed outside DC's Ronald Reagan Building in 1997.

ART21 Interviews with Martin Puryear:

<https://art21.org/watch/extended-play/martin-puryear-big-bling-short/>

On *Pavilion in the Trees* (from APA Website)

<https://www.associationforpublicart.org/apa-now/story/can-it-last-the-permanence-of-pavilion-in-the-trees/>

<https://www.associationforpublicart.org/?s=pavilion+in+the+trees>