Session Track: Effects of Climate on Historic Materials
Session Code: CS09a

Paper: Evaluating the Threat of Environmental Change on Historic Resources: A Case Study and Assessment of Tools

Presented by
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Speaker(s) Biography
Ashley C. Aiken earned her Bachelor of Science in Civil Engineering at Bucknell University in 2005, where she was heavily involved in their J. Paul Getty Campus Heritage Project. She is currently enrolled in the Graduate Program in Historic Preservation at the University of Pennsylvania (Master of Science expected in May 2007.) She will join Morrison Hershfield Corporation in Seattle, WA as a Junior Engineer in Summer 2007.

Michae C. Henry is Principal Engineer/Architect with Watson & Henry Associates and Lecturer in the Graduate Program in Historic Preservation at the University of Pennsylvania. He holds a BS in Mechanical Engineering (University of Houston) and an MS in Engineering (Univeristy of Pennsylvania). He was a 2005-6 Fulbright Distinguished Scholar at the Centre fro Sustainable Heritage, University College London.

Abstract
Climate change challenges the longevity of traditional building materials and craftsmanship with exposure to new, potentially extreme, environmental conditions thereby activating new pathologies and deterioration mechanisms in the historic fabric. As historic preservation professionals, we should anticipate the potential threats of climate change to our historic resources and prepare to respond if those threats are realized. Ultimately, it is essential to develop and understand the time frame in which we have to act, in order to make the most informed appropriate decisions and proactive interventions.

To explore the implications of this topic in depth, a case study was undertaken on the Abel and Mary Nicholson House, located in Elsinboro Township, Salem County, New Jersey. Situated on a tidal marshland within the Delaware Estuary, two miles east of the Delaware Bay, the two-and-a-half story, brick house was built in 1722 and is a National Historic Landmark. The original structure is known for its patterned end brick architecture featuring a diapered-pattern and its construction date in vitrified brick on its east façade. The Nicholson house is a monumental example of Delaware Valley's local architecture and well-to-do Quaker residences and integrates the Quaker's emphasis on family and community.

In the eighteenth century, the tidal marshland surrounding the Nicholson House was reclaimed for agriculture by the construction of low-rise levees or banks. Today, the Delaware Estuary is currently evolving with rising sea levels and related saltwater intrusion into the coastal, unconfined aquifer. Storms and rising tides have overtopped the banks, and the retreat of agricultural activity has removed the economic impetus for the repair and maintenance of the dike system. The site location is within the Middle Atlantic Coastal Plain, which is relatively flat and facing land subsidization, making the rate of

relative sea rise higher and well above the world average. This combination of rising sea levels, failed levees and land subsidence presents serious potential long term threats to the house, which lies on a plot less than 10' above sea level. Composed of a hand-made, low-fired brick foundation, the rising water table and zone of saturation in the groundwater could waterlog the basement and introduce damaging salts to the footings, cellar walls and floor, potentially compromising the historic fabric and structural integrity of the building. With such threats at hand, it is important to establish the time frame within which the property stewards must react before the building is damaged.

Although the building fabric currently exhibits no visual evidence of salt presence, there are some key indicators that the water table is near the basement floor. For instance, levee failure in the area has exposed the site to the effects of tidal flooding. Dying trees and the prevalence of phragmites, an invasive plant species that grows in saltwater, around the property further indicate the progress of saltwater encroachment on the site.

The project researches and, in some cases, applies tools for determining the rate of groundwater rise and saltwater encroachment in the vicinity of the Nicholson house's foundation to infer how long before the deterioration mechanism is activated and the estimated time available for response. Potential monitoring methodologies include: mapping vegetation changes over time with GIS and aerial maps, modeling saltwater transport as a contaminant using Groundwater Modeling System applications, and installing wells to monitor groundwater levels and saline content. Since this phenomenon is expected to occur over several decades, the resolution, repeatability, costs, robustness and simplicity of the methods will all be important considerations. In addition, the project offers a collaborative opportunity with professionals dealing with climate/environmental change in other fields and engages preservationists as stakeholders in the decision-making process.

Session Track: Effects of Climate on Historic Materials
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Paper: Abandoned in the Wilderness: Survival and Rescue at the Adirondack Iron Works

Presented by
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Speaker(s) Biography
Janet Null is an architect with 35 years experience in the conservation and rehabilitation of historic properties. As president of Argus Architecture & Preservation in Troy, NY, she is currently executing such projects as master planning for the first Shaker site in America, master planning and conservation for the Byrdcliffe Arts and Crafts Colony, and the conservation of historic lighthouses on Lake Champlain. Janet has presented a number of papers to APTI conferences, on subjects ranging from conservation theory to the technology of historic bark siding. Janet serves on the Board of APTNE and has received Presidential Citations from APTI for her work on the conservation of Adirondack Great Camps and for volunteer work on post-Katrina heritage recovery.

Abstract
Like the Tropics, the Adirondack Mountains "provide a unique opportunity to evaluate building materials and craftsmanship under...extreme conditions" of climate - in the case of the Adirondacks, those conditions include extreme temperatures, rain/snow, humidity, and forest encroachment. The setting of this paper is a place called Tahawus, the Native American name for New York's highest mountain - aptly meaning "cloud-splitter".

The human interventions of maintenance, repair, renovation or restoration continually mitigate the impact of climate and other environmental factors on buildings - as they are intended to do. It is rare, therefore, to be able to observe the unmitigated impact of the environment on an historic structure that has been completely abandoned for 160 years! Such is the case of the 1854 Blast Furnace of the Adirondack Iron and Steel Co. Constructed in a wilderness, accessed only by a plank road also built by the mining company, the Blast Furnace was (and remains) a mind-boggling achievement. The 40' square by 60' high furnace utilized traditional massive masonry (of the same local stone from which the mine extracted its ore) and superb craftsmanship, combined with cutting-edge engineering. In testament to its superior construction and despite its long abandonment, it is the most intact furnace of its type and era in the U.S.

The only other structure surviving from the Adirondack Iron works (1827 - 1856) is the 1834 MacNaughton House, abandoned (only) since the 1960s. A traditional timber-framed building (also constructed of indigenous materials), the house followed a very different profile and pace of deterioration than the Blast Furnace. By 2005, when the property finally came into the hands of a responsible steward, the MacNaughton House was fast approaching total collapse. Now, more than 30 years after being listing on the National Register, stabilization and conservation of both structures is in progress.

This paper examines the long-term effects of climate on these two abandoned historic structures, the mechanisms of deterioration of the specific climate, the relative capabilities of two different traditional

building systems to withstand the same environmental forces, and the measures being employed to rescue and preserve both structures.

Session Track: Effects of Climate on Historic Materials
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Paper: A HAMMER for the 21st-Century

Presented by
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Speaker(s) Biography
Tad Britt is a Researcher at the US Army Corps of Engineers, Engineer Research and Development Center-Construction Engineering Research Laboratory, Champaign, IL. Britt is a Registered Professional Archeologist and has practiced Heritage Asset Management for over 15 years. He has registered two patents (ARMS; HAMMER) and is the recipient for the 2007 Federal Laboratories Consortium Award for Excellence in Technology Transfer. He holds a Masters of Arts (Anthropology), University of Mississippi.

Abstract
Compiling a robust condition index is critical to improving real-time understanding of climatological effects on historic properties. Conventional methods are labor intensive, potentially destructive, involve multiple technologies that are not well integrated, and require numerous steps to produce a consolidated report with drawings and images. The "HAMMER™" (Hand-held Apparatus for Mobile Mapping and Expedited Reporting) offers an efficient solution to the problem of acquiring and processing multiple streams of critical climate and structural information (e.g., temperature, humidity, tilt, seismic) to generate a condition index. The device is hand-held and /or tripod mounted and trigger activated for synchronized data capture. The core unit includes a computer running a Windows™ XP operating system, which allows secure and encrypted robust processing and 80 GB of data storage capacity. An embedded ArcGIS™ software platform allows for integrated complex geographical information system (GIS) analysis. Base unit features include: position acquisition (GPS) as well as stand-off positioning (LDM); distance, pitch, and roll measurements (IMU); and still and video acquisition and processing. Additional functions include thermal camera, image stabilization and video pattern registration. Voice annotations may be achieved through a wireless, hands-free, headset. Radio Frequency Identification (RFID) tags are used to remotely characterize and monitor climate changes and effects (temperature and humidity sensors). Additional sensors are available to detect and monitor other events that may affect the integrity use of an historic building: proximity intrusion, photo-electric; radiation; acceleration; acoustics; particulates. The HAMMER™ includes an encrypted data capture protocol, ensuring a "chain-of-custody" for all data and metadata. Drawings, photographs, reports, forms, maps, CADD and GIS coverages may be uploaded prior to use and serve as on-board references. The criteria-driven business process enables decision-making via the use of logic-driven, solution oriented customized forms. Because data are captured digitally and the reports generated automatically, information that would have taken days, weeks or months to produce using conventional methods, can now be transmitted over the internet the same day. While this process does not replace conventional face-to-face and other means of rapid communication, it does however, allow for rapid dissemination of text, maps, photos, and other data, which can explain and support effective consultation efforts. And, it allows the user to objectively demonstrate the decision-making processes with stakeholders. The immediate benefit to the historic preservation community will be the digital streamlining of the collection, storage, and display of architectural and condition data. The tool will also decrease the amount of time spent in the field, while improving the quality of data collected. The

HAMMER™ offers a unique integrated suite of capabilities to serve a wide range of users: preservationist, architectural historians, engineers, public works officials, environmental scientists, natural and cultural resource managers, compliance officers, risk managers, real property managers, etc.