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REFLECTIONS



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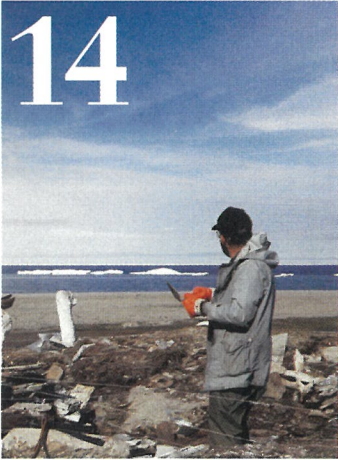
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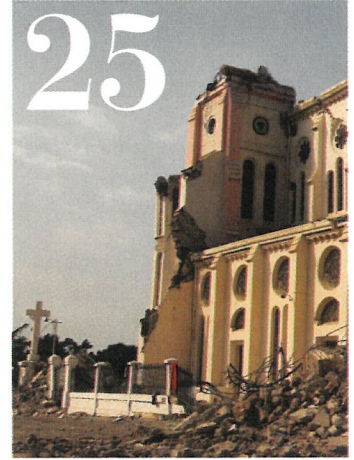
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MESSAGE FROM THE DIRECTOR GENERAL

Thank you for your overwhelming response to the 2010 issue of *REFLECTIONS* on Conservation! I was delighted to hear from so many of you and to learn that the articles in that first issue became a touchstone for some of your work.

For 2011, we have chosen to examine the conservation of heritage collections from the perspective of sustainability — and explore how the Canadian Conservation Institute (CCI) can help museums and other heritage institutions in Canada be economically and environmentally sustainable without jeopardizing their social and cultural sustainability. Looking forward to 2012, we are already planning a special issue to mark the occasion of CCI's 40th anniversary.

I hope you find this second issue of *REFLECTIONS* on Conservation as interesting and valuable as the first one. Please continue to send me your reflections on the interests and needs of the conservation and heritage community.

I look forward to hearing from you.

Jeanne Inch
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Sustainability &

the Canadian Conservation Institute

Jeanne Inch*
Director General and Chief Operating Officer
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The essential goal of cultural heritage conservation is to ensure that heritage collections endure — for it is access to these collections that allows current and future generations to learn about, and truly experience, their cultural heritage. However, to achieve this goal, museums, archives, and other heritage institutions must first be sustainable in themselves.

Much has been written about sustainability and sustainable development, with numerous definitions applied in multiple contexts.

The concept of sustainability was first articulated in the 1980s, at which time it was defined by the United Nations as “meeting the needs of the present without compromising the ability of future generations to meet their own needs.”¹ Other definitions included “the capacity to endure” and “capable of being sustained.”

The idea of the “triple bottom line” as an approach to sustainability was first defined in the 1990s.² Essentially a form of accounting for enterprises, the triple bottom line is based on three perspectives or “pillars”: social, economic, and environmental (sometimes referred to as “people, profit, and places”).

By the beginning of the 21st century, it was suggested that culture should be a fourth pillar of sustainability.

- ▶ Jon Hawkes (2003), writing in the context of public planning, argued that cultural vitality is as essential to a healthy and sustainable society as are social equity, environmental responsibility, and economic viability. If cultural institutions and/or their collections are damaged or destroyed (as occurred in the earthquake that shook

Haiti in January 2010), the community risks losing the evidence of its past, its identity, and its cultural heritage. Museums and other heritage institutions are therefore an integral part of the cultural sustainability of communities.

- ▶ Eleanor Adams (2009), in her work on sustainability indicators for Australian museums, clearly articulated culture as a fourth pillar of sustainability that is interdependent with the other three. She believes that museums are inextricably linked to sustainability principles by the fact that they maintain collections in perpetuity, to serve both current and future generations. Efforts in the United Kingdom support this view.³

In all discussions of the four pillars of sustainability, there is consensus that organizations such as museums and CCI cannot survive if their performance is deficient in any one of the four pillars.

Certainly, concern has been expressed in Canada that museums have generally been measuring their success and their sustainability on economic factors (i.e. revenues and number of visitors), rather than on social and environmental factors. Robert Janes (2009) argues for more socially responsible museums. Canadian Douglas Worts (2006, 2008) believes that the success of museums should be measured on their cultural performance, i.e. according to their impact on the cultural health and well-being of their communities. He hopes that museums will become more culturally relevant by being more responsive to the needs and realities of their communities in a rapidly changing world, thereby helping communities adapt to a sustainable future.

Museums are centred on their collections, both heritage and contemporary. To be sustainable according to the definitions discussed above, they must not only exhibit the collections to current generations in a responsible manner, they must preserve the collections so that they remain accessible to future generations. CCI can assist museums by exploring

*Many thanks to David Grattan (former Manager of Conservation Research in the Research, Conservation and Scientific Services Directorate of CCI; now retired), whose thoughts and insights on sustainability have helped to shape the views expressed in this article.

CCI's role is to support heritage institutions and organizations in Canada in the preservation of their collections during display, storage, handling, study, treatment, and transit.



▲ The Geodetic Hills Fossil Forest on Axel Heiberg Island, Nunavut, is impacted by human activity as well as by natural processes, including wind, freezing and thawing, rainfall, and wandering animals. In a unique experiment, CCI measured wind erosion (visible in this image) of the fossil forest.

▲ Grave markers on Beechey Island, Nunavut, commemorating British explorer Sir John Franklin and other polar explorers. CCI helped reinstall fallen markers.

ways to reduce the environmental and energy costs of caring for collections (which translates to economic savings) without compromising social and cultural sustainability.⁴

CCI has already been working on numerous projects related to sustainability.

- ▶ Our conservation scientists have always taken into account the vast geographic span and extreme cold weather in many regions of Canada. Their advice to museums has been and continues to be practical, e.g. adopt seasonal temperature setbacks as a way to save historic buildings from damage due to winter humidity (Macleod 1975; Lafontaine 1979). More recently, there is also recognition that winter setbacks save energy and reduce operational costs.
- ▶ We have worked with the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) to develop pragmatic environmental guidelines for museums. These guidelines,⁵ based on scientific evidence, allow for

different levels of control for different types of collections according to their vulnerability. They are designed to be as flexible as possible without compromising the integrity of collections or individual objects.

- ▶ To ensure that the reduced energy consumption and financial savings of adjusting temperature, humidity, and lighting do not endanger collections, we have been investigating several issues that need clarification. We are examining the impact of small RH changes on crack propagation to demonstrate the degrees to which sensitive objects can survive RH change without damage. We are also modelling the effect of RH and temperature on the degradation of cellulosic materials.
- ▶ We have supported a minimal-intervention conservation approach for built heritage that supports environmental goals while sustaining the cultural aspects of the buildings. For example, preservation of the heritage character of a building through careful maintenance or re-use, rather than renovation or replacement, offers



▲ CCI campsite (foreground) and Geodetic Hills Fossil Forest on Axel Heiberg Island, Nunavut. Preservation of this fossil forest is critical to its sustainability for long-term scientific interpretation as well as public access.

large savings in materials as well as the energy embedded during the manufacture of those materials.

- ▶ We have helped develop a risk management approach to collections preservation that can also support economic sustainability. Using this approach, museums can identify and prioritize risks to their collections, develop options to reduce those risks, and undertake a cost–benefit analysis of those options to ensure that resources are directed in the most effective manner. Integral to this approach is consideration of the significance of the collections, i.e. their meaning to the community and their fit with the mission of the museum.

As CCI moves forward, we will continue to focus on the areas described above. We will continue our research on displaying vulnerable objects in temperature- and RH-controlled display cases, and reducing the use of toxic chemical fumigants and residual pesticides. We are also examining more energy efficient forms of lighting (from tungsten to fluorescent and now increasingly to light emitting diodes), and investigating their impact on the fading of objects.

Communicating these sustainable approaches to collections care is crucial. As part of this process we are “greening” CCI’s *Framework for Preservation of Heritage Collections* by adding sustainability concerns to each agent of deterioration, from physical forces to incorrect relative humidity. We are also advocating the widespread adoption of the ASHRAE environmental guidelines in heritage organizations in Canada and around the world.

Finally, in addition to our efforts to assist the heritage community, we are reviewing both our internal operations and our service to clients to ensure we become more sustainable as an institution. We are reducing our reliance on print publications and distributing more of our technical and scientific information through our website, as well

as examining options for distance learning. We are also adopting the actions required by the Federal Sustainable Development Strategy for Canada.⁶

Implicit in all the above efforts is the assumption that not only should collections be preserved, but also that they should be preserved at a high standard. But, of course, this can only be the case if museums and archives are themselves sustainable as viable institutions. We are working to ensure that CCI can continue to support museums and other heritage institutions in a manner that is consistent with the objectives of the four pillars of sustainability. And, as always, we will work with other organizations and their experts, both in Canada and internationally, to further this goal. 🌱

Endnotes

1. This definition of sustainable development was adopted in 1983 by the World Commission on Environment and Development (WCED) which was convened by the United Nations and known as the Brundtland Commission, after its Chair Gro Harlem Brundtland.
2. The triple bottom line was first articulated by Freer Spreckley (1981) and later adopted by John Elkington (1997).
3. *Sustainability and Museums: Report on Consultations, January 2009*. <http://www.museumsassociation.org/download?id=17944>.
4. Given that a substantial portion of the capital and operating costs of museums is directed at collections care and management (Lord et al. 1989), reducing the financial and environmental costs of caring for collections should help museums carry out these procedures and subsequently increase their sustainability.
5. *Environmental Guidelines for Museums — Temperature and Relative Humidity (RH)*. <http://www.cci-icc.gc.ca/crc/articles/enviro/index-eng.aspx>.
6. The Federal Sustainable Development Strategy for Canada. <http://www.ec.gc.ca/dd-sd/default.asp?lang=En&n=F93CD795-1>.

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The Role of Risk Management in Sustainable Collections Preservation

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A museum can be considered sustainable if it operates in a manner that does not hurt the environment or community. More fundamentally, it is sustainable if it conducts its business in a manner that can be continued indefinitely given its available resources. Risk management can help collecting institutions improve sustainability in both ways.

Risk management is a decision-making tool that allows the risks that a collection or museum is facing to be identified and quantified in a systematic manner. The improved decision-making that results from identifying and addressing the risks produces improved outcomes, and ensures that time, money, and energy are spent in the most effective manner.

The Canadian Conservation Institute (CCI) has been involved in risk management for a number of years. Important projects include partnerships with the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) and the Netherlands Institute for Cultural Heritage (ICN) to develop and deliver numerous international courses on reducing risks to collections through risk management, and with the Canadian Museum of Nature to develop a comprehensive risk assessment approach

to museum collections. CCI also helped to develop a risk assessment tool that it began testing in 2009. Pilot projects have been carried out at Glanmore National Historic Site in Belleville, the Robert McLaughlin Gallery in Oshawa, and Eldon House in London (all in Ontario). These projects comprised comprehensive risk assessments to identify, analyse, and evaluate the magnitude of the risks to the collections, followed by risk management reports that provided advice on proposed mitigation strategies.

Risk management can assist with sustainability in four key areas:

- ▶ precise identification of risks
- ▶ prioritization of risks
- ▶ estimation of the ability of treatment options to reduce the risk
- ▶ comparison of the cost-effectiveness of risk reduction options

PRECISE IDENTIFICATION OF RISKS

Risk management begins with a comprehensive risk assessment. While a detailed facility survey primarily describes the systems and procedures that are used in an institution, a risk assessment focusses on the kind of damage that could happen to a collection and how it is likely to occur, i.e. *specific* risks. Such precise identification of risks leads to more effective risk reduction strategies, as the following critical questions are more likely to be asked:

- ▶ *what agent?*
- ▶ *from what source(s)?*
- ▶ *follows what path?*

- ▶ causing *what kind(s) of damage?*
- ▶ to *what artifacts?*
- ▶ located *where?*

A review of building systems and procedures is still important (as they can affect what risks occur and how), but staff recollection of past incidents becomes a key source of information.

Consider, for example, a museum with HVAC environmental control. In a traditional facility assessment, the presence of the HVAC system would be noted along with details such as the presence of zones and records of relative humidity (RH) and temperature. A year's worth of graphs showing year-round $45\pm 2\%$ RH would suggest there were no risks from incorrect RH. But the graphs might not show infrequent maintenance problems. What if the humidifier broke down for a week every few years during the winter and the RH dropped to well below 20%? A sensitive collection might sustain greater damage over time than it would under a system that delivered less stringent control but was designed to avoid complete loss of humidification. The problem could be eliminated cost-effectively by building redundancy into the former system, but first the risk has to be identified. This requires understanding the systems sufficiently to recognize the types of problems that could occur and then asking the right people the right questions about systems maintenance.

Risk assessments should be based on research data wherever possible, whether from conservation or other fields (e.g. insurance data). Risk scoring should be explained in simple language in a manner that reflects the current practice of the museum. The resulting risk management report thus provides the rationale for improvement as well as identifying which areas most require it.

PRIORITIZATION OF RISKS

Risk assessment makes it possible to rank risks from extreme to low. By identifying which threats to the collection are most serious, it is possible to determine which risks should be addressed first. For example, fire will always be an extreme risk to combustible collections in combustible buildings. However, because fire codes focus on the safety of human life and often permit older buildings to operate without suppression systems, many museums

An inability to show any benefit from a particular strategy may be due to a lack of good research on mitigation options. For example, the effectiveness of security systems in reducing the risk of theft is not well understood. Likewise, the role of good building maintenance (although certainly critical) in risk reduction is poorly documented — as there is a tendency to pay more attention when things fail than when they do not. The risk management approach can identify where techniques and understanding are lacking, and point out areas where research is most urgently needed.

are not undertaking projects to reduce the risk of fire. Risk assessment can reinforce the importance of a fire suppression system. Prioritization of risks can also show where current mitigation practices are acceptable, even if further improvements could still be made.

ESTIMATION OF THE ABILITY OF TREATMENT OPTIONS TO REDUCE THE RISK

It is important that the measures taken to preserve collections are truly effective. In addition to identifying and prioritizing risks, risk management provides a way to analyse and score the effects of any changes made. Using this approach, some common “solutions” to conservation problems have been shown to have such a small impact that the magnitude of the risk remains essentially unchanged. This can be a double-edged sword. On the one hand, it can identify and eliminate ineffective strategies, thus avoiding the wasteful use of limited financial and human resources. On the other hand, if the benefits of a particular strategy cannot be demonstrated, investment in better practices may be deferred — leading to more risk later.

COMPARISON OF THE COST-EFFECTIVENESS OF RISK REDUCTION OPTIONS

The cost-effectiveness of a single strategy to mitigate a single risk can be estimated by dividing the potential annual reduction in value of the collection due to the risk by the estimated annual cost of the mitigation strategy (including materials, equipment, staff time, etc.). When this approach was used in the pilot projects at Glanmore National Historic Site and the Robert McLaughlin Gallery, the results indicated that the only clearly cost-effective strategies were those that



◀ Properly designed packaging for transport is a proven method to reduce risk of damage to art made accessible through travelling exhibitions.

could reduce the magnitude of the risk substantially (by 10 times or more) at a very low cost.

Unfortunately, the approach outlined above can be used only when assessing a single option that reduces a single risk. At present there are no methods to calculate the cost-effectiveness of a single option that reduces more than one risk, or several options implemented at the same time.

Even without complex methods to assess cost-effectiveness, it is often possible to identify simple inexpensive changes that can reduce or eliminate specific risks without creating any significant new risks. For example, when assessing Glanmore National Historic Site, it was found that attempting to maintain “standard” museum RH levels (i.e. 50% RH) year-round in the building created a high risk of brick spalling in the winter. This risk of damage to a key “artifact” in the collection could be eliminated at no financial cost by eliminating the winter humidification, but the resulting low RH would present a moderate risk to the furniture. However, keeping the winter RH at 25% would reduce the risk of brick spalling by 10 times (in comparison to the risk at 50% RH) without putting the furniture at risk.

Confronting the cost-effectiveness of preventive conservation projects can improve museum sustainability in multiple ways.

- ▶ First, it may encourage creativity in the search for cheaper, sustainable solutions to risk reduction. For example, the use



▲ How cost-effective are object enclosures in terms of reducing risk? The answer may depend on the type of enclosure, the type of storage furniture with which it is used, the degree to which a collection is handled, and the level of environmental, water, and fire risks in storage.

of cheaper fire suppressions systems could make reducing the risk of fire more cost-effective for historic house museums.

- ▶ Second, it will favour methods that are less wasteful of materials, energy, and staff time, since these will be more cost-effective when risk reduction is the same. Finding low-cost options in a field in which fiscal restraint has always been the reality is not new. Demonstrating the relative effectiveness of such approaches would provide the means by which smaller institutions can afford to meet the responsibilities of preserving their collections, and thus continue to do so indefinitely.

Cheaper fire suppression systems are becoming more widely available due to legislation requiring fire suppression systems in new residential buildings in some jurisdictions. Assuming these systems are just as effective as more expensive designs, approving their use in historic house museums could reduce the risk of fire in a cost-effective manner.

CONCLUSION

Finding the funding and time to deal with problems will remain a challenge for museum staff and management who must juggle the requirements of museum programming and collections management and preservation every day. However, by identifying the most serious problems, risk management can provide clearer justification for any changes that are made. Moreover, risk management challenges the conservation community to demonstrate that the preventive conservation recommendations are both effective and cost-effective — and thus sustainable in the long term. 🍃



**Canadian
Conservation Institute
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de conservation**

Museum Climate & Global Climate

Doing the Right Thing for Both

Stefan Michalski
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The last three years have seen a flurry of conferences, publications, and debates about museum climate guidelines, especially in the United States and Europe. Revision, or at the very least re-examination, was inevitable given the new lens of global sustainability. However, the debate, and recognition of CCI's contribution to its balanced resolution, is almost as old as CCI itself.

It is more than 30 years since CCI began working with the idea that "environmental standards should become more intelligent and better tailored to clearly identified needs." In 1979, after recognizing that most Canadian buildings (including CCI's) could not sustain winter levels of 50% relative humidity (RH), CCI advised Canadian museums to consider a seasonal adjustment from the summer setting of 50% RH down to a winter setting of 38% RH (see Lafontaine 1979).

Some conservators in the international heritage community were not comfortable with this concept. Between 1990 and 1994, CCI provided numerous seminars and articles that reviewed the evidence for risks from incorrect humidity and incorrect temperature, and placed them in the context of other risks to collections and buildings, especially in cold climates. In 1991, these ideas helped ground the *New Orleans Charter for the Joint Preservation of Historic Structures and Artifacts*.¹ This Charter, written before sustainability was a word in anyone's consciousness, can now be seen as a manifesto for the mutual sustainability of buildings and collections in a historic house museum. Co-sponsored by object conservators and architectural conservators, and couched in general terms, it had been driven by the all too frequent destruction of historic building fabric in the name of climate control for collections. CCI's

publications and the Charter implied that tight climate control was not simply unsustainable by the building, but often unwarranted for sustainability of the collections.

The 1980s and 1990s were decades of growing energy awareness and ecological concern. Even the largest museums with the largest resources were beginning to face "compromises" in climate control due to limitations in buildings and budgets — realities with which small museums had long experience. The community was ready for more than the simple rule of 50% RH and 21°C.

Climate control systems in Canada and the United States were (and still are) designed by consultants using the Handbook produced by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).² When a new chapter for museums and archives was planned for the 1999 volume, CCI was invited to sit on the technical committee. Contributing to this Handbook allowed CCI to broaden its reach to Canadian clients.

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) is an international organization that carries out research, standards writing, publishing, and continuing education to fulfill its mission of advancing heating, ventilation, air-conditioning, and refrigeration to serve humanity and promote a sustainable world.

The NMDC guiding principles state that “Environmental standards should become more intelligent and better tailored to clearly identified needs. Blanket conditions should no longer apply.”

For the Handbook, CCI developed a schema based on several levels of control, labelled AA, A, B, C, and D, each with a specified level of risk to collections [for more information, please refer to *Environmental Guidelines for Museums — Temperature and Relative Humidity (RH)*³]. This schema recognized that most of the benefits could be achieved simply by avoiding extremes, and that the increasingly expensive control of a narrower range brought only diminishing benefits. The “best” specification was labelled AA so that the “second best” specification could receive the psychologically acceptable label A, rather than the unacceptable label B. Although it was necessary to include the AA target as the traditional and legitimate choice of many at the time, it was already CCI’s opinion that level A (permissible fluctuations of $\pm 10\%$ RH, and seasonal adjustments in temperature of as much as 5°C for summer and 10°C for winter) was the optimal advice for even a large museum, all things considered.

Largely unnoticed in the Handbook chapter were two other radical suggestions driven by a sustainability ethos:

- ▶ temperature set point (the long-term setting) could be anywhere between 15°C and 25°C, not just near 21°C
- ▶ RH set point (the long-term setting) could be at the historic average of the collection, not simply the 50% RH driven by international consistency for loans



Both were a recognition that global sustainability depends on local adaptation to climate whenever possible.

When the Handbook chapter appeared, some conservators were uncomfortable with what appeared to be relaxed standards. The aspirational world of climate control seemed permanently split between the large museums (who kept to very tight standards including for their loan agreements) and every one else (who were continually grateful for the more nuanced perspective CCI was pursuing). In order to stay on the national or international loan circuits, smaller museums simply built special exhibition rooms with tight control. The comfortable world of the “best” climate standard (AA) for large museums seemed unassailable, until sustainability forced a closer examination: was it justifiable?

The directors of the largest museums worldwide belong to the International Group of Organizers of Large-Scale Exhibitions,⁴ known informally as the Bizot group after its founder. When governments began advocating or even mandating sustainability targets, it was inevitable that climate requirements for exhibitions would come under Bizot’s scrutiny. In 2008, the directors of Tate and the Victoria and Albert “convened a group of UK conservators

and other stake holders to review museum’s environmental requirements in an era of energy constraint.” The results were published on the site of the National Museum Directors Conference (NMDC)⁵ as a draft of guiding principles with interim targets: 40%–60% RH, 16–25°C, and a proviso that special objects may need special conditions, probably best achieved by microclimates.

Coincidentally, the National Archives (United Kingdom) was also re-examining the rationale for its climate-controlled storage. The head of preservation at the National Archives, together with the head of conservation at Tate, obtained UK research funding for a series of meetings [called “Environmental Guidelines, Opportunity or Risk (EGOR)”] in 2009 to brainstorm the issue. CCI was invited to participate as the outside expert on the topic. The primary conclusion of these meetings was that the current British Standard on the topic, with its simple and narrow targets widely used by archives and museums alike, had to be revised — and quickly. A new standard is being fast-tracked (within 2 years), and CCI has been asked to sit on the steering committee.

Meanwhile, other organizations were also busy on this topic, and drawing on CCI expertise.

- ▶ In the fall of 2009, the Danish National Museum organized a conference on sustainability and asked CCI for the keynote technical lecture.⁶
- ▶ In the spring of 2010, the American Institute for Conservation (AIC) and the International Institute for Conservation (IIC) organized a special panel called “The Plus Minus Dilemma” and asked CCI to provide the research perspective.⁷
- ▶ The American Museum Directors (AMD) began seeking guidance from their conservation community for sustainable climate guidelines.
- ▶ In April 2010, the director of the Boston Museum of Fine Arts and his head of conservation invited more than 50 heads of conservation, including those from the National Gallery of Canada and the Art Gallery of Ontario, to meet and draft a consensus on guidelines. CCI was asked to attend as technical advisor, alongside the long-time researcher in this area from the Smithsonian Institution. The Smithsonian had implemented revised guidelines [an RH range of $\pm 8\%$ RH centred on 45% RH and a temperature range of $\pm 4^\circ\text{F}$ ($\pm 2.2^\circ\text{C}$) centred on 70°F (21.1°C)] for their 640 buildings in 2004, and their records showed an energy consumption savings of 17% since the change. The head of conservation of the British Museum stated that they had already adopted the guidelines of the NMDC for their own collections in



2008 (40–60% RH, 16–25°C, and special consideration for objects with identified needs). After two days of wrangling, the same principle was accepted by the North American group — but with recommendations for further research by the conservation community. This result was then taken forward to the 2010 annual meetings of the AMD and the AIC (which was already hosting “The Plus Minus Dilemma” panel!).

On January 21, 2011, CCI hosted “Saving Energy, Preserving Collections,” a one-day meeting of senior staff responsible for facilities and collections care from the national museums of Canada, as well as those responsible for federal heritage programs (Moveable Cultural Property Program, Canada Cultural Spaces Fund, and Canada Travelling Exhibitions Indemnification Program). CCI set the stage with a history of the guidelines, then the national museums shared the changes and initiatives that each of them has undertaken in response to sustainability and climate control dilemmas. Discussion established that despite variations and appropriate caution, the federal family of museums and museum programs is moving in the direction of the A class of control.

For CCI, it has been more than 30 years since seasonal adjustments to sustain building fabric were recommended and more than 10 years since an “intelligent” schema (with control levels that are “better tailored to clearly identified needs”) was inserted in the ASHRAE Handbook for North America. Now, finally, it appears that the world of large museums, the international loans they control, and the acceptable behaviour they define, will adopt a target that is, in essence, level A rather than level AA. What will probably come as a surprise to many is the greatly expanded temperature band that it contains, rather than the modestly widened RH band. It is the seasonal adjustments in temperature that hold the main key to sustainable museums, reduced carbon footprint, and reduced costs.

Building and exhibition designers will always need simple climate targets, but the assumption that such targets can form a standard or a guideline must be abandoned. Standards of the future will specify a process for arriving at targets appropriate to circumstances, rather than the targets themselves (except as typical examples). And this process will consider the sustainability of the planet as well as the sustainability of heritage. 🌱

Endnotes

1. <http://www.apti.org/resources/charters1.cfm>.
2. <http://www.ashrae.org>.
3. <http://www.cci-icc.gc.ca/crc/articles/enviro/index-eng.aspx>.
4. http://www.museumstuff.com/learn/topics/International_Group_of_Organizers_of_Large-scale_Exhibitions.
5. <http://www.nationalmuseums.org.uk/>.
6. Video at <http://www.smk.dk/en/explore-the-art/visit-the-conservator/symposium-on-museum-climate/program-and-presentations/>.
7. Transcript at http://www.iiconservation.org/dialogues/Plus_Minus_trans.pdf.
8. <http://www.cyf-kr.edu.pl/~ncbratas/oslo/MichalskiOslo2010.pdf>.

SO WHERE DOES CCI GO FROM HERE? THERE ARE THREE SPECIFIC TASKS FOR THE FUTURE.

First

CCI recognizes the need to harmonize the definition of a “universal” standard. When the dust settles on the slightly different definitions of an acceptable range for a general collection (determined by the many organizations noted above), CCI will tweak the definition of control level A for the next edition of the ASHRAE Handbook (2015) to make it consistent with the majority, and to incorporate any new developments in sustainability (a major focus for CCI as well as ASHRAE). CCI will continue to work with the national museums and federal heritage programs in Canada to ensure adoption of environmental guidelines that support both the need to save energy and the need to preserve collections.

Second

CCI will help museums apply an old and reliable solution to sustainable climate control for objects with identified needs, i.e. microclimates. It is no coincidence that the director of Tate could feel comfortable as champion of the international shift to sustainable targets: years ago, in response to the advocacy of its conservation department, Tate adopted extensive use of (discrete) glass and metal enclosures for its paintings and panels, especially those on loan.

Third

CCI is developing tools to provide better answers to “clearly identified needs.” Included in these tools are computer models of object vulnerability, one for chemical aging of archival records and one for probability of fracture from fluctuations.⁸ After taking the best survey of the relevant data and feeding it into the best available models of the deterioration processes, CCI will provide the implications of these simulations to decision-makers.

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Updated

Framework for the Preservation of Museum Collections

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The Canadian Conservation Institute (CCI) is updating its *Framework for the Preservation of Museum Collections* (first published in 1994). The familiar orange and white wall chart that hangs in museum and conservation labs around the world is being revised to reflect the preventive conservation challenges of the 21st century.

It was back in 1987 that CCI Senior Conservation Scientist Stefan Michalski first introduced a wall chart on preventive conservation at a conference of the International Institute for Conservation of Historic and Artistic Works - Canadian Group in Victoria, British Columbia. Following its introduction, the chart was refined by CCI and used as a teaching tool for a number of years. Robert Waller, then at the Canadian Museum of Nature, also adopted the chart and continued to develop its approach. He added a 10th agent of deterioration — “curatorial neglect” — which has subsequently been incorporated into the more generally accepted “dissociation.”

CCI eventually published a version of the chart in 1994. The *Framework for the Preservation of Museum Collections* (Costain 1994) was based closely on the 1987 original. This was the first time that all the agents that cause deterioration had been compared side by side, and it was seen as a major step forward in preventive conservation.

The Framework has since been adopted by many conservators. CCI has produced it in English, French, and Spanish — and there are also unofficial versions in a number of other languages, such as Persian.

With stock running low in 2008, the question arose whether to reprint the Framework as it was or to revise it. Coincidentally, CCI was approached by Sarah Staniforth (a preventive conservation expert from the National Trust in the United Kingdom) to consider including sustainability issues in the Framework. The decision was made to revisit the chart and update the information.

Many members of the CCI team who had developed the original Framework joined me in revising it: Jean Tétreault, Tom Strang, Stefan Michalski, and Paul Marcon. As we met every Wednesday morning to discuss the necessary changes, our decisions were influenced by two publications. The first is Robert Janes' *Museums in a Troubled World* (Janes 2009), which looks at the sustainability of museums as publicly funded organizations. The second is a paper by Sarah Staniforth and her colleagues (Lithgow et al. 2008),

THE 2011 CHART COMPRISES TEN AGENTS OF DETERIORATION:

Physical Forces

Thieves and Vandals

Dissociation

Fire

Water

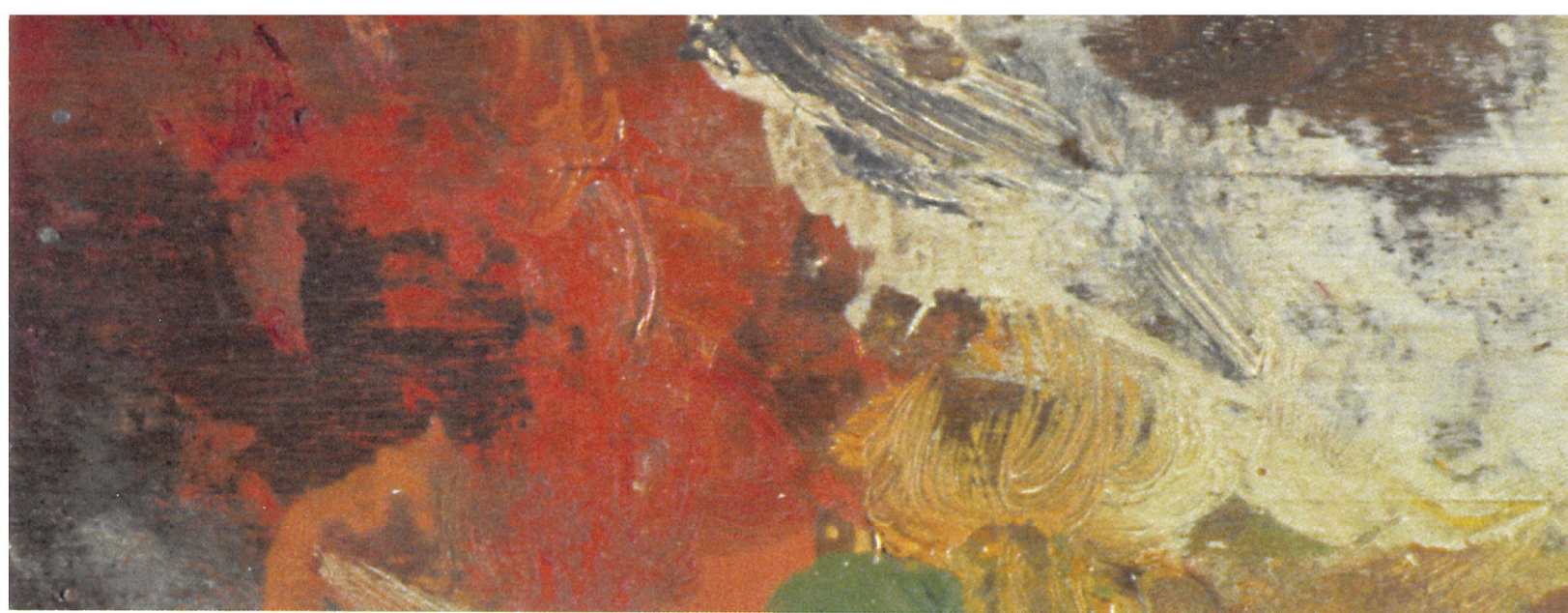
Pests

Pollutants

Light, Ultraviolet
and Infrared

Incorrect Temperature

Incorrect Relative
Humidity (RH)



which describes how the “triple bottom line” approach of economic, social, and environmental factors can be applied to measure the performance of heritage institutions from the point of view of sustainability. The input from a number of external sources, including Sarah Staniforth and Robert Waller, was also instrumental. I thank everyone for their helpful contributions.

All the content in the Framework was reviewed. The 10th agent of deterioration (“dissociation”) was inserted and new information including sustainability issues was added for each agent.

The most noticeable change is surely the addition of sustainability issues. For example, the “Incorrect Temperature” row now includes mention of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)¹ environmental guidelines [see *Environmental Guidelines for Museums — Temperature and Relative Humidity (RH)*²] as well as a suggestion to use seasonal temperature setbacks as a way to save energy. The point is made that museums are heated mainly for human comfort — the objects actually benefit from cooler conditions. Also added are requirements for smoke detectors, which were not mandatory in 1988 but are now universally required by building codes.

Energy cost is discussed at many points — as it pertains to air filtration and removal of pollutants, lighting, the use of high humidity, and temperature control. The message is clear that any control system that requires energy must be justified in terms of collection needs.

The advice for dealing with “Pests” now reflects a more modern approach to fumigation. Although there was little concern about the use of toxic fumigant gases in 1988, nowadays there is widespread recognition that they pose health risks for staff and are damaging to the environment when released. The Framework therefore recommends pest control strategies that are more environmentally friendly such as the use of Integrated Pest Management and non-toxic de-infestation procedures.

The “Water” row points out that climatic changes such as warmer temperatures and increased precipitation have increased the risk of flooding and subsequent water damage. Canadian museums located on the flood plains of rivers are especially vulnerable during spring thaws or after heavy rainfall. Increased precipitation in the form of snow can also lead to structural damage. This was the case in 2007 when the roof of the Prairie Art Gallery in Grand Prairie, northern Alberta collapsed under an unusually heavy weight of snow.

One area that is remarkably little altered is the “Light, Ultraviolet and Infrared” row. This might seem surprising given the widespread adoption of new types of lighting (compact fluorescent, LED, metal halogen, etc.) since 1988. However, the major concern continues to be fading and colour change caused by exposure to light from any type of source rather than the energy consumption involved.

The revised *Framework for Preservation of Heritage Collections* will be released in 2011. Broadly speaking, the architecture of the chart has been preserved and users will find much that is familiar. However, the new content will make the chart more reflective of the preventive conservation issues of the 21st century — including the constantly growing need for sustainability. 🌱

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Sustainable Responses to Archaeological Conservation

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Reburial and In Situ Preservation

Ensuring that cultural heritage endures has always been one of the goals of archaeological conservation. However, the growth of archaeological conservation facilities, conservators specializing in archaeological conservation, and funding for treatment has not paralleled the growth in the number of archaeological sites. Preventing the loss of these newly exposed sites therefore requires an alternative approach. Two possible sustainable responses to consider are reburial and in situ preservation.

The impacts of climate change coupled with urban development and improved underwater dive techniques are increasingly exposing and providing access to new archaeological sites. With archaeological excavation typically producing hundreds and sometimes thousands of artifacts from an individual site (e.g. an historic house, a Thule village, or a shipwreck), these new sites have the ability to produce massive amounts of wet organic material and metal objects that are time-consuming and costly to treat.

The possible effects of global warming are of special concern to archaeological conservation. If permafrost thawed, many sensitive organic materials such as bone, antler, ivory, skin, baleen, and wood, which tend to survive only if permanently frozen, could be lost. If sea levels rose, many coastal sites could be inundated with sea water. The salts from the sea water could contaminate the artifacts as ground water levels changed, and wave action and erosion could damage or obliterate newly exposed sites.

CCI has already seen the impact of such effects. When rapidly melting glaciers in the Yukon and British Columbia led to the exposure and subsequent recovery of the Kwáday Dän Ts'ínchi (Richards et al. 2007) and Ice Patch artifacts (Helwig et al. 2008), CCI had the opportunity to analyse and conserve a knife (AD 1730–1780) with a hemlock handle

and an iron blade lashed with hide (Helwig 2010). Its survival has contributed to the knowledge of pre- to early-contact First Nations culture.

REBURIAL

“Reburial” can be a sustainable option for sites. In fact, it is often a standard procedure both during multi-year excavation projects and after a project is complete. It can help protect exposed structures as well as adjacent unexcavated areas. Reburial is also increasingly common for the preservation of large water-logged finds such as shipwrecks, as their size and the amount of time, space, resources, and staff required to treat them make them difficult and expensive to conserve.

The *General Hunter*, a War of 1812 British frigate, was discovered when low lake levels and heavy ice scour exposed a dozen of the ship's frames on the shores of Lake Huron in 2001. The ship was fully exposed in 2004 to allow careful recording of the timbers by the project archaeologist, but the tons of wood were left where they were found and carefully reburied. This will protect the ship and postpone the significant costs associated with conserving, storing, and displaying it until an excavation and conservation plan can be developed and suitable funding can be found. The proposed plan for the site includes the excavation and treatment of the hull by the project archaeologist and a committed group of volunteers (McClellan and Cassavoy 2009). Once conserved, the ship will be displayed in a new wing of the Bruce County Museum & Cultural Centre in Southampton, Ontario. CCI is providing advice, analysis, and technical assistance for the project, including a project review.

Nationally and internationally, the reburial or stabilization of excavated shipwrecks and sites is becoming an important approach for archaeologists and conservators. This is not surprising given that the cost to conserve even a small fraction of the thousands of shipwrecks and wet sites that exist is prohibitive — not to mention that additional sites are being discovered as coastal areas and sea beds are developed. Conservators and scientists are therefore working to develop systems to safely rebury these finds in stable environments so they are preserved from microbial and insect attacks, erosion, and human activity, for future generations to study. The Netherlands has developed a mound system for preserving shipwrecks exposed during draining of the polders (Maarleveld 1993). Parks Canada has reburied and is monitoring the environmental stability of several early 16th-century Basque whaling vessels, in Red Bay, Newfoundland and Labrador (Stewart et al. 1995; Grenier et al. 2007).

IN SITU PRESERVATION

In other cases, archaeological resources can be left in place, not retrieving them at all or leaving areas known to contain artifacts undisturbed for future researchers. For example, exposed shipwrecks can be left in situ for the enjoyment of divers. Although such wrecks will eventually deteriorate, studies can be conducted to monitor the rate of deterioration, predict the life span of the wreck, and suggest ways to mitigate some of the agents of deterioration.

CCI conservation scientist Nancy Binnie has studied the corrosion rates of metals on underwater shipwrecks. The results of an ongoing study in Fathom Five National Marine Park in Georgian Bay (Stewart et al. 1997) were used to predict the survival rates of the iron fasteners of 22 shipwrecks enjoyed by thousands of divers that visit the park. Another study on quagga and zebra mussels (Binnie et al. 2000; Binnie 2009) showed that these new invasive species pose a risk to all sites as the corrosion rates of metals increase under the accumulations of live shells. Conversely the mussels may help to preserve the wooden timbers by slowing erosion and attack by other micro-organisms.

Another in situ preservation project by former CCI staff member Charles Hett (Hett and Weaver 1980) was completed at Kellett's storehouse on Dealy Island in the Western Arctic Archipelago. Captain Henry Kellett, during his 1852–1854 expedition to search for the lost Franklin expedition, was to build several storehouses (caches) to store food, clothing, and equipment for future expeditions that might become trapped in the Arctic. Curious polar bears had exposed the material at the cache on Dealy Island, and scattered much of it across the tundra. While selected items were collected, treated, and placed in a museum, the remaining artifacts were returned to the cache. The storehouse was rebuilt with a new insulated floor to cover the artifacts, sealing them in an environment where a stable permafrost level will prevent deterioration and stop future losses from polar bear and tourist predations.

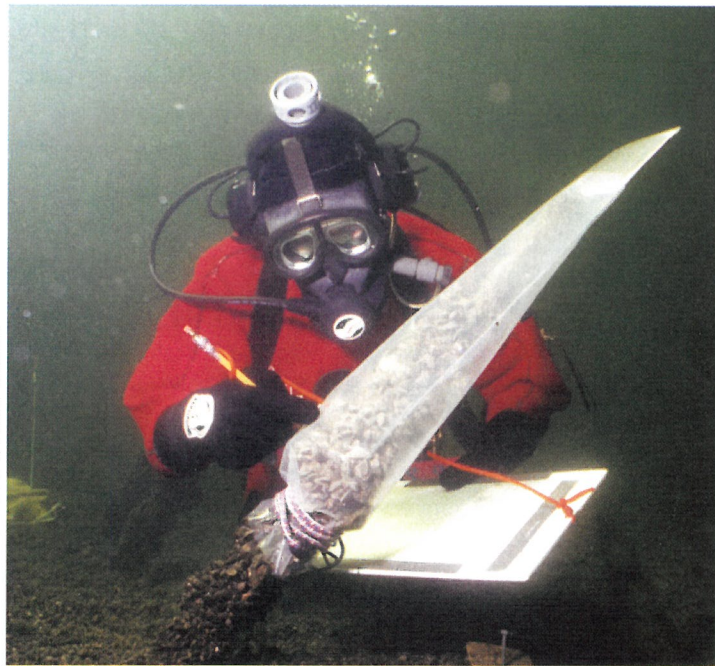


Photo: Jonathan Moore, Parks Canada

▲ Study of the impact of zebra and quagga mussels on underwater heritage.



Totem pole #3 from the village of Nan Sdins has changed over time. Note the loss of lips and feet.

In situ preservation is especially important for structures such as historic buildings or totem poles, which can lose their cultural or historic context, aesthetic impact, and spiritual meaning if they are removed from their original locations. These were important considerations when CCI scientists and conservators David Grattan, Wilf Bokman (former employee), and Cliff Cook participated in the documentation and study of 21 totem poles standing in the village of Nan Sdins on SGang Gwaay in Haida Gwaii / Queen Charlotte Islands — a UNESCO World Heritage site (Grattan et al. 1987). As part of that work, steps were taken to slow the deterioration of the poles, i.e. the underbrush around the poles was removed and cut back, and gravel was added to improve drainage. In 2009, David Grattan and Cliff Cook revisited the site and re-examined the poles, along with CCI conservators James Hay and Andrew Todd (former employee). Using the X-radiography and wood condition assessment of the earlier study, they were able to record the rate of deterioration of the poles over 25 years and to document the degree to which the original study was a useful predictive investigation. They also had the rare opportunity to monitor the development of surface erosion and interior rot over a 25-year period.

Over the coming decade, CCI's archaeological conservators and conservation scientists will continue to help preserve the remnants of the past by developing practical and cost-effective solutions based on risks to preservation. In the meantime, reburial and in situ preservation remain as sustainable responses to archaeological conservation. 🌱

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Built Heritage Preservation



The Drivers of CCI's Work on Canada's Parliament Buildings

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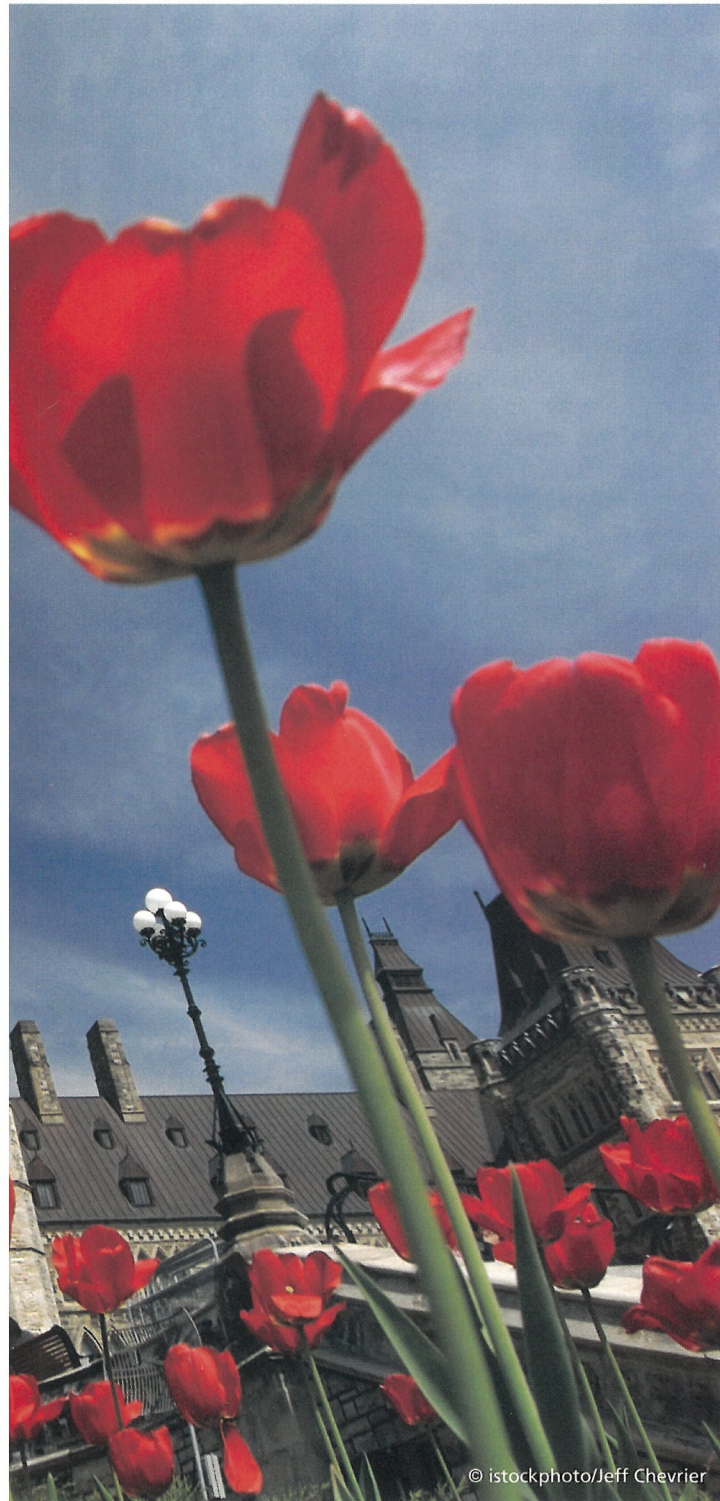
Preservation Services

Research, Conservation and Scientific Services

The West Block of Canada's Parliament Buildings, constructed in 1859 and still used as a working office building for Canada's federal government, currently holds the highest heritage designation in Canada along with the other buildings and monuments of Canada's Parliament Hill National Historic Site. With an approximate gross size of 23 000 square feet, this calculates to an embodied energy investment of 40 020 000 million British Thermal Units (MBTU).¹ Given the additional 35 650 MBTU that would have been required for demolition, tearing down the West Block might have embodied a loss of energy equivalent to 1 317 323 litres of gasoline.



Sustainability



© istockphoto/Jeff Chevrier

Mention “built heritage preservation” and “sustainability” in the same breath and the first thing that usually comes to mind is improving a building’s system performance to reduce its carbon footprint. But there are many other energy costs to be considered. For example, one could include the energy used and the greenhouse gasses created during the processing of raw materials already present in the building (known as “embodied energy”). There is also the energy cost of demolishing and recycling materials already present, as well as that of producing and installing new materials. The pressure to be sustainable has therefore been shifting the culture of built heritage preservation towards minimal intervention — an approach that parallels the ethical imperative of artifact conservators to retain and extend the life of original materials wherever possible.

Estimating the life cycle costs of a building requires a holistic approach (Culver and Randall 2010) that includes start-to-finish data on the costs of:

- conversion of raw materials into building materials and their installation
- operation
- maintenance
- replacement and waste management

Anyone who has received an energy audit of their home is familiar with plug-in data templates used to calculate energy consumption and cost-benefits of upgrades to the building envelope. Assessing the performance of an historic structure requires an even more complex energy modelling program (Newsham et al. 2009).

CONSERVATION APPROACH TO BUILT HERITAGE PRESERVATION

Conservators of heritage interiors focus on materials and techniques originally used in a building, as well as on later additions and alterations that either contribute to, or detract from, its heritage character. Preservation efforts in built heritage usually encourage the retention of significant design elements to preserve “heritage character” and

The energy embodied in an historic building can create a potent argument for retaining its original materials. However, retaining these materials requires additional research into conservation solutions to extend their life. It is in this area that much of CCI's work on Canada's Parliament Buildings is centred.

"character defining elements," but do not necessarily devote efforts to retain damaged and/or non-performing original materials. To meet the growing demands of sustainability, built heritage conservation must now maintain not only the heritage character of an historic building, but also many elements of the original heritage fabric — which requires that its condition and performance be improved.

Maintaining original building materials can be a radical option to deal with the energy use conundrum. The Heritage Canada Foundation² uses the expression "Landmark not Landfill" to focus solutions on the sustainability cost of demolition. The National Trust for Historic Preservation (NTHP) in the United States uses the motto "the greenest building is the one already built."³ The NTHP estimates that up to 48% of greenhouse gasses in the United States are generated by processes that fuel the construction, operation, and demolition of buildings.⁴

In recent years, sustainable design for new buildings has focussed on meeting Leadership in Energy and Environmental Design (LEED)⁵ criteria that include:

- ▶ assessments of the environmental impact of the manufacture and use of building materials
- ▶ the carbon footprint generated by the choices of material in construction
- ▶ the specification (and development) of passive building systems for air handling, heating, cooling, water use, and lighting

While the LEED criteria are useful for new building design, their application to historic buildings that are being repurposed or rehabilitated may be ill-considered. The attempt to improve building performance can lead to an unnecessary level of demolition and loss of heritage fabric and elements. For example, old windows might be replaced with new higher performing windows in preference to being retrofitted. Additionally, attempting to achieve new construction level performance standards may result in a loss of heritage character or damage to the building fabric. The installation of vapour barriers, HVAC, and insulation, for instance, could lead to damaging freeze-thaw cycles in historic masonry exteriors by over insulating and heating historic building interiors.

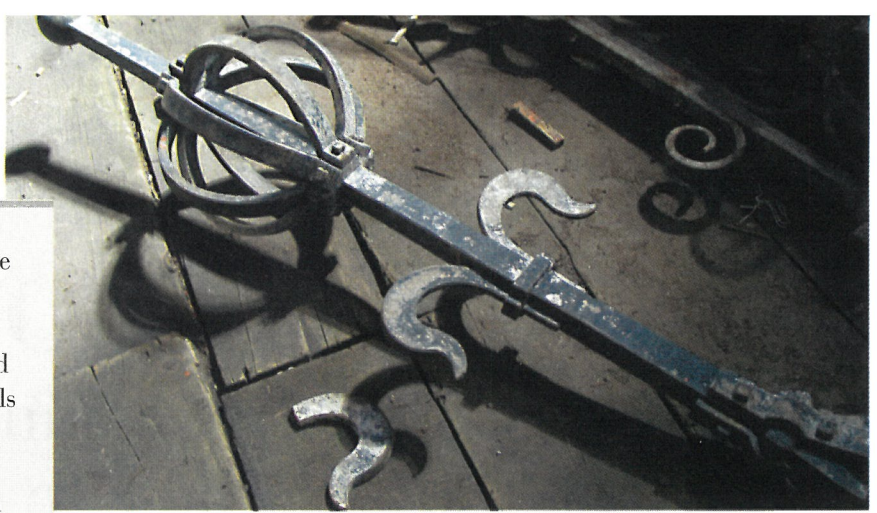
It is often assumed that performance upgrades, including energy efficiency, can only be achieved using modern, certified, engineered materials and assemblies — but research demonstrates that this is not always the case. A detailed energy audit by Culver and Randall (2010, pp. 9–11) of a retrofit of the 1902 Swift Hall at Vassar College in the United States showed that adding storm windows, weather stripping, and caulking to the historic window frames provided energy savings that met LEED criteria. The historic windows (made from dense old-growth wood) also have a life cycle of hundreds of years if continuously maintained, whereas many modern replacement alternatives (made of new fast-growth wood or vinyl) may fail after only 10–25 years.

PARLIAMENTARY SUSTAINABILITY AND THE LINK TO BUSINESS CONTINUITY

The concept of sustainability extends beyond a building's simple physical presence — especially when the continuity of the business conducted within its structure is critical to a nation. The responsible custodianship of Canada's Parliament Buildings was recently identified as a sustainability issue after it was found that "...gaps in governance contribute to the delays in addressing the continuing deterioration of the Parliament buildings."⁶ Responsible and accountable decision-making and the ability to commit resources to the conservation of the Parliament Buildings and their heritage collections are therefore important factors in sustainability. These findings have given new urgency to the major capital construction projects in Canada's Parliamentary Precinct, an area that encompasses a number of key heritage sites and structures, including several buildings where government operations are conducted. CCI is contributing to the work in the Parliamentary Precinct with projects that focus on the principles of conservation within the context of built heritage preservation.

CCI is developing a dedicated expert services unit to respond to the increasing demand for investigation, technical analysis, and conservation design development. The focus of this unit will be primarily to better conserve heritage collections and special historic materials of the interiors that are essential to the heritage character of Canada's federal heritage real property portfolio.

► Architectural objects
from Parliament Hill.



The efforts of “green businesses” to recycle building materials and keep them out of landfills are exceptional and deserve recognition. However, it must be remembered that recycling “end-of-life” original materials also has a significant carbon cost in terms of the energy and resources required to remove them, transport them, and transform them into new products.

PRESERVING CANADA'S PARLIAMENT BUILDINGS

CCI is part of a team⁷ working on the preservation of key heritage character-defining elements and heritage collections of Canada's Parliament Buildings, including the West Block, the adjacent Wellington Building, and the former Bank of Montreal Building. This work includes investigations, surveys, and technical analyses of original materials in primary heritage interior spaces; risk assessment, packing and transport, and project management during major capital construction; and conservation treatment investigation of significant collections that focus on the dozens of special heritage rooms that will be conserved and restored in 2018 during the rehabilitation of the Centre Block. The first step in this series of cascading major capital projects is the rehabilitation of the West and East Blocks.

If the West Block had been demolished and replaced with a modern building — an option that was seriously considered in the 1950s when its capacity was deemed to have reached a critical point — the loss to Canada's historic legacy would have been incalculable. Only a change in government and protests over the loss of a key heritage building halted the plan.⁸ Unfortunately, a subsequent rehabilitation of the West Block in 1961 created a modern interior with drop ceilings, false walls, fireproofing, and major alterations to circulation plans, all of which now pose challenges to the recovery of any authentic heritage character in many of the interior spaces.

Although there is no longer any talk of tearing down the Parliament Buildings, the need to conserve them is now pressing. Risk-projections have indicated, for instance, that the possibility of building or system failures in the Centre Block will rise significantly by 2019 — and any failure that would require the building to be shut down would adversely affect the continuity of government. For this reason, heritage sustainability is now linked to the continuity of Canada's Parliament in a way it has never been in the past. Over the next decade, CCI conservators and scientists will assist in finding strategies that will allow as much of the heritage material as possible to be retained and to recover materials thought to be lost. Conveniently, these efforts will also contribute to the reduction of the carbon footprint of this major construction project — a key element of sustainability. 🌱

Endnotes

1. The Greenest Building is the One Already Built, *Embodied Energy Calculator*, from the 1979 Advisory Council on Historic Preservation (ACHP) report *Assessing the Energy Conservation Benefits of Historic Preservation: Methods and Examples*, http://www.thegreenestbuilding.org/1979_ACHP_Energy_Conserv_and_Hist_Pres.pdf.
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6. http://www.oag-bvg.gc.ca/internet/English/parl_oag_201004_03_e_33716.html.
7. The team is under the direction of the Department of Public Works and Government Services Canada, Architecture and Design, with NORR Architects Engineers Planners, Fournier Gersovitz Moss Architects & Associés, and A.E. Henry Enr., and other specialist consultants.
8. HANSARD, Index to Debates July 1 – July 18, 1955, *Parliament Buildings, Retaining traditional character of*, S607, S354-60, S364-67, S387-90. The Hon. Robert Winters, Minister of Public Works in the cabinet of Prime Minister Louis St-Laurent, hired the firm of Mathers and Haldenby to produce several design concepts and models for the replacement of the West Block.
HANSARD, Index to Debates 1958 Vol. II, *West Block, preserving*, 1194-5, 3350. One of the most vocal opponents of this plan was conservative MP the Hon. Howard Green who, as Minister of Public Works under the Rt. Hon. J.G. Diefenbaker, halted the demolition plans.
HANSARD, Index to Debates April 11, 1962, *Parliament Buildings - West Block, preserving*, 2844. The Hon. D.J. Walker, Minister of Public Works, reported the renovation decision for West Block was \$2,300,000 cheaper than the demolition and replacement option (\$5,088,000 for the former and \$7,390,000 for the latter). Unfortunately at the time, the 1960s renovation was invasive and introduced extensive asbestos fireproofing to the interior.
Louis-René Beaudoin fonds, MG3QC1V3, Library and Archives Canada, memo of L.R. Beaudoin Speaker of the House, March 18, 1955 describes West Block space options provided by Chief Dominion Architect Edwin Gardner including one to demolish the West Block and replace it with a larger building to increase office space for parliamentarians. Costs outlined were \$146.00 per office (renovation option), \$169.00 per office (option to construct a wing with 150 new offices), and \$90.00 per office (demolition and rebuilding option).

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Pest Control

Sustainability, Greening, and Reducing the Use of Toxic Chemicals

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Pests can be very destructive to both the aesthetic elements and the structural integrity of collections, historic buildings, and objects. Pest infestations can also threaten the ecosystem that extends beyond the museum and be a health risk to humans. A sustainable approach to pest control is therefore an important consideration — it affects material integrity, collection value, human health, institutional operations, the external environment, and public perception.

Part from the environmental effects of fumigants and pesticides, adverse effects from chemical interactions with them can increase or accelerate the loss of an object's valued properties or its use. Consider the case of pesticide-impregnated specimens. In principle, this protection is laudable. It confers long survival time to otherwise susceptible specimens in rather open storage conditions, but it can limit their use. For example, specimens treated with pesticides are no longer suitable for educational programs that require extensive handling. Specimen DNA used for systematics or comparing historical genetic variability to currently endangered species is also negatively impacted by pesticides such as dichlorvos (DDVP) and fumigants such as methyl bromide, which both affect DNA recovery.

Pest control has traditionally been based on the use of chemical fumigants and pesticides. Although effective, many of these products have proved to be harmful — to humans, to the environment, and sometimes even to the objects they are designed to protect. While these negatives have to be judged against the pest threat, a more diverse range of pest control methods would create the ability to deal effectively with pests while reducing the consequences of treatment.

Pests in museums or other heritage institutions are simply doing what they do naturally to survive, looking for food and creating an opportunity for their offspring to thrive. The deterioration that results is an ecological activity determined by the nutrition, water, temperature, and humidity conditions they find — all of which can be influenced by human activity to contain, control, and get rid of them. Where, when, and how these activities are used depends on the perception of risk when pests are discovered.

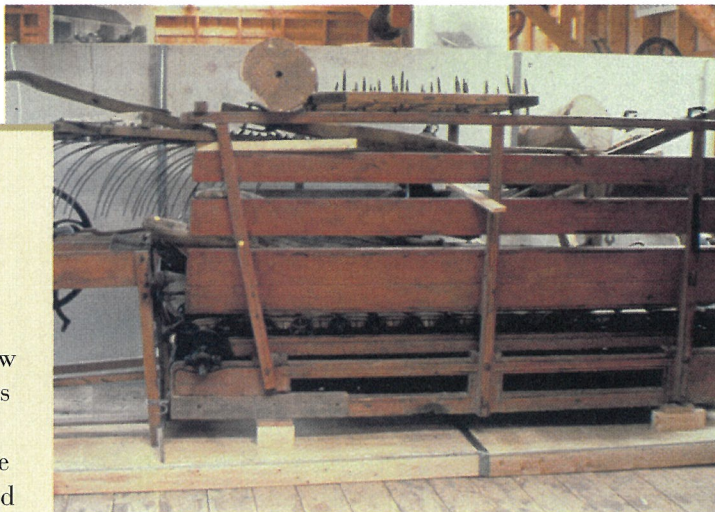
Preventing the infiltration of pests is an important first step in a sustainable model of pest control. Investing in passive systems such as pest-resistant building details and cabinetry is therefore an important consideration, as is ensuring that new objects introduced to the collection (whether new acquisitions or travelling collections) are not infested.

Regular inspections to detect the presence of pests are also important. Determining no pest activity is comforting (but may not be reliable); determining a tiny amount suggests good detection efforts; and determining moderate levels is worrisome as it implies there may be more depending on uncertainties in the institution's ability to investigate fully. So what level of pest activity requires action?

Because of uncertainty, some effort must be made to maintain safe conditions even when "nothing is happening." A minimum "must spend" level directed to



- ▼ Objects were placed inside this insulated plywood box that was then heated with air and kept between 55 and 60°C until the thickest pieces were heated through. This heat treatment kills all insect life.



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Newly acquired objects always present a risk, the likelihood of which depends on their previous environments, past pest-reduction history, and ability to support pests. Many of the world's museums now routinely quarantine all new acquisitions in low-temperature conditions (an environmentally friendly pest control option), whether or not they are likely to be infested. This effectively eliminates the need for individual museums to use fumigants.

Travelling exhibits also present a risk. However, if the objects come from collections where infestation is carefully monitored and dealt with, they will have a lower individual risk of bearing pests than new acquisitions. The adoption of International Standards For Phytosanitary Measures No. 15 (ISPM15),¹ which provides international protocols for crating that restrict the movement of damaging forest pests, also reduces the likelihood that travelling exhibits will carry pests.

periodic observations, passive control methods, and timely remediation will protect the greater resource (museum functioning, public trust, etc.) and lower the uncertainty of the actual level of pest activity.

The impact of pest activity on a museum's resources depends on the effectiveness of containment, the efforts to discover the extent of infestation, the timing of the discovery, and the labour expended on remediation. Some pests also require more immediate action than others. Pests that can grow quickly on delicate objects are perceived to be more dangerous than pests that grow more slowly. For example, clothes moths grow quickly and can rapidly cause significant damage to an ancient wool textile. Likewise, dermestids can

quickly destroy organic materials in a specimen. Discovery of either of these pests calls for immediate action. In contrast, slow-growing wood borers take considerably more time to damage a structure, so immediate attention is not as critical.

When remedial action is required, the importance of protecting the environment while protecting collections from pests can evoke emotionally conflicting responses. The environmental cost of using an ozone-depleting fumigant to protect an irreplaceable wooden object may seem insignificant (especially when compared to the world's historical use of such gases, which has been measured in megatonnes), but the moral cost is not reduced. The use of such a fumigant is a harmful cumulative action and should be avoided where possible.

In response to the negative effects of fumigants and pesticides, as well as to their regulation or elimination, the Canadian Conservation Institute (CCI) and the heritage community have been constantly revising pest control activities over the last several decades. This has resulted in the development of more environmentally friendly techniques such as controlled atmosphere fumigation and thermal treatment. There has also been a move toward Integrated Pest Management (IPM), which combines layers of activities and knowledge of as many effective tools as possible to respond to individual pest/place/people situations. IPM incorporates three basic steps: inspection, identification, and treatment options. It does not inherently confer sustainability, but it does provide the largest number of options to reduce pest damage. IPM can be structured around the main signals



of pest problems an institution usually faces, which ensures the least possible chaos while retaining flexibility — and is likely to reduce the financial burden of control while achieving the maximum possible success.²

Even the use of “sustainable” methods for pest control (methods that incorporate IPM and environmentally friendly techniques) may be cumulatively unsustainable if they produce unrecoverable waste or do not stop an object’s deterioration. But there is always the “feeling” that something should be done because of the cultural value of preserving the object. The goal is to sustain maintenance activity (including pest control methods) within an ethical framework that will accommodate inevitable losses ranging from replacement to restoration to removal — or even just slowing down the natural disappearance of the object.



The heritage community can be proud of how rapidly they have reduced their use of toxic chemical fumigants and residual pesticides compared to other industries. This is a testament to their professionalism and willingness to investigate alternative control methods. Their desire to protect the environment has extended to a focus on sustainability.



SO IS PEST CONTROL IN COLLECTIONS A SUSTAINABLE ACTIVITY?

Sustainability cannot be judged on whether deterioration is slowed by an action (because unsustainable acts could do the same). Instead, sustainability is about retaining the ability to act and combat the losses of cultural property to pests. The international heritage community has recognized the dangers of pesticides and fumigants. In response, they have moved away from widespread use of environmentally detrimental ozone depleters, toxins, and carcinogens, and become more restrained in applying the remaining suite of pesticides. But effective (and sustainable) pest control is still available through IPM and replacement technologies such as controlled atmosphere fumigants and thermal treatments. As these more environmentally neutral procedures become the norm, the likelihood of pest control in collections remaining sustainable will increase. 🌱

INTERNATIONAL COLLABORATION ON SUSTAINABLE APPROACHES TO INTEGRATED PEST MANAGEMENT (IPM) RESEARCH AND TRAINING

Canada and Japan

Pests are one of the 10 agents of deterioration³ identified by CCI. Interestingly, many of the pest management challenges faced by Canadian museums are also shared by museums in Japan. In fact, about 70% of pest species are similar, and building or site issues, ranging from outdoor locales to modern facilities, are much the same. Subterranean termites for instance, a common problem in Japan, will increase in Canada as our climate warms. International agreements (restricting fumigants that are ozone depleting) and registration changes are creating comparable legislative environments and workplace restrictions. Given these parallels, cooperation between Canada and Japan in IPM research and training can maximize the benefits not only for cultural heritage preservation in both countries, but also for similar institutions around the world. Collaboration between CCI and Tobunken, Japan’s National Research Institute for Cultural Properties, Tokyo, has helped both countries to demonstrate the low adverse impact and effectiveness of pest control strategies other than proscribed and candidate replacement fumigants, and also to improve teaching of the IPM “toolkit” for protecting cultural heritage. Developing similar international collaborative research and training approaches with other countries may help identify additional opportunities for sustainable IPM to help institutions preserve their heritage collections.

Endnotes

1. <http://www.ispm15.com/>.
2. Strang and Kigawa (2009) discuss Integrated Pest Management in detail. Information is also available in *Pests* (<http://www.cci-icc.gc.ca/crc/articles/mcpm/chap06-eng.aspx>).
3. *Ten Agents of Deterioration*. <http://www.cci-icc.gc.ca/crc/articles/mcpm/index-eng.aspx>.

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Sustaining Cultural Heritage in the Wake of Disaster

An Interview with Elisabeth Joy
on her Work in Haiti

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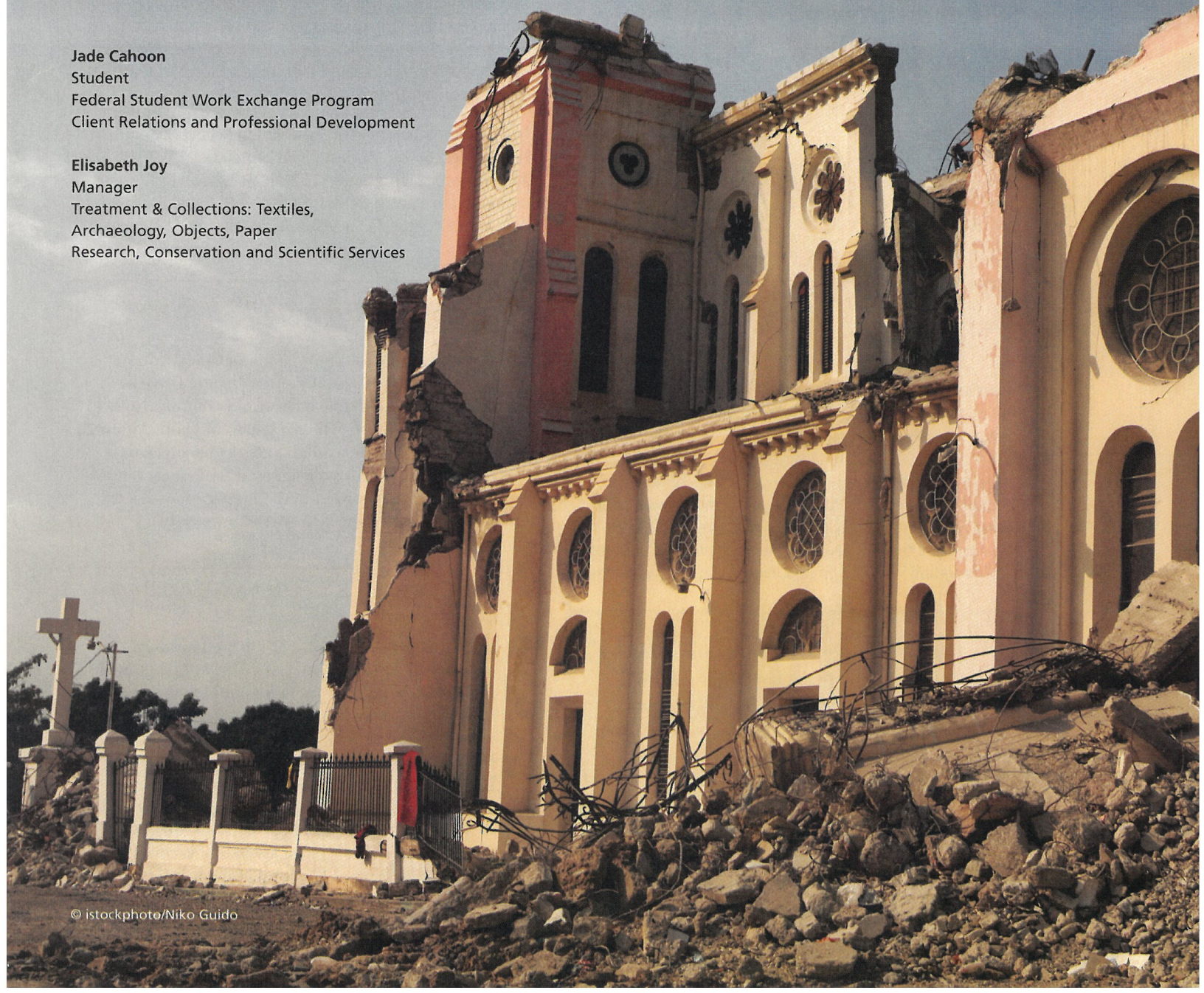
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The catastrophic earthquake that struck Haiti on January 12, 2010, killed more than 250,000 people, left over 1.5 million homeless and destroyed much of the nation's infrastructure. It also devastated Haiti's rich cultural heritage. Historic buildings, museums, libraries, archives, galleries, churches, theaters, artists' workshops and marketplaces were damaged and ruined. Thanks to many brave and concerned Haitians, some cultural collections were saved, but most are stored in poor conditions and many are still under the rubble. Haitians rightly value their cultural heritage as a source of identity and dignity. It is a legacy of freedom and creativity that gives the Haitian people the resilience to survive and the promise of a better life.¹



at building capacity within Haiti's cultural community — training Haitian heritage professionals who would, in turn, train their colleagues and peers. Many experts in the field of conservation volunteered their time to serve as teachers, including Elisabeth Joy.

The workshop was held at the Cultural Recovery Centre in Port-au-Prince from August 23 to September 10, 2010. The 26 participants represented 15 Haitian cultural institutions, including the Haitian Centre d'Art, the National Archives of Haiti, and l'Institut de Sauvegarde du Patrimoine National.



Despite these hardships, they were dedicated to preserving Haiti's culture and made the difficult trip to the Centre every day.

Access to food, clean water, and shelter are paramount after a crisis, but people also want and need their personal belongings and a connection to their heritage. Therefore, in response to the Haitian earthquake, the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) organized a three-week pilot workshop² on emergency recovery measures and disaster prevention for cultural heritage. The workshop, developed in collaboration with the Smithsonian Institution, was aimed

The Cultural Recovery Centre is funded by the Smithsonian Institution, and run in collaboration with the Government of Haiti. Its mission is to assess, catalogue, and store collections that were rescued from earthquake-damaged buildings. It also includes conservation laboratories to treat objects, paintings, and paper.

Q How did you get involved with this project?

A ICCROM contacted the Canadian Conservation Institute (CCI) to see if there were any French-speaking conservators who would volunteer to help prepare and deliver the workshop in Haiti. Although I was the only one available to go at such short notice, many of my colleagues at CCI (most notably Wendy Baker) assisted in the preparations for my participation. Their help was indispensable.

Q Can you tell me what your role in the project was?

A I was one of the teachers, so I helped produce and deliver training materials. The workshop was divided into different modules, and I was assigned to teach pest management. Basically, I gathered whatever CCI resources were available along with some general resources and information from the Internet (pre-existing PowerPoint slides, books, things like that) and adapted those course materials to what was needed in Haiti, e.g. concentrating on pests found in Haiti. I also looked for techniques in pest management that could be applied in Haiti.



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For instance, freeze drying is a common procedure in Canada but it would not be suitable in Haiti due to the frequent power outages (if the power goes off while a freeze dryer is turned on with organic materials inside, it becomes a breeding ground for mould).

We were on the go from 6:00 a.m. to midnight, working weekends and evenings — but it was so rewarding. At the end, the participants told us they did not feel so alone, that in some little way we were helping them. For me, it was 2 weeks of constant preparation, lecturing, and training; for others, such as Vesna Živković (Chief of the Department of Preventive Conservation in the Serbian Central Institute of Conservation), it was 3 weeks. The weather was hot and humid. It was difficult to see people living in tents and in the streets — it made us very grateful when we came home. We couldn't walk anywhere; we had to be chauffeured, which was very limiting. It made me very appreciative to be living in Canada.

Q How would you describe your overall experience in Haiti?

A Amazing. Just amazing. I would happily go back if I could be useful. That's the thing — resources are very limited, it's important to go there in the framework of a specific project.

Q You mentioned that “strategies had to be adapted to the realities of Haiti.” What is the current situation of the conservation and heritage community in Haiti?

A Haiti suffered enormous human and material losses in the earthquake — and the Haitian heritage community was not exempt. Many of our participants were living in tents, in partially damaged houses, or in the outskirts of the city. Despite these hardships, they were dedicated to preserving Haiti's culture and made the difficult trip to the Centre every day.

All institutions were affected — some more than others. Many buildings were destroyed, burying the collections in the rubble. Others were damaged, exposing the collections to the elements and to vandalism. Recovered collections were often stored in shipping containers that, although they offer a short-term security solution, will subject the objects to damaging heat and humidity if storage extends for long periods of time. Some museums are looking for funds and resources to repair their buildings or land to rebuild elsewhere. Even the rare institutions that suffered no damage are facing the consequences of the collapse of infrastructure in Haiti, e.g. loss of power and limited resources to manage their collections.

As collections are recovered from the rubble or damaged buildings, or taken out of the containers,



To date, close to 3000 works of art have been saved based on the training we gave.

Throughout the workshop, I (along with all the other instructors) also tried to touch on issues such as employing a sustainable workforce and addressing all the agents of deterioration³ that can damage collections. Information on these agents was especially important to ensure that collections could be sustained in the future. The information presented was based on what we would normally teach in Canada, but we focused on issues that are critical in Haiti right now, such as the major termite problem. Depending on questions or situations that arose during the course, we adapted or developed course material to respond to the students' needs.

Q Which was the most difficult challenge during your trip, and what was the most rewarding experience?

A The most rewarding experience was definitely working with such an incredible group of people. Many of the 28 participants had risked their lives trying to save cultural heritage items. They were so knowledgeable and so generous.

they will require emergency stabilization, safe storage, and conservation treatments. The ICCROM workshop has provided training in how to plan and carry out recovery operations, triage and prioritization, stabilization, and safe storage. As instructors, we also emphasized the importance of teamwork and the need for museums to network in order to deal with the many challenges of preserving cultural heritage for the future generations.

In December 2010, the Smithsonian Institution – Haiti Cultural Recovery Project was selected as an international finalist for the U.S. Ambassadors Fund for Cultural Preservation,⁴ a grant that would allow them to better equip their laboratories and to offer additional formal training courses.

Q Obviously, some Haitian heritage institutions were quite damaged by the earthquake. Going forward, what do you see in the future for Haiti's conservation community? Can they recover?

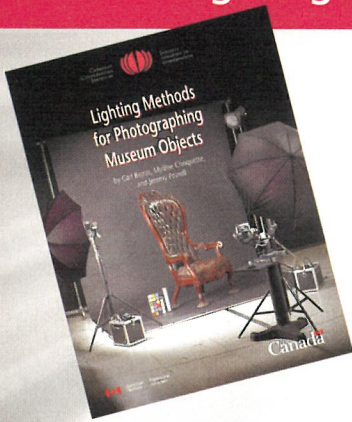
A I think they can — these people are amazing. They have a real dedication, resourcefulness, and passion for their heritage. 🌱

Endnotes

1. *Haiti Cultural Recovery Project*. <http://haiti.si.edu/>.
2. http://www.iccrom.org/eng/news_en/2010_en/events_en/09_21courseFirstAidHTL_en.shtml.
3. *Ten Agents of Deterioration*. <http://www.cci-icc.gc.ca/crc/articles/mcpm/index-eng.aspx>.
4. <http://exchanges.state.gov/heritage/afcp.html>.



Lighting Methods for Photographing Museum Objects



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