The "Collections Risk Management" Program at the American Museum of Natural History

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Abstract   In addition to the wear and tear of time and exposure that normally endanger museum collections, larger scale events such as September 11, 2001, the Northeast Blackout of 2003, Hurricanes Katrina and Irene and the Virginia Earthquake of 2011 have emphasized the threats to collections and underscored the importance of a comprehensive approach to risk planning. In response, the American Museum of Natural History has been steadfastly committed to identifying a complete picture of its collections priorities, and is accomplishing an overall risk assessment of its research, exhibit and library/archive collections. The assessment model used for this three-phase project is based on the Cultural Property Risk Analysis Model (CPRAM) developed by Robert Waller and colleagues at the Canadian Museum of Nature and adapted to accommodate the specific needs of a large, complex institution. These assessments have provided AMNH administrators with information crucial to making long-term strategy and policy decisions about reducing and mitigating risks to collections.
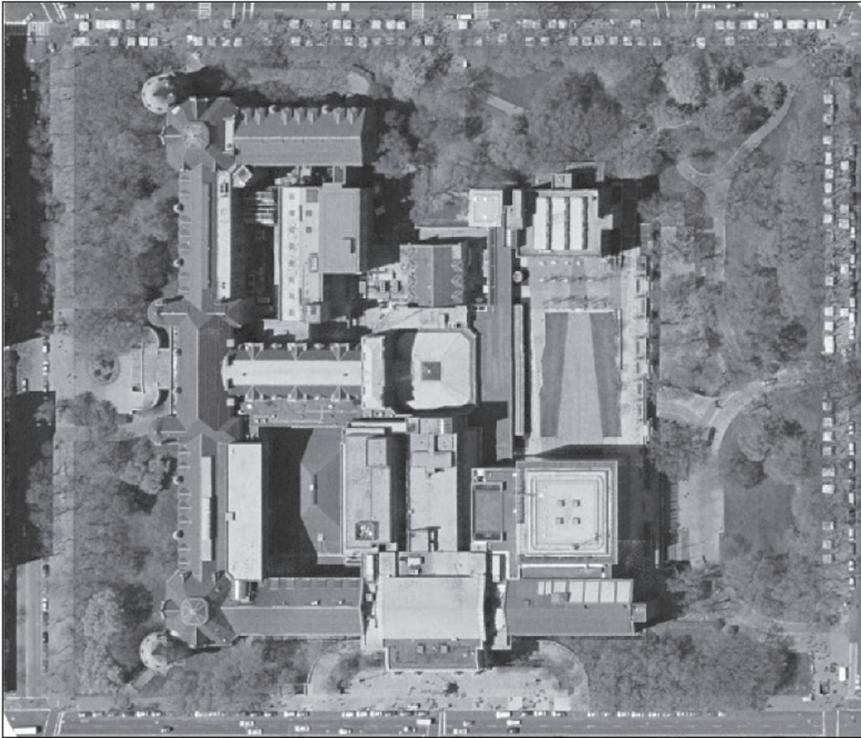
Figure 1. American Museum of Natural History: the Building Campus.

Since its founding in 1869, the American Museum of Natural History (AMNH) in New York City has developed to span 16 acres, containing 26 interconnected build-ings and covering a total of 1.6 million square feet of space (Figure 1).The oldest building was built in 1877 and the newest dates from 2000.There are 46 public halls, four temporary gallery spaces, 400+ collection storage rooms, 26 laboratories, one main library as well as supplemental libraries and archives in nearly every depart-ment. The collections, which number approximately 32 million, continue to grow by roughly 90,000 catalogued entries per year. Almost all of these items are stored on-site. Over 4.5 million visitors per year come to see the collections on display, many of which are considered iconic treasures of the museum: the Star of India sap-phire, the habitat dioramas in the Akeley Hall of African Mammals, the exquisitely carved totem poles in the Hall of Northwest Coast Indians, and the Cape York—world's largest meteorite on display—to name a few.The research collections and those on exhibit are supported by archives comprised of renowned curators, scien-tists, naturalists and artists (e.g., Margaret Meade, Henry Faifield Osborne, Theo-dore Roosevelt, and Carl Akeley) (Figure 2).
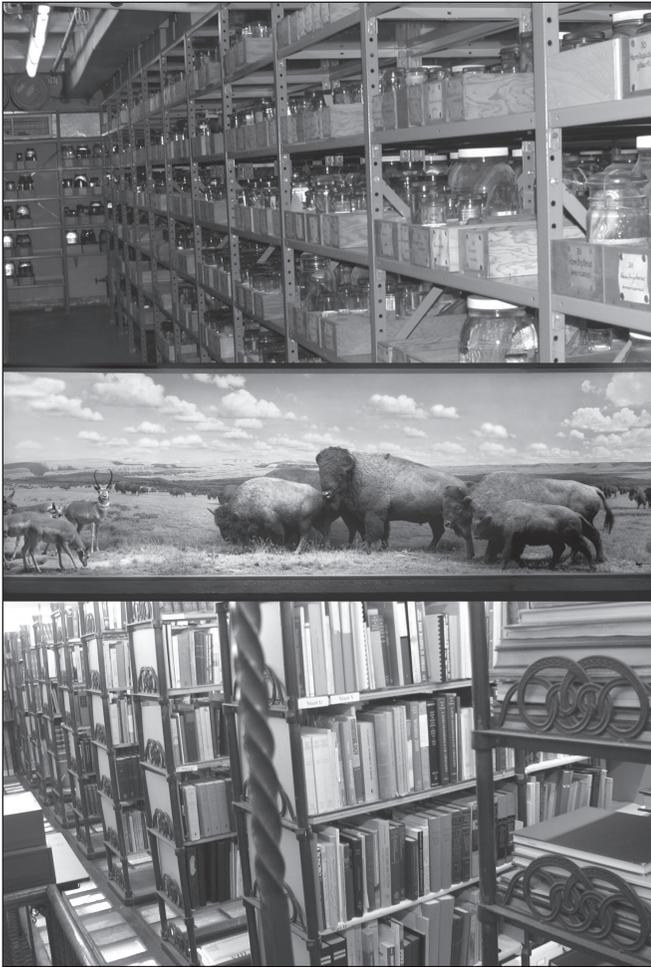
Figure 2. AMNH Collections: Fluid Preserved Collections, North American Mammals dioramas, Library and Archive collections.

AMNH Collections Risk Assessment Program—Critical Partnerships

In response to the natural and man-made events of the past decade—power outages, hurricanes, earthquakes, terrorist attacks and threats, extreme seasons and pollution—the AMNH has developed a comprehensive approach to risk related planning and has invested resources in developing extensive plans for Emergency Management, Business Continuity and Disaster Recovery. The collections risk assessment has been a key tool in evaluating priorities and setting strategic direction concerning the preservation of the research, exhibitions and library collections.

Unfortunately, not all of these planning efforts could be supported internally and departments were encouraged to look outside the museum for potential support. The Institute for Museum and Library Services (IMLS) has been and continues to be a key supporter for the collections. Citing professional standards and surveys, we were able to argue the need for a museum-wide risk assessment to provide baseline data and to set future direction for the institution (American Association of Museums 2007, Heritage Preservation 2005). In 2004, the AMNH received its first grant from the IMLS Museums for America program to begin phase one of what would eventually grow to be a multi-phased, museum-wide risk assessment program. Phase one encompassed the research collections: 32 million accessioned and/or catalogued specimens and artifacts stored on- and off-site. Phase two began in 2009 and was comprised of the collections on permanent exhibit, approximately 22,000 objects. Phase three started in 2011 and addresses the museum's library and archives, materials that support the museum's collection. Without the support of IMLS and its commitment to collections stewardship, it would not have been possible to accomplish such an expansive task in any reasonable timeframe. Though this 'partnership' was the museum's first and a considerable influence, several others have been critical to the success of the risk assessment program.

Our Primary Partnership

Our primary partnership has been with Robert Waller, co-creator of the Cultural Property Risk analysis Model (CPRAM) at the Canadian Museum of Nature. Rob's contributions have been invaluable to the AMNH Risk Management program in helping the assessment team adapt CPRAM to the specfic needs of the Museum and its vast and actively researched collections. During each assessment phase, Rob provided training workshops to the Museum staff to introduce the process, and offered an opportunity to discuss the unique challenges in applying the model to the AMNH collections. In each workshop, pertinent information concerning the project timeline and process were distributed, the concepts involved in the methodology were presented, and mock estimations were applied within selected storage areas. Over 50 individuals from both Science and Operations departments have been trained thus far, and at this point nearly eight years into the process, the Museum has internal staff with enough training and expertise to push the program forward effectively. However, utilizing an outside consultant has continued to provide a strong influence and legitimacy to the program. As part of a system of internal and external evaluations of the accumulated data, Rob has been consistently accessible, providing valuable feedback when reviewing preliminary results and advising on strategies for collecting data more efficiently.

Internal Partnerships: Senior Management, Facilities/Operations, and Science

Approaching a collections risk assessment independently is a set up for failure; it must be approached as a team effort, and internal partnerships are critical to its success. At the AMNH, internal partnerships were formed between senior management, operations and scientific departments. Over 50 staff members throughout the museum were involved in some capacity with one or more of the risk assessments. Having senior management on board to support and guide the project throughout its duration has been instrumental to the program's success. Creating collections priorities based on unbiased and quantitative evaluations was a system with which the Museum's management staff was familiar and knew to be effective. The program "speaks" their language, so the partnership has been mutually beneficial. With an advocate for the program in a senior role, there is a greater potential for the results to have significant impact.

Risk assessment relies heavily on hard data regarding buildings and museum systems to evaluate the magnitude of various risks. The AMNH Operations staff was able to provide vital data concerning collections security, fire probabilities, HVAC systems, and Integrated Pest Management procedures, to name just a few. Having staff on board with an historic knowledge about the building envelope and its infrastructure (critical variables concerning collection preservation), emphasizes the unique significance of this partnership. Collaborations with operations staff continued throughout the entire risk assessment process, from initial data collection to the final stages of cost analysis and mitigation. Particularly significant was our partnership with staff from Operational Planning. These staff members deal with strategic planning and analysis on a daily basis and not only provided invaluable input and guidance in the final stages of analysis and mitigation, as mentioned above but also developed our most critical tool for data management, the SCoRE database (see below).

Scientific staff, including conservators, collection managers, preparators, curators, and researchers provided the information needed to determine the extent to which specific threats could impact specimens. They too brought to the table historical knowledge, as well as an understanding of specific materials needs and uses. This partnership provided some of the most useful information concerning collections history, environment, condition, use and significance.

External Partnerships—Subject Area Experts

In order to assess certain risks accurately and efficiently, partnerships with subject area experts were required, particularly when accurate risk evaluation required concrete data. For example, catastrophic risks were quantified through consulta-

tion with earthquake engineers, meteorologists, and museum security professionals to determine probability of occurrence. Sporadic or seldom occurring risks relied on a combination of internal and external subject area experts to provide the most unbiased evaluation.

Cultural Property Risk Analysis Model (CPRAM)—A Modified Version

The assessment model used for the AMNH Risk Management Program was based on CPRAM, yet adapted to meet the demands of a very large, active collection. The CPRAM model has allowed the Museum to approach prioritization of collection needs equally and quantitatively, eliminating as much subjectivity as possible (Waller 2003). The basic steps involved in the CPRAM method are:

1. Definition of the scope of the assessment
2. Disaggregation
3. Data collection
4. Risk quantification
5. Analysis and planning

Definition of the Scope

To approach the daunting task of evaluating the collections museum-wide, the AMNH began by breaking the project down into phases, beginning with the research collections. At the beginning of each phase, the project team worked together to create a carefully worded document that specfically defined what would be included in the assessment and any applicable restrictions and/or parameters.This document was called the "Project Scope."The document began by defining the risk assessment process, how and why it was used, and who was involved. It then outlined the methodology and specifically listed the collections that would be evaluated or excluded. Finally, a deliverables section provided details on how the results of the project would be presented (i.e., a report prioritizing collections needs, a list of strategies for mitigation, a baseline of risks to be used to compare progress, and areas in need of further research). By clearly defining what was evaluated (i.e., items in the permanent collection, but not items on loan) and setting pre-determined boundaries (i.e., focusing on a forecast time period) confusion was avoided and consistency ensured.

Disaggregation—Defining collection units and specific risks

Because a collections risk assessment is comprehensive by nature, it becomes necessary to break down the system (collections and risks) and define components in very specific terms in order to then rebuild it in an organized and useful manner. Dividing both the risks and the collections into smaller components ensures that both are understood in a clear, comprehensive fashion.

Furthermore, in defining collection units an understanding of how an institution will need to view and use the resulting data should be clear from the start, as final presentation may require specific details concerning data organization. Science and collections staff may want to view data not only by material type, but also by department or by division. Management and operations staff may want to view results by building, by floor, or by specific exhibit hall. The AMNH collection units were created based upon the hierarchy that already existed within the Museum: Divisions, Departments, and Collections. For example, the Vertebrate Zoology Division is made up of the Mammalogy, Ornithology, Herpetology, and Ichthyology Departments, which may include fluid and osteological collections, among others. So a collection unit named "Vertebrate Zoology, Mammalogy, Fluids" is distinguished from another described as "Vertebrate Zoology, Ornithology, Fluids." In addition to following the structure of the Museum's holdings, the collection units were further defined by location: building, floor, and room—*an adaptation the AMNH program created in order to allow risks to be evaluated by location*

Finally, disaggregation also helps to remove bias by emotionally distancing the evaluator from the collections in their care. For example, the AMNH specific risks were broken down using the "Type 1–3" model (Waller 2003) and has identified nearly 100 risks applicable to our collections. When asked to provide estimates for certain specific risks, such as the potential for damage due to handling an object an evaluator may have an immediate emotional response to the question, responding with a high estimation. A different evaluator may struggle with being able to estimate a number at all, until the question is separated into its constituent parts.

- Why are these objects handled?

- How many different scenarios can you think of?

- How many objects are handled/used in each scenario per year?

- Out of a given number of objects handled in each way, how many are damaged, and to what extent?

By disaggregating the specific risk into smaller, related quantifiable questions, bias can be removed and the evaluator can feel confident in their estimation. *The AMNH has customized the model by developing specific risk questions that can be referenced project-wide.*

Data Collection

Once the collection units were identified, background data was collected to define them clearly and consistently. Collection staffs were queried about the degree of access into each collection, the nature of the materials in each collection unit, and its history of use, including as examples, the average number of researchers per year, or the time period that it has been on display. Additional information sometimes included the percentage of the collection unit that had been imaged or databased, notes on historical and current labeling methods and materials, or historical preparation methods or conservation treatments. All of this information was fed into one document called the "Collection Unit Description." To give a sense of the breadth of this information, so far the AMNH collections risk assessment has identified 328 collection units museum wide. This includes research collections, collections on exhibit, and library and archive material.

In addition to details specific to each collection unit, data was also recorded for each collection unit location, such as the physical infrastructure, the cabinetry contained within a specific area, as well as the history of the collection spaces. Approximately 186 collections storage areas, 46 exhibit halls, and associated areas containing library/archive collections museum-wide were thus surveyed. Collecting this information upfront has saved time and effort in subsequent evaluation processes. *As mentioned earlier, breaking the collections down by location was a major development in the Museum's risk program, as it expanded our ability to reorganize and present risk data to multiple and varied audiences.*

Risk Quantification

Once sufficient background data had been collected, the process of risk quantification began. This involved determining an overall magnitude of risk for each specific risk as it applied to a collection unit. There are four variables used to measure specific risks: Fraction Susceptible, Loss in Value, Probability and Extent. Fraction Susceptible and Loss in Value are theoretical margins to the severity of a particular risk, while the Probability and Extent values are reflective of the mitigating agents based on the existence of an institution's current practices (Waller 2003). These variables are combined to determine the Magnitude of Risk (MR). Ultimately, it is the MR value that is used to analyze the risk data and identify areas of greatest need.

In order to accurately and effectively quantify these variables, multiple steps were taken to ensure that all vested parties could feel ownership of the final results. For each collection unit, a statement of significance was created to provide a concise summary of the values, meaning and importance of the collection unit. The statement of significance was also a reference point for determining the percentage loss in value to a collection unit. Other tools developed to aid in determining the loss

in value were the value assignment rationale and the loss in value rubric. The value assignment rationale outlined the various facets of the collection unit's total value—as a research object, as an artifact of social/historic signficance, or as an aesthetic or artistic object. A ratio was created to differentiate and relate the multiple types of value possessed by one collection unit. The value assignment rationale explains what criteria were applied to determine the ratio. Once these core documents were established, the risk evaluation variables were determined through a series of meetings between the risk analyst and the evaluators—those staff members determined to be key stakeholders for the collection's preservation.

Analysis and Planning

Both the strength and the challenge of this approach is the enormous amount of data that is collected concerning the collections, how they are used, their primary storage and the building envelope. Collecting this data in a detailed, systematic fashion is critical in ensuring strong results. Initially, the data was collected and organized using templates, questionnaires, and spreadsheets. These tools may be sufficient for institutions that have smaller collections and less complex facilities. With 328 collection units and nearly 100 specfic risks to the collections, data storage and analysis at the AMNH is exceedingly complex; there are nearly 32,800 total risks requiring assessment. At the end of the project, the team will have collected more than 131,000 quantitative data elements relating to collection risk, including details about specimen locations, levels of security/pest control, fire detection in these areas, specimens' susceptibility to specfic risks, and subsets that require special attention.

Scientific Collections Risk Evaluation database (SCoRE)

It was quickly discovered that the calculations that had to be performed across the various collection units, locations and risks could not be addressed easily using Word or Excel. Instead, a relational database was required. Microsoft Access was capable of acting as both a data repository and as a system for data mining and data crunching. In 2004, the Scientific Collections Risk Evaluation database (SCoRE) was developed in Access to work over the museum network with a small user base. After completing a series of risk assessments in 2009, the limitations of Access were realized, and the Museum hired an external vendor to convert SCoRE from Access to a MySQL platform that would be more stable, more robust and would be supported on a museum server. *The SCoRE database has been the most important tool developed specifically for this program and is integral to the continuing success of the AMNH risk management program* (Elkin et al 2001).

Visualizing Results

Generating reports is key to any database and critical when presenting the results of a risk assessment. The SCoRE report generator allows for the immediate creation of a selection of reports that organize data by Collection Unit, Department, Division or Museum-wide.

Collection Specific Reports: Collection Unit Descriptions, Collection Size and Collections Distribution

These reports are straightforward. They document the storage and use of collections at a particular point in time, the breakdown of specimen counts by department, division and/or museum wide, and the distribution of collections throughout the campus. In addition to being useful for collections and conservation staff, these documents also have the potential to inform annual reporting and planning.

Location Specific Reports: Security, IPM and HVAC Conditions

These reports show the breakdown of specimens by specific security and environmental conditions. They provide summary data concerning the physical conditions of the collections storage and the percentage of collections stored under the given parameters. One example of the utility of such a report might be in highlighting the breakdown of specimens housed in storage conditions with sprinklers versus those housed without.

Risk Summary Reports: Risk Estimation Logic, Risk Profiles and Matrices, and Risk Mitigation Scenarios

Risk Estimation Logic Reports outline the detailed documentation of the logic used when quantifying the variables that make up the magnitude of risk. It was imperative that this data be documented and archived carefully as it is the backbone of the magnitude of risk number. The risk profiles and matrices create comparative summaries, and the final risk data can be presented in a number of formats: bar charts, pie charts or simple chart form. One way of evaluating the data is to visualize all of the museum divisions side-by-side to determine division level priorities. This provides a quick snapshot of how the departments rate against one another (see Figure 3). More importantly, it is possible to determine which collection unit has the highest risk exposure by reconfiguring the data to summarize at the collection unit level. This could reveal that some collections within a department are in excellent shape,
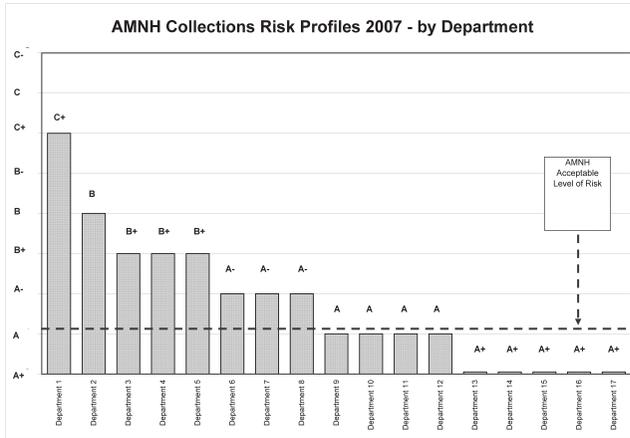
Figure 3. SCoRE generated "Mock" Magnitude of Risk bar chart, grading system.

Figure 4. SCoRE generated "Mock" Magnitude of Risk matrix, numeric values.

while others still require improvement. In other situations, analysts may want to view the actual magnitude of risk values; this can be accomplished through a matrix forma (see Figure 4).

In addition to creating divisional, departmental, and collection level risk summaries, the assessment data can be used to provide visual examples of how mitigating potential risks could decrease the vulnerabilities of the museum's col lection and change the risk profile. These are called Risk Mitigation Scenarios. Such

scenarios can be based on actual accomplishments or can be developed as a tool to convince an audience that the funding provided will make a change. These kinds of before-and-after examples have been very effective with administrative audiences and can be used to show a variety of scenarios, including how—with a series of short, medium and long-term mitigation strategies—the Museum could reduce its risk exposure from the current situation to an acceptable state.

Conclusion

The Cultural Property Risk Analysis Model (CPRAM) provided a framework to develop a risk management program tailored to suit the needs of a large, varied, and actively used collection. By prioritizing strategic organization of the numerous layers of information collected as part of each risk assessment phase, we have been able to refine the application to be equally efficient and effective. The high-level comprehensive data collected thus far has had far reaching benefits by providing administrators with information crucial to making long-term strategy and policy decisions about mitigating the risks to the museum's collections. In fact, in June 2008 the Museum added risk assessment to its overall collections management policy thus emphasizing the need for proactive risk mitigation tactics instead of reactive, impulsive decisions based on subjective evaluations. Additionally, the ability to create customized reports has given fundraising staff the necessary tools to speak to donors about high priority projects. The results from our risk assessments have found their way into funding documents such as the annual capital requests to the City and a potential new campaign the Museum is planning. And, that is precisely what the program was intended to do—provide a tool to help senior managers, collection and conservation staff, and fundraisers make more informed decisions.

One of the biggest challenges of establishing the AMNH Collections Risk Management Program was balancing priorities throughout for the most efficient use of time and efforts. For a large institution such as the AMNH, it has been most effective to conduct a broad and comprehensive risk assessment sweep to establish high priorities, and to follow up with more in-depth assessments for those areas that are identified as needing more research. It has been important not to lose time focusing too long on collections with little to no data or internal staff perspective and team members have to continuously remember that the goal of such an expansive museum-wide evaluation is to provide a broad overall picture.

Finally, starting a risk assessment program at any institution is a marriage, ongoing and in constant need of work and commitment. Since 2005, the AMNH Risk Management program has taken on something of a life of its own, and it is likely that there will never be an "end" phase, as these evaluations need to be revisited and updated as the museum experiences staffing, storage, and facilities changes. The addition of the risk assessment program to the museum's collection policy was a sign

of the American Museum of Natural History's commitment and recognition of this ongoing and evolving process.

Acknowledgments

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