

Green museums
Green+exhibits

communicating
sustainability
— through —
content + design

by
Rachel Byers

a master's project

december 2008

Presented to the Arts Administration program of the
University of Oregon in partial fulfillment of the requirements
for the Degree of Master's of Science in Arts Management

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Acknowledgements

I would like to thank the following Arts and Administration faculty who had a great impact on my graduate education: Dr. Doug Blandy, Dr. Gaylene Carpenter, Dr. Patricia Dewey, Dr. Lori Hager, Kassia Dellabough, Bill Flood, Alice Parman, and Eric Schiff. I especially thank my research advisers Dr. Janice W. Rutherford, who helped me get this project off the ground, and Dr. John Fenn, who helped me cross the finish line.

I also want to acknowledge Cynthia Budlong, Ann Craig, Patty Krier and everyone else at the University of Oregon Museum of Natural and Cultural History. My exhibit fellowship at MNCH was a vital part of my education. I also thank Bob Hart and all the ladies at the Lane County Historical Museum who made my work there enjoyable.

I appreciate the help and support of all who participated in this research project: Jennifer Willcox at OMSI, Heather Mikulas at Phipps, Chris Siefert at CMP, and authors Sarah S. Brophy and Elizabeth Wylie.

Thank you to my fellow student cohorts: Betsy Bostwick, Kim Johnson, Elizabeth Lamb, Eunju Nam, Julia Robertson, Katie Schumm, Tara Sweeney, Wei-Ping Wang, and Na Young Yoon. The ten of us composed a wonderful, supportive community that made a graduate education experience that could never be matched. I especially want to thank Tara for convincing me that I'm an expert at the Transforming Museums Conference and Elizabeth for being my partner in procrastination as we finished our research during our one extra term.

I would like to thank my family, Mom, Dad, Regina, Michael, Jim, and baby Maggie, who sent their love and support to me from across the country in Pittsburgh and Ohio.

Finally, an immense thank you to Jeff for accompanying me on this adventure in Oregon. I can't wait to share new adventures with you in the future.

Rachel Byers

Education

Master's of Science in Arts Management, University of Oregon
Certificate in Museum Studies

Eugene, Oregon, completed December 2008

"Green Museums & Green Exhibits: Communicating Sustainability through Content & Design"

Master's Research Project, completed December 2008

Received School of Architecture & Allied Arts Student Travel Fund award

Presented Transforming Museums Conference, Seattle, Washington, May 2008

Defended, October 2008

Bachelor's of Art in Anthropology, Ohio University

Bachelor's of Science in Journalism

Minor in Music

Athens, Ohio, June 2006

Related Professional Experience

Digital Archivist, Lane County Historical Museum

Eugene, Oregon, December 2007 to present

Planned and implemented Digital Preservation Project

Preserved nitrate negatives in digital files with metadata

Wrote grant to Oregon Heritage Commission

Supervised related student project

Exhibit Fellow, University of Oregon Museum of Natural & Cultural History

Eugene, Oregon, January 2007 to June 2008

Received competitive Laurel Award fellowship

Designed panels and labels; wrote and edited exhibit text

Identified and scheduled traveling and changing exhibits

Supervised community volunteers and university students

Related Professional Experience

Exhibit Design Intern, Presentation Design Group, Ltd.

Eugene, Oregon, summer 2007
 Edited and organized exhibit text
 Researched and ordered materials
 Fabricated exhibit fixtures

Curatorial Assistant, Kennedy Museum of Art

Athens, Ohio, July 2003 to June 2006
 Assisted in creation of digital database for Native American jewelry collection
 Conducted scholarly research for presentation and exhibitions

Exhibitions

Exhibit Team Member, "Walk a Mile in These Shoes—The Stories They Tell"

Large-scale exhibit at the University of Oregon Museum of Natural & Cultural History
 Installed March 2008

Exhibit Team Member, "Yuungnaqpiallerput: The Way We Genuinely Live"

Large-scale exhibit produced by Presentation Design Group, Ltd.
 First installed September 2007 at Yupiit Piciryarait Cultural Center and Museum
 Traveled to Anchorage Museum January 2008

Producer, "Geology of Oregon"

Small-scale exhibit at the University of Oregon Museum of Natural & Cultural History
 Installed March 2007

Curatorial Team Member, "Art of the Zuni"

Permanent exhibit at the Kennedy Museum of Art
 Installed September 2007

Curatorial Team Member, "Weaving is Life: Navajo Weavings from the Kennedy Southwest Native American Collection"

Permanent exhibit at the Kennedy Museum of Art
 Installed March 2005

Education Programs

Producer, Lane County Historical Museum Digital Preservation Project Slideshow

Oregon Day of Culture, October 2008

Edited historical negative scans for optimal image quality; wrote interpretation captions

Created digital slideshow to increased public access of local history

Team Member, University of Oregon Museum of Natural & Cultural History

Opening Celebration, "Walk a Mile in These Shoes—The Stories They Tell"

May 2008

Consulted volunteers to improve exhibit interpretation

Presented informal talk about exhibit development

Developer, University of Oregon Museum of Natural & Cultural History

Archaeology Quest

Developed fall 2006, produced spring 2008

Interactive board game demonstrates archaeology to museum visitors

Team Member, University of Oregon Museum of Natural & Cultural History

Teacher In-Service Day

October 2006

Assisted in planning and implementation of event

Monitored attendance and participant evaluation

Other Experience

AmeriCorps VISTA Service Member, Rural Action, Inc.

Trimble, Ohio, summer 2006

Provided community outreach to Appalachian Ohio

Planned and led environmental day camps

Collected watershed survey data

Field Crew Member, Field School in Ohio Archaeology

Hocking Hills State Forest, Ohio, summer 2004

Excavated pre-Columbian Native American artifacts in rockshelter

Learned and performed archaeological field techniques

Abstract

The goal of this master's research project was to investigate the dynamic relationship between sustainability and museum administration in order to define what it might mean for a museum and its exhibitions to be green. Through an extensive literature review and three case studies of leading green museums, I set out to understand how sustainability might be integrated into museums, how the roles and characteristics of museums defined their role in a sustainable society, how exhibits could communicate sustainability to museum visitors, and how to produce exhibitions using green design. The findings of this master's research project informed a set of recommendations that provide practical instruction for museums, or any other arts or cultural organizations, to consider while developing green exhibits.

Key Words

Museums

Exhibits

Sustainability

Green Museums

Green Exhibits

List of Figures

- 2.01 Conceptual Framework
- 3.01 Sustainable Design Characteristics
- 3.02 Green Museum Practices
- 3.03 Green Design Exhibits Characteristics
- 4.01 OMSI Green Exhibit Certification Levels
- 4.02 CMP Charm Bracelet Project Charms



Chapter one

i n t r o d u c t i o n

1.01 Purpose of the Project

Green Museums & Green Exhibits: Communicating Sustainability through Content & Design investigated how museums are incorporating sustainable practices, design, technology, and content into their operations and exhibitions. My goal was to analyze collected research data to inform the development of “Greening Guidelines,” a set a recommendations for producing green exhibits that could provide practical instruction for museums and similar institutions. To achieve this aim, I synthesized existing literature about green museums and green exhibits and conducted three case studies of leading green museums: the Oregon Museum of Science and Industry (OMSI), Phipps Conservatory and Botanical Gardens (Phipps), and the Children’s Museum of Pittsburgh (CMP).

1.02 Statement of the Problem

Today, the world is facing an environmental crisis that affects all regions of the world and all levels of society (Center for Naval Analysis Corporation, 2007; Goering, 2007; Intergovernmental Panel on Climate Change [IPCC], 2007; World Commission on Environment and Development, 1987). Greenhouse gas emissions are leading to a potentially catastrophic rise in global climate temperatures (Eilperin, 2007; Goering, 2007; IPCC, 2007; Savage, 2007; Seattle Times news services, 2007). Plants, animals, and ecosystems are rapidly nearing extinction (Eilperin, 2007; IPCC, 2007; Johnson, 2008), while natural disasters such as hurricanes, floods, and wildfires, are increasing in frequency and severity (Brophy & Wylie, 2008; IPCC, 2007; Seattle Times news services, 2007). Many problems are associated with human actions of a consumption-

based culture (IPCC, 2007; World Commission on Environment and Development, 1987; Link, 2006; Worts, 2004). Humans harm the environment through the process and the effects from the extraction of natural resources and the manufacture of products from those resources. However, the current rate at which humans consume and pollute cannot be maintained indefinitely. Scholars believe that consequences of these actions may lead to Earth's inability to support life. In order to prevent this crisis, human actions need to change (IPCC, 2007; World Commission on Environment and Development, 1987; Link, 2006; Worts, 1998; Worts, 2004; Worts, 2006).

People act on the natural environment based on beliefs and values held within cultural and societal norms. Education and personal experiences also inform a person's understanding of nature (Scarpino, 2004; Worts, 1998; Worts, 2004; Worts, 2006). American culture defines nature as a force to control and conquer in a tradition that began with European settlement and westward expansion (McDonough & Braungart, 2002; Scarpino, 2004). At the same time, American society is diverse and its many constituents hold different beliefs and values. This diversity has caused global climate change and environmental regulations to be controversial and political issues today (Center for Naval Analysis Corporation, 2007; Savage, 2007; Seattle Times news services, 2007).

The politically charged issue of climate change has found its way into museums. During the spring of 2007, the Smithsonian National Museum of Natural History was accused of watering down *A Friend Acting Strangely*, an exhibition that illustrated the effects of climate change on the Arctic. For fear of losing funding from Congress, the Smithsonian eliminated display elements that described the severity of climate change

and explained the link of human activities to climate change (Zongker, 2007, May 21; Zongker, 2007, May 22,).

Other museums are responding to the environmental crisis in a more positive way, by incorporating sustainability into their operations and programming. In the museum field, such institutions are known as “green museums” (Brophy & Wylie, 2006; Brophy & Wylie, 2008; Wylie & Brophy, 2008). Green museums are organizations engaged in green business practices, eco-friendly facility management, and sustainable educational programming (Brophy & Wylie, 2006; Brophy & Wylie, 2008; California Association of Museums, 2008; & Wylie & Brophy, 2008). Zoological organizations and children’s museums were the first in the field to adopt green practices. Zoos were motivated by the opportunity to take an active role in the conservation of wildlife and their habitats (Brophy & Wylie, 2006; Brophy & Wylie, 2008; Wylie & Brophy, 2008). Children’s museums sought green design to create healthy indoor environments for their young visitors (Brophy & Wylie, 2008; Judy, 2006; Madison Children’s Museum, 2008). Recently, museums of all types have gone green. In the past decade, twenty or more museum organizations have constructed green buildings (Brophy & Wylie, 2006; Brophy & Wylie, 2008; Wylie & Brophy, 2008).

Green museums are a recent trend in museum management and are earning great interest among the professional community (Brophy & Wylie, 2006; Brophy & Wylie, 2008; De Varine, 2006; Sutter, 2006; Worts, 2006; Wylie & Brophy, 2008). Currently, literature about museum sustainability is flourishing. Within two years, green museums were twice the cover story for the professional publication of the American Association of Museums (Brophy & Wylie, 2006, & Wylie & Brophy, 2008). (The American

Association of Museums (AAM) is the national organization for museum professionals and is dedicated to enhancing the value of museums through leadership, advocacy, and service (American Association of Museums [AAM], 2008)). The journal *Museums & Social Issues*, edited by Kris Morrissey, the Director of the University of Washington's Museology Graduate Program, devoted its entire Fall 2006 issue to museums and sustainability (DeVarine, 2006; Kociolek, 2006; Link, 2006; Sutter, 2006; Worts, 2006). For the first time in July 2008, green museums were the subject of a full-length book, *The Green Museum: A Primer on Environmental Practice*, by Sarah S. Brophy and Elizabeth Wylie (Brophy & Wylie, 2008).

The topic has leapt from the page and into professional discourse. Museum professional conferences are the sites of discussions about green museums. During the 2008 American Association of Museums Annual Meeting and Expo, a Professional Interest Committee on Green Museums (PIC Green) had its founding meeting with 102 people in attendance (AAM, 2008). Other professional associations are developing programming and regulations concerning sustainability. For instance, the California Association of Museums has a Green Museum Initiative that aims to inspire state museums to adopt sustainable practices (California Association of Museums, 2008).

Some scholars believe that sustainability will become a required museum practice and a condition of accreditation (Brophy & Wylie, 2006; Brophy & Wylie, 2008; Wylie & Brophy, 2008). (Accreditation is awarded by the American Association of Museums to recognize museums' commitment to excellence, accountability, high professional standards, and continued institutional improvement. To receive accreditation, a museum must meet predetermined requirements and submit to an application process (AAM,

2008)). If AAM determines that sustainability is required institutional behavior for museums, then accredited and unaccredited museums across the nation will work green practices into their operations (Brophy & Wylie, 2006; Brophy & Wylie, 2008; Wylie & Brophy, 2008). There is evidence that this is already occurring. Recently, the Association of Zoos and Aquariums revised its accreditation standards to include a requirement of environmental advocacy (Association of Zoos and Aquariums, 2008, Wylie & Brophy, 2008).

Green museums are not limited to professional interest but have made headlines in the popular press as well. Much of the coverage focuses on newly constructed museum buildings with sustainable architecture and design, (Associated Press, 2008; Bernstein, 2007; Hall, 2007; Zipp, 2008). Whatever the topic, coverage in the popular press raises awareness of green museum movement among nonprofessionals. It can be argued that repeated coverage of green museums in the popular press may be more important than in scholarly literature. The readers and writers of the popular press represent the museum audience. The frequency of green museum articles in this media can indicate that museum audiences have interest in sustainable practices of museums. By going green, museums address not only the professional aspirations of their field, but the interests of their visitors (Brophy & Wylie, 2006; Brophy & Wylie, 2008; Worts, 2003; Wylie & Brophy, 2008; Zipp, 2008).

Even with the recent proliferation of professional literature and media coverage, existing literature on museum sustainability is incomplete. Literature relevant to green museums is divided into specialized fields such as environmental studies, architecture, and arts administration. Little empirical research is available that explicitly explores

green museums, and even less exists about green exhibits. This study aims to fill the gap in the research pertaining to the relationship between green museums and their exhibit themes and design. It will synthesize existing literature and analyze case studies in order to draw conclusions and formulate recommendations about the current state of green exhibits in the United States.

1.03 Purpose Statement

The goal of *Green Museums & Green Exhibits: Communicating Sustainability through Content & Design* is to explore the dynamic relationship between sustainability and museum administration in order to delineate what it might mean for a museum and its exhibits to be green. An extensive literature review, document analysis, case studies, and in-depth interviews informed this research. Findings from this study, in the form of “Greening Guidelines,” will help museums identify good practices when considering sustainable practices and green exhibition design.



Chapter two

r e s e a r c h m e t h o d o l o g y

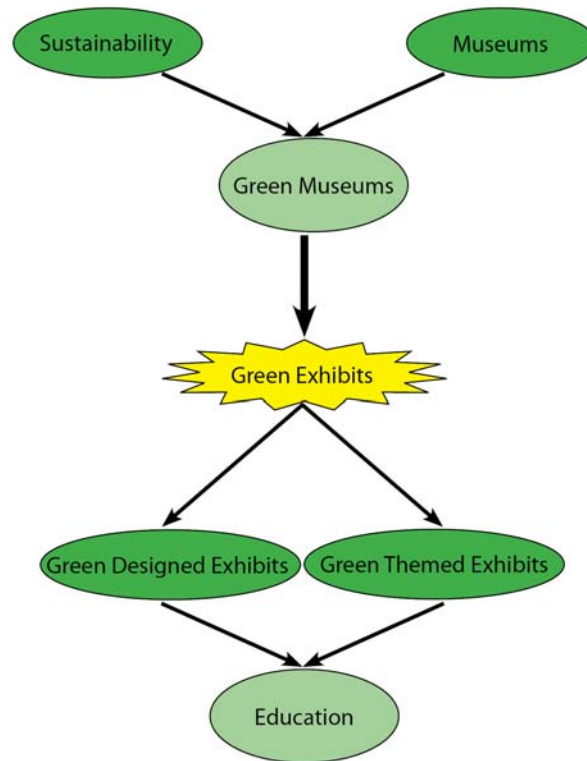
2.01 Introduction

In this research project, I wanted to examine the possible roles museums have in a sustainable society by incorporating sustainability into their operations and exhibitions. To achieve this goal, I analyzed three case study institutions active in the green museum movement: the Oregon Museum of Science and Industry (OMSI), Phipps Conservatory and Botanical Gardens (Phipps), and the Children's Museum of Pittsburgh (CMP). I gathered information about the organizations' sustainable operational practices, the green themes covered in their exhibitions, and the green design techniques used in their exhibit construction. From the collected data, I developed practical guidelines for green exhibits that could inform everyday museum operations. This research fills the gap in the scholarship by synthesizing the existing literature of the rapidly evolving field of green museums and by providing concrete recommendations for green exhibits. This master's research project lasted approximately twelve months from January 2008 to December 2008.

2.02 Conceptual Framework

This research examines the relationship between green museums and their exhibit themes and construction practices. I selected several reoccurring themes in order to focus my investigation: sustainability, museum roles and characteristics, green museums, exhibit roles and characteristics, green exhibits, green design, and environmental education. Findings from this exploration will inform recommendations that may be useful when planning for and implementing sustainable measures in museums and similar institutions. See figure 2.1 for a visual of the conceptual framework.

Figure 2.01 – Conceptual Framework



2.03 Methodological Paradigm

The study follows the critical inquiry paradigm, using an exploratory approach and qualitative research methods. The critical inquiry methodological paradigm asserts that all science begins with a value position of right and wrong. Using this paradigm, a study argues a value position and promotes change (Neuman, 2006; Cresswell, 2003). This study argues that museums *should* implement sustainable measures. It is a normative argument, asserting that green museums are morally right. Green museums and green exhibits educate in order to provoke action. They strive to produce change in visitors' thoughts and habits so that they act in a way that is sustainable for the planet (E. Wylie, personal communication, February 8, 2008). Following this theory, this study hopes to

encourage museum professionals to implement sustainable practices in their operations and exhibitions.

2.04 Role of the Researcher

As in any qualitative research, the role of the researcher is important because interpretation of the data is conducted through his or her own experiences, values, and judgments (Creswell, 2003; Neuman, 2006). To validate my inherently biased interpretation, I used scholarly work from journals, books, and trade publications to provide a professional and academic view of the subject. Additionally, I used newspapers, magazines, and websites to provide an understanding of how green museums are being viewed by the general public, outside academic and professional circles. These resources helped to provide a more balanced view of the topic. To fully examine the information gathered, I developed research questions.

2.05 Research Questions

My research intends to answer the following main research question: How are green museums producing green exhibitions? I developed six sub-questions to help guide the study:

1. What is sustainability?
2. Why should museums as institutions be concerned with sustainability?
3. What green practices are museums currently practicing in their administration and exhibitions?
4. How are museums communicating their green efforts to the public?
5. How are museum exhibits used to educate visitors about sustainability concepts?
6. What green design techniques are used in the development of green exhibits?

2.06 Definitions

There are several important words and concepts that need definition in order to fully understand this study. These definitions are a synthesis of information compiled from scholarly works and original data. Additional definitions can be found in Appendix B.

Green museum: a museum organization that is engaged in green business practices, eco-friendly facility management, and sustainable themed educational programming.

Green exhibit: an exhibit that covers a topic related to sustainability and/or that uses sustainable design in its construction.

Green theme exhibit: a museum exhibit that explores a topic related to sustainability.

Green design exhibit: a museum exhibit that uses green design principles in its construction, use, and disposal.

Sustainability: a way of life that meets the needs of the present and future generations by balancing the natural environment, society, and economy through the recognition that human individual and collective behavior affects and is affected by the Earth.

2.07 Research Timeline

I conducted research from January to December 2008. From January to September, I collected and analyzed scholarship for the extensive literature review. In February, I conducted two in-depth interviews with leading green museum researchers, Sarah Brophy and Elizabeth Wylie, who provided me with insider knowledge of the green museum movement. Then in May, I presented the initial findings from my initial literature review and data collection at the Transforming Museums Conference at the University of Washington in Seattle. In August, I contacted the case study institutions to request participation in the study. I conducted in-person interviews and on-site observations of the case studies in September. Finally, on October 31, I defended my research through a presentation to the faculty, staff, and student cohorts of the Arts and

Administration Program at the University of Oregon. See Appendix E: Research Timeline for a complete breakdown of my research schedule.

2.08 Research Approach + Strategy of Inquiry

This study is qualitative research that uses exploratory approach to examine the relationship between sustainability, museums, and exhibits. My strategy of inquiry was collective instrumental case study methodology. Case study methodology is a research strategy that examines only a few strategically selected cases in a holistic, open-end way while looking for patterns (Creswell, 2003; MacPherson et al., 2000; Neuman, 2006; Stake, 1995; Verchuren, 2003). It is an effective tool for exploring the why and how of research questions by providing thick description. The collective case studies methodology uses multiple cases in order to explore one concept while instrumental case study methodology examines one case that is essential to understanding a particular social concept (Neuman, 2006; Stake, 1995).

As the primary researcher, I analyzed leading green museums using collective instrumental case study methodology in order to explore green exhibitions. A holistic approach gave me a thorough understanding of each institution and its programming. It also revealed the patterns, structures, and processes inherent in the data which allowed me to compare the case studies. Collective instrumental case study methodology allowed me to compare and contrast three institutions that have various forms of sustainable practices and green exhibits.

I used triangulation of methods to gather data for the study. Triangulation means to employ multiple research methods to collect information, giving the study appropriate

focus and purpose, thus increasing validity (MacPherson et al., 2000; Neuman, 2006). In each case study, I visited the site and conducted an in-person interview with a key informant on staff and documented it with an audio recording. We continued the dialogue during a personalized tour of the museum and its operations that highlighted green features and practices. During the tour, I recorded on-site observations through photography. Finally, the key informant provided related unpublished documents that circulated internally within the organization. I obtained additional case study data through documents such as websites, marketing materials, press releases, and 990 tax forms (organizations exempt from taxes report to the U.S. Internal Revenue Service using 990 forms (Children's Museum of Pittsburgh (CMP), 2007a; Oregon Museum of Science and Industry (OMSI), 2007a; Phipps Conservatory and Botanical Gardens Inc., 2007).

2.09 Selection of Participants

In order to choose instrumental cases, I used purposive sampling. Neuman (2006) describes purposive sampling as a nonrandom sampling method where the researcher uses his or her judgment to select cases that are especially informative subjects. Through the initial literature review, I identified potential case studies that would provide the best information on green museums. Then, I limited my case studies to three institutions that I could obtain access and willing participants: The Oregon Museum of Science and Industry (OMSI) in Portland, OR, The Phipps Conservatory and Botanical Gardens (Phipps) in Pittsburgh, PA, and the Children's Museum of Pittsburgh (CMP).

A fourth institution was initially included as a case study, the Senator John Heinz History Center in Pittsburgh. I was unable to attend the interview and site observation

because of illness. Due to time and resources, I was unable to reschedule the interview with the institution. However, I determined that the OMSI, Phipps, and CMP case studies were strong enough to eliminate the Heinz History Center from participation in the study.

2.10 Delimitations

Creswell (2003) describes delimitations as factors that narrow the scope of a study. Many of the study's delimitations are a result of the lack of time and resources available to masters-level graduate research. Additionally, I narrowed the scope of the research by focusing on specific museums as case studies. I chose to limit my case studies to science, nature, history, and children's museums because environmental change is usually seen as a scientific or societal issue, (Barrett & Sutter, 2006; Center for Naval Analysis Corporation, 2007). Although sustainability is not directly related to the mission of art museums, some art organizations do use green practices (Bernstein, 2007; Brophy & Wylie, 2006; Brophy & Wylie, 2008; Worts, 2001; Worts, 2003; Wylie & Brophy, 2008; Zipp, 2008). However, I wanted to understand how museums were using their educational potential to teach the public about sustainability. Based on information from my literature review, I determined that OMSI, Phipps, and CMP would provide excellent learning opportunities among the natural history, science, cultural, historical, and children's museums in the United States. Focusing on institutions in two cities narrowed the scope of the study further.

2.11 Recruitment + Consent Forms

Recruitment instruments allowed me to gauge human subjects' interest and to confirm their participation in the study. They informed participants about the research topic, data collection methods, anticipated findings, and the nature of participants' contribution. Subjects were recruited by email. OMSI, Phipps, and CMP volunteered to participate because they are passionate about their sustainable practices and wish to promote the green museum movement

All subjects were required to sign an informed consent agreement. Informed consent described the rights of the participant and the nature of involvement. By signing the forms, subjects agreed that information gathered during interviews was non-confidential and allowed their names to be connected to the information provided. The forms acknowledged that participation in this study is voluntary and can be terminated at any time without penalty. Informants from case study institutions were chosen based on their professional experience and relevance to the study regardless of gender, race, income, ethnicity, etc.

2.12 Data Collection Instruments, Coding + Analysis Procedures

I collected research data through interviews, on-site observations, and document analysis. I documented interviews through note-taking and audio recording. I recorded on-site observation through note-taking and photography. During data analysis, I looked for reoccurring patterns and themes. I organized and recorded this information under guidance of a coding system. Keywords of the research codebook included: sustainability; museum roles and characteristics; museum missions; museum

sustainability; exhibit roles and characteristics; green exhibits; exhibit materials; education; and marketing. From these patterns, I developed conclusions and recommendations. I saved all digital data on my computer's hard drive with external drive backup while storing all physical data in a file cabinet. I will keep the collected data indefinitely for the purposes of future educational reference and documenting career development.

2.13 Strategies for Validating Findings

I used a multi-instrumental approach to establish the trustworthiness of the research. Triangulation of methods provides layered, rich data from multiple sources. It gives the study grounded theory and thick description, thus increasing its transferability, or usefulness (Creswell, 2003; Neuman, 2006). Triangulation of methods allowed me to collect a variety of data, giving the study referential adequacy with a well-developed body of research (Lincoln & Guba, 1985).

Review by my research advisors and peers increased the credibility of this master's research project, or the extent to which the data, analysis, and findings are believable and trustworthy (Creswell, 2003; Lincoln & Guba, 1985; Neuman, 2006). First, I used peer debriefing to discuss data and findings with research advisors, cohorts, and key informants. Additionally, terminal member checks were conducted to allow human subjects to confirm facts and quotations given during interviews.

2.14 Limitations

According to Creswell (2003), limitations identify potential weaknesses of the study. Due to the qualitative nature of this study, external validity is a research limitation. While its findings are valuable, they are not generalizable. The Greening Guidelines are meant as a reference, not a prescription, for other museums.

Literature exploring the issues surrounding green exhibits has roots in the intersection of museology and environmental studies. Both academic fields are rapidly evolving. The museum field continuously redefines its standards of practice based on professional research and creativity. In environmental studies, scientific and technological advances bring about new knowledge and innovative methods of inquiry. Based on the progressive nature of these disciplines, findings of this study are time-specific. Therefore, longevity of the relevance of this study is limited. However, findings are intended to be built upon with future research from the field.

Finally, I must recognize my own inherent bias as the primary researcher. In my analysis, I examined the information through the lens of an emerging museum professional who believes that sustainability can improve the poor condition of environmental and social systems. My opinions have narrowed the scope of this study.

2.15 Benefits of the Study

Current literature offers a wide scope of information about climate change, environmental degradation, sustainability, museum administration, green museums, and the design of exhibitions. However, there is little scholarship on green exhibits

themselves. This study is significant because it will provide museum professionals with practical information about green exhibits.

The study offers benefits to its case study participants. Subjects had opportunity to evaluate their green practices during consultation. Also, participants can learn from one another's case studies within the research. As the primary researcher, I have benefited because I would like to use sustainable practices green exhibit design in my future career as an museum professional.

Finally, this study benefits human kind in general. It is hoped that indirect consequences will help to bring about a healthy, sustainable future for human beings and the planet Earth.



Chapter three

literature review

3.01 Introduction

This study uses a literature review to gain insight into the green museum movement. I focused on several themes to provide an in-depth overview of the phenomena. In order to understand how museums are applying sustainability to their operations and exhibits, I first had to identify what sustainability means. Therefore, I investigated several sustainability concepts including green design. Then, I examined the roles and characteristics of museums in order to understand how sustainability can be applied to museum administration. This informed a synthesis of existing green museum literature. Finally, I used a similar formula to investigate the roles and characteristics of exhibitions in order to understand how exhibits can be green in their content and design.

3.02 Definitions of Sustainability

Sustainability is a broad term that has many meanings. Scholars offer sustainability as a solution to the current environmental crisis, but they do not agree on an exact definition of the word (Barrett & Sutter, 2006; Center for Naval Analysis Corporation, 2007; Hawkes, 2001; IPCC, 2007; Link, 2006; McDonough & Braungart, 2002; Mendler & Odell, 2000; Seattle Times new services, 2007; World Commission on Environment and Development, 1987; Worts, 2006). This research relies on the following concepts common to most understandings of sustainability: human individual and collective behaviors affect and are affected by the Earth; the current human lifestyle cannot be maintained given the Earth's limitations; and humans need to change their behaviors in order to sustain the health of the planet and all its inhabitants. In this research project, I use "green" and "sustainable" interchangeably.

In Western culture, sustainability has permeated mainstream consciousness. (Brophy & Wylie, 2008; Mendler & Odell, 2000; Worts, 2006). “Sustainability” and “green” have become buzzwords (Brophy & Wylie, 2008). At the same time, “greenwashing” has become part of the vernacular. Brophy & Wylie (2008) say, “greenwashing (adapted from whitewashing) means exaggerating green properties or arbitrarily selecting the green aspects and ignoring the non-green aspects” (p. 8). Green museums are responsible for the ways they incorporate sustainability into their administrations. They risk their reputations if they are involved in greenwashing (Brophy & Wylie, 2008). Therefore, it is important to have a solid understanding of sustainability in order to responsibly apply it to museum administration.

Brundtland Definition

Scholars frequently cite the definition of sustainability developed by the United Nations Brundtland Commission, also known as the World Commission on Environment and Development (Link, 2006; World Commission on Environment and Development, 1987; Worts, 2006). In 1987, the Brundtland Commission met to address the deterioration of the human and natural environment. From its hearings, there came recognition that a global effort is necessary to address environmental problems. Its report, *Our Common Future*, defined sustainability as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development, 1987).

The Brundtland Commission definition provides a base for understanding sustainability. The definition suggests that human populations are interconnected through

time and that the quality of life of the people of tomorrow is just as important as the life of people today. It recognizes that planning and foresight are important components to sustainability (World Commission on Environment and Development, 1987). However, it does not suggest how individuals are supposed to act to achieve sustainability (Worts, 2006).

The Three Tenets of Sustainability

The Brundtland Commission also puts forth the idea that sustainability could be achieved when three intersecting spheres of activity—environment, society, and economy—are appropriately balanced (World Commission on Environment and Development, 1987). Scholars have addressed the three areas of sustainability in subsequent literature calling them spheres, tenets, or pillars (I will refer to them as the three tenets of sustainability) (Hawkes, 2001; Link, 2006; Worts, 2006). Link (2006) describes said the three spheres of sustainability are unequal and that the economy and society are wholly-owned subsidiaries of the environment. Without the environment providing a healthy and sound life-support system, humans will cease to exist, making social and economic systems irrelevant (Link, 2006). Another theory describes the environment, society, and economy as pillars of sustainability, while adding culture as the fourth pillar (Hawkes, 2001). Having culture as the fourth pillar of sustainability asserts that cultural vitality is just as important to a sustainable society as environmental responsibility, social equity, and economic viability. This view defines culture as the creation and transmission of human values, beliefs, and purpose of life. At the same time,

there is a recognition that culture refers to arts and heritage, the muses of museums (Hawkes, 2001).

Some scholars call the three tenets of sustainability the “triple bottom line,” especially when applying them to organizational operations (Hawkes, 2001; McDonough & Braungart, 2002). In Western culture, the economic sphere dominates. Western society is built on self-interest where success is determined by what one owns and can buy. The dominance of the economic sphere materializes in Western business practices (Link, 2006; McDonough & Braungart, 2002). Businesses often focus on financial gain, leaving social and ecological considerations as an afterthought. McDonough & Braungart (2002) argue that the theory should be called the “triple top line.” The triple top line addresses ecology, equity, and economic considerations equally at the outset (McDonough & Braungart, 2002).

The societal attitude toward the economy and consumption illustrates an unconsciousness regarding world relationships (Worts, 2004). In this mind frame, decisions are based on short term gains without recognition of consequences to those outside the immediate decisions in place or time. “This dominance of the economic sphere essentially shifts the environmental and social costs onto others, usually those with less political or economic power” (Link, 2006, p. 176). Also, it shifts costs onto future generations in what has been called “generational tyranny” (Link, 2006). This attitude needs to change in order to create a sustainable society.

Sustainable Design

For the purposes of this research, it is important to understand sustainable design in order to responsibly apply it to exhibit fabrication. Sustainable design uses systems thinking (McDonough & Braungart, 2002; Mendler & Odell, 2000; Sutter, 2006). In a system, components are closely linked and cannot be managed in isolation from one another (Sutter, 2006). The Earth is a large, closed-loop system where no new material is added or subtracted to the mass of the planet. Materials may change form, but they never leave the system. Therefore, we never throw trash away, because there is no real “away.” It is just stored somewhere else in the system (McDonough & Braungart, 2002).

Mendler & Odell (2000) employs systems thinking in their definition of sustainable design saying, “sustainable design moves away from extractive and disposable systems that are energy intensive, resource inefficient, and toxic toward cyclical, closed-loop systems that are restorative, dynamic, and flexible” (p. 2). Sustainable design demands that every material and process be questioned from the perspective of their impact on ecological and human health. See figure 3.01 for characteristics of sustainable design.

Figure 3.01

Sustainable Design Characteristics*	
- Reduction of environmental impacts	- Use of environmentally preferable building materials
- Reduction of waste + pollution	- Recycling in construction, use, + demolition
- Efficient resource use	- Design for longevity
- Conservation of water + energy	

** This list is not exhaustive, but demonstrates possible characteristics*

Green Buildings

Green buildings employ sustainable design (Mendler & Odell, 2000; United States Green Building Council [USGBC], 2008). In the U.S., about one-third of all energy is consumed to heat, cool, light, and run appliances in the built environment (USGBC, 2008). Green buildings conserve natural resources and energy through the efficient and intelligent use of energy, water, materials, and building site. They incorporate nature into their design and use daylight for illumination. Sustainable design enhances indoor air quality through efficient ventilation and using lower toxicity materials. The indoor environment affects the productivity and health of human occupants through the quality of its air, lighting, temperature, and acoustics (Brohpy & Wylie, 2008; Cascadia Region Green Building Council, 2008; Mendler & Odell, 2000; USGBC, 2008).

Sustainable design does not have to look much different from or cost much more than traditional design (Matthiessen & Morris, 2007; Mendler & Odell, 2000). Davis Langdon's 2004 and 2006 studies found that there is no significant difference in average costs for green buildings compared to non-green buildings. Financial savings are greatest when sustainable design is integrated from the beginning. Even when upfront costs are higher, they are offset by the building's lifetime operating costs savings. The health and productivity benefits of human inhabitants of green buildings have been proven but are difficult to quantify (Matthiessen & Morris, 2007). The cost of green is decreasing and will continue to decrease as demand rises (Brohpy & Wylie, 2006; Matthiessen & Morris, 2007).

In order to develop good practices for sustainable design building projects, the U.S. Green Building Council (USGBC) was formed by a consortium of building owners, suppliers, contractors, governmental agencies, architects, engineers, and others in 1993 (Brohpy & Wylie, 2008; USGBC, 2008). USGBC promotes mainstream change in the building industry toward sustainability through the creation and implementation of performance criteria. It created the Leadership in Energy and Environmental Design (LEED), a rating system that guides the green building process. LEED addresses performance in five key areas related to human and environmental health: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality. It also recognizes buildings for their innovation and design, including providing for an educational component. The LEED rating system has levels of green building that qualifies buildings for Platinum certification at the top, followed by Gold, Silver, Bronze, and Certified, the minimum level (Brohpy & Wylie, 2008; Mendler & Odell, 2000; USGBC, 2008).

The number of LEED-certified buildings is growing rapidly and museums are part of this trend (Brohpy & Wylie, 2008; USGBC, 2008). When LEED first defined requirements for platinum certification, they were thought of as the highest environmental performance possible. Now, green buildings are easily meeting and going beyond platinum-level requirements. In response, the Cascadia Region Green Building Council, based in Oregon, Washington, and British Columbia, has issued the “Living Building Challenge.” The Living Building Challenge attempts to raise the bar of green design and define the highest level of sustainability in the built environment. Its six performance areas are similar to those of LEED: site, energy, water, materials, indoor

quality, and beauty and inspiration. However, Living Building projects go beyond LEED platinum by encouraging buildings to generate their own energy using renewable resources and to capture and treat all their water on site. As of December 2008, no one building has met all requirements of the Living Building Challenge (Cascadia Region Green Building Council, 2008).

Cradle to Cradle Design

One theory related to sustainable design that may be appropriate for exhibits is Cradle to Cradle Design. Developed by McDonough & Braungart (2002), cradle to cradle design asserts that waste can be eliminated by design. The current industrial infrastructure is linear where products are designed for a lifetime with a definite end. This is a cradle to grave model where resources are extracted, shaped into products, sold, and eventually disposed of in a “grave” of some kind, usually a landfill or incinerator. Conversely, using cradle to cradle design, products have a continuous lifetime. The material’s use beyond the immediate need is considered during the design process (McDonough & Braungart, 2002).

McDonough & Braungart (2002) point out the flaws inherent in the traditional conservation paradigm of “Reduce, Reuse, Recycle,” or the “Three R’s.” Reduction only slows depletion and destruction, allowing them to take place in smaller increments over a longer period of time. Reusing materials transfers any toxins and contaminants that they may contain to another place. The authors refer to recycling as “downcycling,” saying that the recycling process reduces the quality of a material over time because it forces materials into more lifetimes than their original design intended. Recycling is often

expensive and can add toxic chemicals to materials so they can be used again (McDonough & Braungart, 2002).

Cradle to cradle design offers an alternative to the three R's. The paradigm asserts that in order to properly reuse and recycle, materials must be divided into two separate closed-loop systems—the biological system and the technical system. Biological materials circulate within the biological system while industrial materials move within the technical system. By keeping the systems separate, their materials stay pure and therefore can be reused and recycled without losing quality. In these closed-loop systems, waste is nonexistent. An industrial material that is no longer useful will feed the creation of a new industrial material. The same is true for biological waste. Using cradle to cradle design, materials do not have an end to their lifetime; instead, they constantly circulate within a closed system (McDonough & Braungart, 2002).

3.03 Museum Roles + Characteristics

The complexity of sustainability presents an opportunity to examine it in terms of the context in which it is used. If it is thoughtfully and responsibly molded, the definition of sustainability can provide guidance for decision-making and action. Therefore, the museum field must ask itself, “what does sustainability mean for museums?” In order to answer that question, the institutional purpose, roles, and characteristics of museums must be examined.

Museums Belong to Humanity

There are many museums around the world (AAM, 2008, Weil, 1995). Museums are diverse in their size and function, but they do have some universal characteristics. Most museums accredited by the American Association of Museums (AAM) are legally nonprofit institutions, but others are private or governmental. As nonprofit institutions, museums receive public money. In exchange, they belong to and provide a social service for the citizenry at large (AAM, 2008; Gurian, 1999). Museums are under the direction of their communities, governed by board of unpaid, lay citizens (Skramstad, 1999). The public generally regards museums as institutions of authority and keepers of the truth (Gurian, 1999). In order for museums to deserve this public credibility, museums have the responsibility to follow a high standard of ethical conduct. Museums carefully craft mission statements to guide decisions to adhere to their higher purpose of public service (AAM, 2008; Scheiner, 1997; Sullivan, 1994).

Museums take on the duty to acquire, preserve, study, display, and interpret objects of importance to human society in perpetuity (AAM, 2008; Gurian, 1999). AAM says the one characteristic that all museums share is that they provide a “unique contribution to the public by collecting, preserving, and interpreting the things of this world” (AAM, 2008). Museums have collections in various fields including art, anthropology, natural history, history, nature, science, and technology. Museums also include institutions with living collections such as aquariums, arboreta, botanical gardens, and zoos. Other museums do not have collections such as planetariums, children’s museums, and some science and technology centers (AAM, 2008, McLean, 1993).

Museums are Educators

Education is a primary goal of museums, giving meaning to objects and collections. Museums use their collections and knowledge to produce educational exhibitions and programs (American Association of Museums (AAM), 1992). “In the new world of the new century, the authority that a museum claims will be built not primarily through its collections nor on its specialized expertise, but through those resources engaged in conversation and dialogue with those audiences the museum serves” (Skramstad, 1999, p. 131). Museums are centers of informal education where learning occurs outside the school classroom. It is experiential, participatory education that addresses a variety of learning styles. Museum education is hands-on and designed to stimulate all the senses by working with real objects of art, history, and science. The real and authentic objects, stories, and people of a museum experience resonate with visitors and provide an engaging learning experience (Gurian, 1999; Munley, 1999; Skramstad, 1999).

Museum education is usually a social experience. It is not limited to the younger years; adults, senior citizens, or those with special needs can enjoy museum education. Museums attract a broad and diverse audience that includes tourists and local citizens. They can be a place where families learn together or where two strangers have a conversation (Gurian, 1999; McLean, 1993; Munley, 1999; Skramstad, 1999). “The museum is a place for tactile, emotional, and intellectual contact with people, ideas, or objects that have the potential to inspire. It is a place where people can meet and make friendships with others who share similar interests or where they can be a part of something larger and more important than their own individual lives” (Skramstad, 1999,

p. 126). At the same time, a visit to a museum can be a solitary, personal experience. Museums provide inspirational spaces for quiet reflection on higher, more abstract questions. In their best form, museums provide powerful and transformative educational experiences (Skramstad, 1999).

Museums are Forums of Civic Engagement

The museum field is self-reflective and committed to excellence. Museum professionals have questioned in what roles would museums most relevant in the twenty-first century (AAM, 1992; Gurian, 1999; Munley, 1999; Skramstad, 1999; Weil, 1990; Weil, 1995; Worts, 2003). Museums need to be worth their monetary costs during a time when the American economy is unstable and when there is steep competition for public funds (Weil, 1995). For museums to be relevant in contemporary society, they need to create mechanisms for relating to the public in meaningful ways (Worts, 2003). Some scholars suggest that museums can be most relevant as community centers, forums for dialogue, and catalysts for change (Gurian, 1999; Munley, 1999; Skramstad, 1999).

Museums that are community forums provide space to debate the major social, political, and moral issues of our time. Museums are in a unique position to address complex issues in a non-threatening way through their programs and exhibitions that combine education, entertainment, and inspiration (Gurian, 1999; Munley, 1999; Ševčenko & Russell-Ciardi, 2008; Skramstad, 1999; Weil, 1990). “Museums need not steer completely clear of today’s complex and difficult social issues. In fact, if they do, it will be to their peril. Through exhibits, programs, and community partnerships, museums can provoke discussion and actively participate in projects that strive to achieve goals

related to literacy, cultural understanding, and sustaining our natural environment” (Munley, 1999, p. 247). Museums can provide an educational experience that fosters the ability to live productively in a pluralistic society and to contribute to the understanding of challenges faced by the global citizenry (AAM, 1992; Gurian, 1999; Munley, 1999; Skramstad, 1999).

Recently, scholars have described the forum role of museums as civic engagement (Munley, 1999; Ševčenko & Russell-Ciardi, 2008). Civic engagement refers to public dialogue and collaboration on complex and multidimensional issues of concern to local and global communities. Through civic engagement, museums act as safe places where people who would not normally meet can interact. Museums can serve as moderators and improve the quality of conversation on critical civic issues, in that they collect and transmit multiple viewpoints and, when appropriate, provide a voice of reason and authority (AAM, 1992; Gurian, 1999; Munley, 1999; Ševčenko & Russell-Ciardi, 2008; Skramstad, 1999).

Museums fulfill their mission of public service by listening to community interests and needs. When museums become forums for civic engagement, they actively engage and deepen connections with and among their visitors. Then, they can learn to better serve their constituents and work to improve their communities. Museums can build relationships among community stakeholders and encourage pride and participation in community life and in the museum itself (AAM, 1992; Gurian, 1999; Munley, 1999; Skramstad, 1999).

Museums Create + Transmit Culture

Despite the possibilities that lie in the function of museums as civic forums, the field tends to avoid complex, political issues (Gurian, 1999; Ševčenko & Russell-Ciardi, 2008; Skramstad, 1999; Sullivan, 1994). When involved in politics, museum professionals face legitimate concerns about the survival of their institutions and their jobs. If controversy rises, they could lose board and staff support and cost their museums public visitation and funding (Ševčenko & Russell-Ciardi, 2008). While museums often claim to be value-neutral and nonpolitical, in practice they reflect and shape their community's knowledge, beliefs, and values. Museums define for their societies what is transcendent and valuable through the selection and preservation of artifacts, specimens, and documents. Through the exhibition and interpretation of objects, museums present and create history and meaning (Gurian, 1999; Skramstad, 1999; Sullivan, 1994).

Museums are often subject to criticism and controversy because they reflect and create cultural identity. American society is not homogenous, but pluralistic and filled with diverse people, ideas, attitudes, and values. A museum cannot possibly represent all people and viewpoints. Therefore, staff must make decisions on what to collect, what to exhibit, and how to interpret it. Personal, institutional, and community knowledge, beliefs, and values affect these decisions (Skramstad, 1999; Sullivan, 1994). Therefore, it is important that a museum communicates and enforces its mission so that decisions of its staff reflect institutional values (Gurian, 1999; Skramstad, 1999; Sullivan, 1994).

Museums are institutions of authority that shape and transmit culture, giving meaning and value to people's personal and collective lives. Museum education can lead visitors to make a connection between new knowledge and their own lives (Skramstad,

1999). Through a combination of education and encouragement, museums have the ability to stir the public to contemplate and occasionally to act (Gurian, 1999).

3.04 Museum Sustainability

Before the green museum movement, sustainability in the museum field meant financial stability. Douglas Worts (2006) said that the use of sustainability to refer to the maintenance of status quo is highjacking of the word. He argued that sustainability implies a significant change. Humans must change their beliefs, values, and behaviors at the cultural level in order to adapt to the challenges required for a sustainable world. As cultural institutions, museums can play a vital role in facilitating this change. Worts said that museums can help develop a “culture of sustainability” (1998; 2003; 2004; 2006).

Culture is the values, beliefs, history, rituals, symbolic objects, and built heritage which reflect the aspects of life which people can know and control and which people cannot fully understand or control, but to which they need to have a conscious relationship (Worts, 2004). In short, culture is the collection of values, beliefs, and behaviors of a given human population. Culture defines the way humans understand the world and what they believe about sustainability. “Our values, beliefs, and attitudes shape the way that we define and use nature” (Scarpino, 2004, p. 147). In order to achieve sustainability, human attitudes and behaviors need to reflect the interconnection between human populations, the natural environment, and the future. In a culture of sustainability, every citizen and human community takes responsibility for his or her affect on the environment (Worts, 1998; Worts, 2003; Worts, 2004; Worts, 2006). This requires change in human culture.

Many of museums roles and characteristics position them to be facilitators of the change that leads to a culture of sustainability. First, museums preserve and transmit patrimony, or objects in a museum's collection, in perpetuity. To museums, the natural environment is patrimony and worthy of conservation (Scheiner, 1997). "Behaving ethically toward the environment would signify, for the museum community, a commitment to all things that have a value for humanity. Humanity itself, life on Earth, and the health of the planet are this generation's common patrimony and the heritage of future generations" (Scheiner, 1997, p. 186). A culture of sustainability represents an individual and collective commitment to recognize the value of humanity's common natural and cultural heritage (De Varine, 2006). If the current unsustainable lifestyle persists, the future of the planet and the human race is in jeopardy. Without a future, museum's mission of preservation is moot (De Varine, 2006; Scheiner, 1997).

Museums are not only collectors but educators of the public. Humans need to understand sustainability in more than intellectual arguments. They need to use their senses, emotions, spirituality, as well as their intellect, in order to fully comprehend their role in the future of the planet. People need to feel both empowered and responsible for achieving sustainability (Worts, 2003). Museum educational programs and exhibits have the ability to communicate sustainability with a broad audience in meaningful ways (Barrett & Sutter, 2006; Scheiner, 1997; Sullivan, 1994; Sutter, 2006; Worts, 1998; Worts, 2003; Worts, 2004; Worts, 2006). "As educational institutions, we are necessarily agents of change, not only changing the knowledge, beliefs, attitudes, and feelings of our individual visitors but also affecting the moral ecology of the communities that we serve" (Sullivan, 1994, p. 257). In order for museums to accomplish this, they need to have an

active relationship with their communities (Scheiner, 1997). Museums that use their role as community forums to reach out to their constituents are agencies of civic engagement. The complexity of sustainability makes it an excellent topic to explore and debate in a community forum. Additionally, museums can use their collections and programming to teach about sustainability. Museums can help awaken people as citizens by showing how every day choices impact the Earth and the future. They can help us to understand how the environment, humanity, and economy interact with one another (Link, 2006).

In their role as institutions of authority, museums have the power and the responsibility to model methods of preserving the planet and its inhabitants. As ethical institutions, museums have a moral responsibility to teach new perceptions about the environment (Scheiner, 1997). Scholars say that contributing to a culture of sustainability is an opportunity for museums to be relevant in the twenty-first century (Worts, 2003). “In a world where humankind, the environment, and sustainable development are a focal point for international policies, not only in the economic field but also in the field of culture, it is vital to revise the roles and responsibilities of museum professionals and to formulate a new image for the profession (Scheiner, 1997, p. 180). Putting sustainability in practice can lead to thoughtful, proactive museum work (Link, 2006; Scheiner, 1997; Worts, 1998; Worts, 2003; Worts, 2006).

3.05 Green Museums

Green museums are part of the solution to deterioration of the global environment while they advance their missions, engage their communities, and are socially responsible. There are many ways museums can be green. Some museum practices are

already green. For example, some common collection care procedures are green, such as using storage materials that contain low or zero volatile organic compounds (VOCs) and using efficient ventilation strategies (Brophy & Wylie, 2008). The first step green museums should take is recognizing what sustainable practices it already does. Then, museums implement new green efforts. See figure 3.02 for ways museums can incorporate sustainable practices into their operations (Brophy & Wylie, 2006; Brophy & Wylie, 2008; De Varine, 2006; Link, 2006; Sutter, 2006; Worts, 2003; Worts, 2004; Worts, 2006; Wylie & Brophy, 2008).

Figure 3.02

Green Museum Practices*	
<ul style="list-style-type: none"> - Energy efficiency - Efficient HVAC systems - Recycling - Reduce resource use - Reuse materials - Efficient waste stream - Composting - Green food service in café - Green gift shop purchases - Energy-Star appliances - Green architecture & technologies 	<ul style="list-style-type: none"> - Green office supplies - Green cleaning products - CFL & LED lighting - Natural lighting - Water efficient bathroom fixtures - Native landscaping - Green roofs & walls - Historic preservation - Encourage green transportation - Green education - Green Exhibits

** This list is not exhaustive, but demonstrates possible characteristics*

Museums' missions will determine what green practices are used, interpreted for visitors, and to what extent. Scholars suggest that sustainability is a natural extension of museum missions (Brophy & Wylie, 2006; Brophy & Wylie, 2008; Wylie & Brophy, 2008). Some museums choose to make sustainability a central part of their identity, writing their commitment to being green in their mission statements. The prevailing opinion is that environmental issues are relevant for only science or natural history museums. It is easy to connect environmental sustainability to the missions of museums

with living collections and museums with nonliving collections that educate about the Earth. With these institutions, going green is motivated by the desire to “walk the talk” (Brophy & Wylie, 2006; Brophy & Wylie, 2008; Wylie & Brophy, 2008).

However, museum of all types are finding that sustainability aligns with their missions by engaging their communities and encouraging sustainable values (Bernstein, 2007; Brophy & Wylie, 2006; Brophy & Wylie, 2008; Worts, 2003; Worts, 2006; Wylie & Brophy, 2008; Zipp, 2008). “Museums can play a critical role in moving the communities they serve towards a more sustainable future. Aligning their missions and programs with sustainability principles... ..will recalibrate their own daily practices as well as awaken their community to the array of choices perhaps otherwise invisible to them” (p. 183, Link, 2006). Additionally, green operational practices will save money on utility bills and other overhead costs, providing more resources for programming (Brophy & Wylie, 2006; Brophy & Wylie, 2008; Wylie & Brophy, 2008).

When museums align their mission with sustainability, they change practices associated with facilities management. Museums have a larger ecological footprint than conventional office buildings (Brophy & Wylie, 2006; Brophy & Wylie, 2008). Museums are often composed of large rooms with high ceilings that demand a lot of energy to heat and cool. Additionally, museum exhibits consume energy through their lighting and mechanical systems. “Museums are notoriously heavy energy consumers, using more than twice as much as conventional office buildings” (Brophy & Wylie, 2006, p. 39).

Museums consume a large amount of energy and resources in order to create proper conditions to store and preserve collections. Collections of art, natural history, history, and science require continuous and rigorous climate control. Therefore, heating,

ventilation, and air condition systems (HVAC) are always running, consuming energy. Additionally, museum collections must be protected from light to avoid excess ultraviolet radiation. To do this, museums are often windowless buildings that require artificial lighting at all times of the day. Museum organizations that have living collections such as zoos, aquariums, and botanical gardens require an enormous amount of water, electricity, and other resources to keep their collections healthy and alive (Brophy & Wylie, 2008). Using sustainable facilities management practices reduces resource consumption and makes the indoor museum environment safe and healthy for objects, staff, and visitors (Brophy & Wylie, 2008; Mendler & Odell, 2000).

Many green museums develop a policy to direct their operational efforts in environmental sustainability. A sustainability policy guides decision making, much like a museum mission does. It articulates the museum's commitment to sustainability and determines priorities and goals, delegates authority, and identifies evaluation methods. Policy development and implementation requires participation by the board, staff leadership, and employees from across museum departments (Brophy & Wylie, 2008). It is important for staff and volunteers to understand and be dedicated to a museum's green practices. Therefore, museums must effectively communicate their expectations sustainable professional behavior. Some museums hire an additional position dedicated solely to initiating and implementing green practices (Brophy & Wylie, 2008).

Another way museums establish sustainability in their operations is by forming a "green team." Green teams are composed of motivated employees who volunteer to promote sustainable choices within their organization. They are responsible for

developing and communicating green practices among the staff. Museums and businesses from across disciplines have had success using green teams (Brophy & Wylie, 2008).

Sometimes, it takes just one compassionate staff member to push a museum into the green museum movement. The first step towards sustainability is often establishing a recycling and composting program (Brophy & Wylie, 2008). These programs can be initiated by one employee who offers to take home recyclables and food scraps from the staff break room. Recycling is an eco-friendly habit that many Americans do at home and they expect to continue that habit at their places of employment. Museums are usually happy to initiate a recycling program because it is familiar practice and success is likely. There is a wealth of information on recycling, plus it is easy to monitor and evaluate. Additionally, recycling and composting divert waste from the dumpster, reducing the cost to haul trash away. Some vendors buy recyclables, allowing museums nationwide to earn income as collection sites for recyclables from their communities (Brophy & Wylie, 2008).

Museums can experience benefits by going green (Brophy & Wylie, 2006; Brophy & Wylie, 2008; Sutter, 2006; Worts, 2006; Wylie & Brophy, 2008). Benefits include financial savings; increasing public trust; engaging communities; attracting new audience members; gaining a competitive advantage; developing a reputation for innovation; and positively impacting the environment. “The benefits can be both immediate, as in increased attendance, and intangible, as in connecting to a deepening ecoconsciousness among the young people who are our future audience and supporters. In the current state of green public awareness, environmental sustainability can brand museums as trusted educators leading by example” (Wylie & Brophy, 2008, p. 45).

However, most conventional museums are not engaged in sustainable practices, despite the benefits they might incur for their institutions and their local communities (Sutter, 2006).

3.06 Exhibit Roles + Characteristics

Exhibitions are a common feature that all museums share (AAM, 2008; McLean, 1993). They are the most prominent and public of museum offerings. Exhibitions are the essence of the museum experience because they are the reason most visitors go to museums. Museums devote a great proportion of their money, staff, time, and other resources on exhibits (McLean, 1999).

There are several types of exhibits. The word “exhibition” refers to a display containing multiple components; an “exhibit” is single-component display. However, “exhibit” is often used interchangeably with “exhibition,” and will be in this research. A permanent exhibit is an installation that covers a topic essential to the museum and its collections, and is designed to last five to ten years or longer. Temporary exhibitions are designed to be open for weeks or months and require less development and resources. Temporary exhibits provide a venue for current events, new discoveries, topics of special interest, experimentation, or to showcase collections normally hidden in storage. Sometimes museums rent temporary exhibits from other institutions; these are often called traveling exhibits. Blockbusters are large-scale, expensive temporary exhibitions designed to attract big crowds and media attention (McLean, 1993; McLean, 1999).

The earliest manifestation of an exhibit was an object under glass with a simple identification label. These exhibits were one-way conversations where the museum held

the authority and explained the unquestionable truth to passive visitors (McLean, 1993; McLean, 1999). Since then, exhibits have evolved. Today, visitors are no longer passive spectators, but active participants. Exhibitions are filled with multimedia, technology, conversational labels, and hands-on objects. (McLean, 1993; McLean, 1999; Weil, 1990).

Exhibits are Object-Based

There are many different types of exhibits—dioramas, period rooms, immersive environments, online exhibits—that cover a variety of subjects such as art, history, science, and technology. Kathleen McLean (1993) said there are three principles that all museum exhibitions share: their main function is to show things; they are a medium of communication; and they are experiences, not products. First, exhibitions show things, namely objects from a museum's collection. Exhibits are object-based learning experiences that use physical objects to illustrate intangible things such as ideas, principles, information, or phenomena.

Exhibits are Mediums of Communication

Through the display and interpretation of objects and ideas, exhibitions are a medium of communication between the museum and visitors (Gurian, 1999; McLean, 1993; McLean, 1999). Exhibits express not just facts and information, but also feelings, and values. The communication is more than just a passive transmission of knowledge. Through exhibitions, museums hope to present experiences that inspire, enthrall, and awe. They try to tap into the emotional range of the visitor and try better the individual,

the community, and the world. Exhibits are modes of communication that try to make transcendental experiences happen (McLean, 1993; Weil, 1990).

Exhibits are three-dimensional mediums of visual and aesthetic expression. “In addition to words, communication takes place through every aspect of the designed environment. How an exhibition smells, sounds, and feels may be just as important as how it looks, or what it says” (McLean, 1993, p. 17). Exhibits use photography, illustrations, and graphics to fully explore a subject. Other, less obvious design considerations have powerful communication abilities. Color can conjure associations with places, things, and emotions. The use of space can convey feelings, like constraint or freedom, and show connections among ideas and objects. Exhibit text communicates not only with words, but with the size of letters and the style of font. Additionally, exhibits speak with sounds, whether it is music, human conversation, or sounds of nature, the city, or machinery. These design considerations and others help to make exhibits experiences (McLean, 1993).

Exhibitions are Experiences

Exhibitions are experiences, not products. They are visual, auditory, tactile, social, and kinesthetic experiences. What visitors do and feel in an exhibit is just as important as what they learn. Sometimes an activity or a feeling is the most memorable part of an exhibit (McLean, 1993). The social experience is a significant aspect of exhibitions and museums. Exhibits are public space and provide an engaging environment where people interact. They entice people to share values and insights (Gurian, 1999; McLean, 1993; McLean, 1999). “Even without staff, an exhibition

designed to encourage face-to-face interaction and dialogue among visitors—often strangers—is arguably one of the most vital contributions museums can make to the social dynamics of our times” (McLean, 1999, p. 197). Exhibits intend to stimulate thought and discussion.

Exhibitions are a medium for a museum’s efforts in civic engagement. “The public nature of exhibitions makes them the obvious stage on which to play out the tensions of our times—tensions between access and exclusivity, common and expert knowledge, the prescribing and the challenging of meaning, and market and mission” (McLean, 1999, p. 194). Exhibits can display visual and physical evidence of subjects such as racism, violence, political oppression, and war. Museum exhibitions can increase awareness and understanding of complex issues among a wide audience (Gurian, 1999; McLean, 1993; McLean, 1999; Munley, 1999; Ševčenko & Russell-Ciardi, 2008).

Exhibitions are not Neutral

Exhibitions are not a neutral form of communication (McLean, 1993; Sullivan, 1994; Weil, 1990). Museum exhibits send a value-laden message to visitors about what the institution believes is worthwhile (Sullivan, 1994). An exhibition reflects the values, attitudes, and assumptions of those who developed it. The values and interests of exhibit developers shape the exhibit by the decisions of what is included and left out of the exhibition. Unconscious biases can affect the selection and arrangement of objects and images, the wording of text, and the choice of subject (Weil, 1990).

Museum professionals are aware of the biased nature of exhibits. Today, museums admit that they are not the ultimate authority on a subject. Museums often

provide an opportunity for visitors to contribute their views to exhibits through avenues such as comment books. Additionally, museums are paying close attention to the opinions, interests, and needs of museum visitors. During the development process, museums sometimes consult with people who have a stake in the exhibit such as community members, tribal representatives, and others who have first-hand knowledge of the subject. Today, exhibit development is a collaborative process that aims to produce the most engaging educational experience possible (McLean, 1993; McLean 1999; Weil, 1990).

3.07 Green Exhibits

In green museums, exhibitions are used to communicate sustainability through their content and design. I have determined that there are two types of green exhibits. The first exhibit is green because its topic is green. These exhibits examine subjects related to sustainability such as the natural environment, conservation, and ways humans use nature. The second green exhibit examines any subject, but is constructed using sustainable design methods and materials. In this research the two types of green exhibits will be called “green theme exhibits” and “green design exhibits,” respectively.

Green Theme Exhibits

A green theme exhibit is a museum exhibit that explores a topic related to sustainability. Green theme exhibits do not have to be solely about sustainability (Barrett & Sutter, 2006; Brophy & Wylie, 2008; Clark, 2004; Scarpino, 2004). Instead, green theme exhibits can cover various topics such as a specific ecosystem, how a culture

adapts to its environment, or what an environment looked like before a city replaced it.

Green theme exhibits can be successful by being local in scope (Clark, 2004).

Sustainability is a complex, global issue that requires action on the individual and local levels. By framing sustainability locally, visitors can draw on their existing knowledge and personal experiences to aid comprehension (Scarpino, 2004). Green theme exhibits provide visitors with the opportunity to reflect on their place in the larger world (Clark, 2004; Link, 2006; Scarpino, 2004; Worts, 2006). They do not have to give precise directions on how to live a sustainable lifestyle. Instead, they inspire change. Through the power of knowledge and inspiration, green theme exhibits encourage sustainable behaviors (Barrett & Sutter, 2006; Brophy & Wylie, 2006; Brophy & Wylie, 2008; Link, 2006; Worts, 2006).

Sustainability is not a foreign subject to museum exhibitions (Clark, 2004; Scarpino, 2004). Museums have always explored human life and the natural environment. One of the nation's first museums, the Philadelphia Museum, founded in 1786 by Charles Wilson Peale, documented the natural world through the display of minerals, insects, fossils, and other specimens. In early twentieth-century museums, exhibitions depicted nature as an object of human activity that provides food, shelter, and economic resources. These exhibits portrayed nature as a force that was conquered and tamed by European settlers. Since the emergence of the environmental awareness movement of the 1960s, American museums began to produce exhibits that examine the relationship between humans and the environment. Today, museum exhibits explore sustainability (Clark, 2004).

The topic of sustainability does not easily lend itself to museum exhibits because it is intangible; there are no objects that inherently are sustainability. Still, museums can use their collections to illustrate concepts of sustainability. Incorporating sustainable themes into museum exhibitions may require a change in the way objects are interpreted. For example, museums can present objects as historical evidence of the relationship between humans and the environment. Or objects can represent the environmental consequences of their creation, use, and disposal. To visualize objects' potential to demonstrate sustainability, museums may need to reexamine their collections and rethink their collecting policies (Clark, 2004).

With green theme exhibits, museums have expanded what they consider an object appropriate for exhibition (Clark, 2004; Brophy & Wylie, 2008). The museum itself has become a subject of exhibits. One type of green theme exhibit showcases how a museum has adapted to sustainability by interpreting its green technology and sustainable practices. These exhibits use signage and other interpretive materials to identify a green practice, explain why the museum employs it, and describe how it benefits the environment. With this green theme exhibit, visitors learn about the museum's efforts in order to apply the knowledge to how they live in their homes and communities. This is called leading by example (Brophy & Wylie, 2006; Brophy & Wylie, 2008; Worts, 2006).

A goal of some green theme exhibits is to educate in order to produce change (Barrett & Sutter, 2006; Brophy & Wylie, 2006; Brophy & Wylie, 2008; Worts, 2006). Within the museum community, there is a fear of issues that have strong political and ideological associations (Scheiner, 1997). Sustainability and advocating for change has

ideological associations. However, as stated previously, museums and their exhibitions are inherently value-laden. When they produce any exhibition or program, they take a position on that issue. Museums can consciously choose the position they take—it doesn't have to be extreme. Green museums can choose how much they want to advocate for a culture of sustainability. The position of green theme exhibits may be relatively neutral, like stating that scientific research provides the best knowledge about the environment and sustainability. Knowledge alone can affect change. Green theme exhibits can increase public awareness of environmental issues without crossing the line between scholarship and political agitation (Clark, 2004).

Green Design Exhibits

In order to set the right example, green theme exhibits need to incorporate sustainable design into their construction. A green design exhibit is a museum exhibit that uses green design principles in its construction, use, and disposal. Green design does not have to be limited to exhibits about the environment; it can be used in any exhibition.

Museum exhibits impact the environment at every stage of the exhibit life cycle—from production and processing of raw materials, to design and fabrication, to exhibit use, and finally at exhibit disposal. Green design exhibits try to mitigate a museum's effect on the environment (Abeyasekera, 2006; Bell & Sarna, 2008; Brophy & Wylie, 2008; Exhibitor Magazine Group, 2007; Gray, 2008; Madison Children's Museum, 2008; McLean, 1993). In order to accomplish this goal, green design exhibits use a variety of techniques. See Figure 3.03 that shows characteristics of green design exhibits.

Figure 3.03

Green Design Exhibits Characteristics*	
<ul style="list-style-type: none"> - Reduce the amount of materials - Use durable materials - Design for reuse - Use reused materials - Use recyclable materials - Use recycled materials - Avoid the use of toxic materials - Design for energy efficiency - Design for material separation - Contribute to healthy indoor environment 	<ul style="list-style-type: none"> - Use locally produced materials - Use rapidly renewable materials - Reduce construction waste - Use sustainable wood products - Use materials with low or zero VOCs - Use affordable materials - Design for multiple purposes - Use resources efficiently - Use design for educational purposes - Do not harm museum collections

** This list is not exhaustive, but demonstrates possible characteristics*

Much of green exhibit design focuses on materials—what they are, how they are used, and how they are disposed (Abeyasekera, 2006; Bell & Sarna, 2008; Exhibitor Magazine Group, 2007; Gray, 2008; Madison Children’s Museum, 2008). Many materials used in standard exhibit construction produce toxic emissions, contribute to environmental degradation, originate from nonrenewable resources, and contribute to indoor air pollution. These include plexi-glass, plastic laminates, plywood, paints, adhesives, carpeting, stains, finishes, wood, sealants, particleboard, drywall compound, fabrics, and furniture finishes (Madison Children’s Museum, 2008). There are environmentally-friendly alternatives to these materials. Environmentally-friendly building materials can have one or more of the following attributes: they are composed of renewable resources; they use resources efficiently in their manufacture; they do not contain toxic chemicals; they do not negatively affect indoor air quality; they are durable;

they are reusable; they are recyclable; and they are affordable (Gray, 2008). Some environmentally-friendly materials are more sustainable than others. An authoritative list of the best green exhibit materials does not exist. Therefore, exhibit developers must take responsibility for researching and choosing sustainable exhibit materials.

Plywood, a staple material for exhibits, can be used to illustrate how environmentally-friendly options can substitute traditional materials. Plywood is bonded with an agent that contains formaldehyde, a toxin that is harmful to human health. Formaldehyde is added to products for preservation purposes and is can be found in other exhibit materials such as carpeting, paints, adhesives, and fabrics (Gray, 2008; Madison Children's Museum, 2008). Fortunately, there are environmentally-friendly alternatives to plywood. One option is wood certified as sustainably harvested from well-managed forests. Another is rapidly-renewable wood products made from plants that regenerate themselves quickly and easily, usually within a ten-year cycle or shorter. There are many different rapidly renewable materials such as bamboo and cork. One is wheatboard, a particle board made from compressed wheat stalks, a by-product from agriculture that was formerly burned. Finally, plywood can be substituted by plywood, or a special kind of plywood that is bonded without the use of formaldehyde (Brophy & Wylie, 2008; Madison Children's Museum, 2008). With research, exhibit developers can learn about the wealth of environmentally-friendly alternatives to traditional exhibit materials.

In order for environmentally-friendly materials to be a viable alternative to traditional exhibit materials, they need to be able to meet the demands of the museum environment. Exhibit developers prefer materials that are lightweight, easy to handle, and have tensile strength and durability. Exhibit materials need to readily accept paints, tints,

dyes, and adhesives while being impervious to dirt and stains. They need to be chemically stable and constructed with inert substances in order to protect fragile museum collections. Plus, exhibit materials need to be affordable (McLean, 1993). Many green materials are not inferior to their traditional equivalents in these qualities. Museums that have incorporated green materials into their exhibits have found that they perform well. In general, green materials are durable and outlast traditional exhibit materials (Brophy & Wylie, 2008).

Although there is a great interest in the field, the cost of environmentally-friendly materials is the primary obstacle to a broad adoption of green exhibits, according to a survey of exhibit developers and exhibit material suppliers by Exhibitor Magazine Group. The survey found that green options cost an average of twenty-six percent more than traditional materials (Exhibitor Magazine Group, 2007). While green materials may cost more up front, when one calculates the savings over time, sustainable materials are the better investment (Brophy & Wylie, 2008; Madison Children's Museum, 2008). Additionally, the green design field is evolving rapidly. As it does, environmentally-friendly materials become more accessible. As demand for these materials continues to increase, expenses will decrease (Brophy & Wylie, 2008; Exhibitor Magazine Group, 2008).

Cost is typically measured by the amount of money exchanged for a product. However, "true cost" is a more sustainable way of measuring costs and benefits. True cost weighs the combination of social, environmental, and economic costs against the apparent benefits associated with a choice. In green exhibits, costs of materials can be measured as the total expenses of growing, producing, and transporting the materials,

plus their durability and reusability, and the cost of disposing them (Madison Children's Museum, 2008).

Exhibits can have costs to the environment and to humans (Bell & Sarna, 2008; Brophy & Wylie, 2008; Exhibitor Magazine Group, 2007; Gray, 2008; Madison Children's Museum, 2008; McLean, 1993). For example, many exhibit materials contain volatile organic compounds, or VOCs. VOCs slowly release toxic gasses into the atmosphere in a process called off-gassing. They are found in many exhibit materials including paints, finishes, varnishes, sealants, wood products, carpet, and furniture. VOCs cause indoor air pollution and are harmful to human and environmental health. Plus, they degrade museum collections. Green design exhibits use materials with low or zero VOCs, creating a healthy indoor environment for museum visitors, staff, and collections (Gray, 2008; Madison Children's Museum, 2008; McLean 1993). For instance, the ink traditionally used to print exhibit signage is petroleum-based and contains VOCs. There are alternatives that do have zero or low VOCs such as eco-solvent inks and vegetable-based inks. Soy-based ink is a popular option and, besides being environmentally-friendly, it is available in brighter colors, lasts longer, and makes paper easier to recycle than petroleum-based inks (Madison Children's Museum, 2008).

Exhibit developers can incorporate the three Rs—reduce, reuse, and recycle—into green design exhibits (Abeyasekera, 2006; Bell & Sarna, 2008; Madison Children's Museum, 2008; McLean, 1993). Many exhibit materials are recyclable. Recycling makes new products from old, saving resources and reducing waste. Exhibit materials that can be recycled include: paper, paperboard, corrugated cardboard, wood, aluminum, steel, copper, glass, textiles, rubber, and some plastics. Some recyclable materials may be a

better choice than others. For example, recycling aluminum saves ninety-five percent of the energy it would take to produce new products from aluminum ore. Conversely, plastics require a large amount of energy and resources to produce and recycle (Madison Children's Museum, 2008; McLean 1993).

Some exhibit materials can be replaced with products containing post-consumer recycled content of equal or nearly equal quality (Abeyasekera, 2006; Bell & Sarna, 2008; Gray, 2008; Madison Children's Museum, 2008; McLean, 1993). These include paperboard, paper, wood products, some plastic products, aluminum, and glass. Recycled products may contain different percentages of post-consumer content; the greenest choice is the product with the highest level of post-consumer content. Other exhibit materials do not yet have equivalent recycled products, including acrylics and plastic laminates (Gray, 2008; McLean 1993). Exhibit developers should consider how a product is recycled. Like cradle to cradle design argues, the processes used to recycle consume energy and resources. Sometimes chemicals are added to recycled materials to make them useful again. For example, during the recycling process, bleach, a moderately toxic chlorine salt, is added to some paper (Madison Children's Museum, 2008; McDonough & Braungart, 2002).

Products made from a combination of materials are the most difficult to recycle and often cannot be recycled at all (McDonough & Braungart, 2002; McLean, 1993). In museum exhibits, signage is often printed on a paper product, mounted with glue on plywood, and coated with plastic laminate. By themselves, the paper and the plywood could be recycled. With glue and plastic laminate, such signage is destined for a landfill. Green design exhibits are constructed so that materials can be easily separated. Using

green exhibit design, the sign's materials could be bolted together instead of glued. The plastic laminate could be replaced by a sheet of plastic that could be reused in subsequent exhibits or recycled. At the end of the exhibit, the sign could be deconstructed and its materials placed in the appropriate recycling streams (Madison Children's Museum, 2008; McLean, 1993).

Design for material separation allows for reuse. Exhibits components are usually designed to be used once for an immediate need. Instead, exhibit developers can plan ahead and design components to be reused in subsequent exhibits. Exhibits could consist of permanent features that hold content that changes with each new exhibit. This multi-purpose design would also allow content to be changed during the duration of the exhibit. Content could be replaced to provide room for new discoveries or corrections. Multi-purpose design would keep permanent exhibits fresh. Reuse saves resources and money by extending the value on materials. Additionally, reusing and repurposing materials for future exhibitions keeps them from crowding museum storage facilities (Brophy & Wylie, 2008; Madison Children's Museum, 2008; McLean, 1993).

Green design exhibits reduce waste. Waste can be minimized during exhibit construction by recycling and reusing materials. Exhibit developers can reduce resource use by design. Exhibits do not have to be big to be enjoyable. In green theme exhibits, developers reduce the number of extraneous design elements. This can improve the overall exhibit experience and educational potential by eliminating unnecessary distractions (Abeyasekera, 2006; Brophy & Wylie, 2008; Madison Children's Museum, 2008; McLean, 1993).

A final green exhibit design consideration is conservation of resources such as energy and water. When exhibits use less electricity and water, they save museums money. For example, efficient use of exhibit lights can conserve electricity. Museums can start by changing their light bulbs. Light-emitting diodes (LEDs) and compact fluorescent (CFLs) lights are a green choice. Then, museums can use occupancy sensors that detect motion to trigger exhibit lights only when a person enters the room. Light sensors protect delicate museum collections from ultraviolet radiation because objects are only exposed to light when necessary. Additionally, when lights are on, they generate heat. On-demand lighting generates less heat and reduces the need to cool the building. Light sensors will reduce use of resources and money spent on energy bills (Brophy & Wylie, 2008; Gray, 2008; Madison Children's Museum, 2008).

3.08 Conclusions

There are many ways museums and exhibitions can be green. While this literature review provides an overview of possible methods, it is not exhaustive. To learn more about how museums are employing sustainability into their operations and exhibits, I investigated three case studies: the Oregon Museum of Science and Industry, Phipps Conservatory and Botanical Gardens, and the Children's Museum of Pittsburgh.



Chapter four

case studies data + analysis

4.01 CASE STUDY ONE:

Oregon Museum of Science + Industry

OMSI puts the "WOW!" in science for the kid in each of us!

The Oregon Museum of Science and Industry (OMSI) is a nonprofit educational institution founded in 1944 in Portland, Oregon. OMSI's says:

The Oregon Museum of Science and Industry (OMSI) is a scientific, educational, and cultural resource center dedicated to improving the public's understanding of science and technology. OMSI makes science exciting and relevant through exhibits, programs, and experiences that are presented in an entertaining and participatory fashion.
(Oregon Museum of Science and Industry [OMSI], 2008a).

OMSI is committed to sustainability in its operational practices and exhibition fabrication. To understand how the Oregon Museum of Science and Industry has gone green, I interviewed Jessica Willcox, OMSI Creative Director in the Exhibits Department, on September 12, 2008. Willcox has been with OMSI for over seven years in various capacities, and is the key developer of OMSI's Green Exhibit Certification guide.

OMSI Organizational Information

OMSI has 219,000 square feet of exhibit space consisting of five exhibit halls and eight science labs pertaining to life science, Earth science, physics, and technology. It has a gallery dedicated to featured exhibits that change every four months. Also, OMSI has an Omnimax theater, the Northwest's largest planetarium, and a motion simulator ride. The museum owns and interprets the USS Blueback submarine, the United States Navy's last non-nuclear, fast attack submarine. The submarine sits outside the building in the Willamette River (OSMI, 2008a).

OMSI has one of the largest traveling exhibit programs in the country. The museum develops and produces interactive and scientifically accurate exhibits for purchase and rent. Additionally, OMSI's exhibit team of designers, engineers, project managers, and fabricators are available for consultation to help other museums materialize ideas into exhibits. Exhibit services include conceptual planning, research, prototyping, evaluation, design, and fabrication (OSMI, 2008a).

In addition to exhibitions, OMSI produces educational programs for groups, children, adults, and educators (OSMI, 2008a). For the 2007 fiscal year, (June 1, 2006, to May 31, 2007), OMSI experienced a record 900,000 visitors (OMSI, 2007c). Some of these visitors included school children on field trips and attendees of special events.

A board of trustees, led by Nancy Stueber, the current president, governs OMSI. OMSI is an independent, 501(c)(3) organization that receives no state or local tax support. It relies on admissions, memberships, donations, and revenue from programs and services to operate and produce programs and exhibits (OMSI, 2008a; OMSI, 2007c). For the 2007 fiscal year, OMSI spent \$21,406,090 in total expenses with \$17,472,464 of that spent on museum activities and educational programs (OMSI, 2007a).

OMSI Green Facility

In 1992, OMSI opened in its current facility on the east side of the Willamette River. The museum sits on 18.5 acres of former brownfield—land used for industrial purposes. Today, the property is clean and inviting. It is landscaped with native plants and has a popular bike path that runs between the river and the museum (Brophy &

Wylie, 2008; OMSI, 2008a; Wylie & Brophy, 2008). Although the OMSI facility is not LEED-certified, it has many environmentally-conscious attributes.

One of the museum's most eco-friendly features is its parking lot. When OMSI was developing the blueprints for its facility in 1990, the City of Portland asked the museum to redesign its parking lot to include bioswales. Bioswales are landscaped areas filled with trees, shrubs, and other plants. They capture stormwater, clean it of silt and pollution, and then release it into the watershed. At that time, there were no city or state policies addressing onsite stormwater management design. With OMSI's collaboration, Portland experimented with bioswale design and plantings. The city learned how to best use bioswales and made revisions in its municipal codes concerning stormwater management (Brophy & Wylie, 2008; Portland Bureau of Environmental Services, 2005; Wylie & Brophy, 2008).

OMSI installed bioswales on its 4 acre parking lot by converting traditional landscaped parking lot islands to vegetated swales. To gain additional area for the swales, the lot was the first in the city to use smaller parking stalls. The bioswales saved OMSI \$78,000 in construction costs by eliminating the need for stormwater pipes, sedimentation manholes, and catch basins. Portland's Bureau of Environmental Services (BES) provided significant levels of support for this project. In 1996, BES performed a water quality audit to test the performance of OMSI's bioswales. They found that the bioswales prevent 3.9 million gallons of untreated rainwater from entering directly into the Willamette River (Brophy & Wylie, 2008; Portland Bureau of Environmental Services, 2005; Wylie & Brophy, 2008).

A final consideration in OMSI's parking system is that the museum charges two dollars to park a car in its lot. This money goes toward purchasing wind power from Portland General Electric. OMSI encourages alternative transportation and has bike racks outside the building. During peak months, city buses drop off and pick up visitors at the museum's entrance (OMSI, 2008a).

A second way OMSI contributes to the health of its local watershed is by using cooling towers to heat and cool its building. Before the cooling towers were installed in 2008, OMSI used water from the Willamette River to do this job. This is a common practice for buildings along river shores, but it causes thermal pollution and disrupts aquatic wildlife. Cooling towers eliminate the need to use river water by recirculating water within a closed system (Brophy & Wylie, 2008; OMSI, 2008a).

OMSI's cooling towers have helped earn the museum Salmon-Safe certification. Salmon-Safe, an independent nonprofit organization, awarded the certification after their evaluation found that OMSI facilities were designed and managed to protect water quality and fish habitat. The museum's native plantings, bioswales, cooling towers, and sustainable landscaping help protect the Willamette River, home to Chinook salmon. OMSI is the first science museum in the nation to earn Salmon-safe certification (Brophy & Wylie, 2008; OMSI, 2008b).

Finally, OMSI has an Earth-friendly elevator it calls an eco-vator. Most elevators operate on a hydraulic system that uses oil and pressure to make the car rise and fall. The hydraulic oil is stored partially underground and can sometimes leak, damaging the environment. OMSI's eco-vator runs on a traction system of cables and counterweights.

It does not need oil, plus it uses much less electricity than a hydraulic elevator
(Observation, September 12, 2008).

OMSI Operational Sustainability

OMSI has adopted sustainability as a strategic value (Brophy & Wylie, 2008; Willcox, personal communication, September 12, 2008). The museum uses the triple bottom line definition of sustainability to guide decisions based on environmental, social, and fiscal responsibility. OMSI has written a sustainability policy to articulate commitment to its sustainability. The museum focuses efforts on carbon dioxide emission reduction, waste reduction and prevention, green exhibit production, and environmental education (Brophy & Wylie, 2008).

OMSI has a sustainability committee to plan and implement green practices. The committee meets about once every month and is composed of representatives from senior management and across departments including exhibits, programs, finance, human resources, and maintenance. The sustainability committee serves as a central point for communication and information on OMSI green practices. It informs management and staff of new initiatives, as well as progress and successes of old ones. The committee identifies and researches projects, sets performance targets, and develops plans to achieve them. Finally, the sustainability committee documents and evaluates all of OMSI's green practices (Brophy & Wylie, 2008; Willcox, personal communication, September 12, 2008).

OMSI's motivation to go green came from its staff and community. "With scientists, which a lot of our team is, there's an inherent concern for the Earth and its

resources. Part of it is from the employees. Part of it is from the community, the visitors care about it. Especially in Portland, it's a very green city and we want to be a part of that" said Jessica Willcox, Exhibitions Creative Director (Willcox, personal communication, September 12, 2008). However, not all of OMSI's staff is committed to sustainability. Willcox said there are some cynics who do not believe that OMSI's efforts are accomplishing much, "We're a big organization, people have lots of opinions. And there is a trade-off – everything we do, there's a cost to it" (Willcox, personal communication, September 12, 2008).

One of OMSI's first green practices was establishing a compost system (Brophy & Wylie, 2008; Willcox, personal communication, September 12, 2008). The museum wanted to cut costs by reducing the amount of waste it generated because sanitation vendors charge hauling fees based on weight and volume. To get started, OMSI recorded an initial benchmark for unsorted garbage using its vendor's hauling records. Then, the museum did a waste audit by going through its trash to learn what it was throwing away. OMSI found that rainfall and food waste from the museum café contributed a significant amount of volume and weight to their garbage. To reduce weight from rainfall, OMSI initiated a quick and easy solution—a policy that the dumpster always be covered. To reduce food waste, OMSI began composting (Brophy & Wylie, 2008).

OMSI composts its pre-consumer food wastes inside a worm bin using a process called vermicomposting. Inside a worm bin, worms eat and process vegetable scraps and shredded newspaper. Their waste, called worm castings, creates a nitrogen- and phosphorus-rich fertilizer that helps plants thrive. OMSI had to upgrade its original worm bin to a larger facility that now contains over 200,000 worms (Brophy & Wylie, 2008).

OMSI's café has other green practices. The café is a member of the Food Alliance, an independent nonprofit organization that provides food from sustainable agriculture and socially-responsible commerce. The OMSI café uses shade-grown coffee and has real flatware that is washed, not thrown away. It has compostable cups and plates; however, this serviceware requires an involved process to fully biodegrade. Portland and the surrounding areas do not have facilities to accommodate this kind of compost; therefore OMSI must ship this compost, along with paper towel waste from the bathrooms, to a facility near Seattle, Washington. The shipping does negatively impact this green practice, but Willcox argues that the value of public education makes up for it (Brophy & Wylie, 2008; Willcox, personal communication, September 12, 2008).

OMSI Green Themed Exhibits

OMSI's permanent exhibits do not contain sustainability themes. The museum is planning to redesign their Earth Hall in two or three years. At this early stage, developers are considering green messages for the exhibit. The only OMSI exhibit that connects humans to the environment is outside the museum on the bike trail. OMSI installed several panels on the bike trail that interpret the history and ecosystem of Portland and the Willamette River. People do not have to pay an admission fee to learn how Portland inhabitants have used the river over the years and how individuals can conserve the ecosystem today (Observation, September 12, 2008; Willcox, personal communication, September 12, 2008).

OMSI employs the type of green theme exhibit that leads by example. The museum is proud of its efforts in sustainability and interprets its green practices for

visitors. It uses exhibit signage to describe its parking lot bioswales, cooling towers, eco-vator, and worm bin. Interpretation is not overly obvious or in-depth. Signs are placed on or near a feature and explain how it works, why it is environmentally-friendly, and why it is important. The interpretation provides essential information without disrupting permanent exhibits (Brophy & Wylie, 2008; Observation, September 12, 2008; Willcox, personal communication, September 12, 2008).

In the café, OSMI uses signage to help visitors sort, recycle, compost, and throw away trash in the appropriate bins (Observation, September 12, 2008; Willcox, personal communication, September 12, 2008). Visitors sometimes make sorting mistakes, so OSMI is experimenting with this signage to understand how to best reach visitors. Composting is not a widespread habit in individual homes, public places, and businesses. Schools have had success in training students to compost because they can reinforce the message every school day. OSMI does not have the benefit of building on previous experience because there are new visitors everyday. OSMI had success in putting a volunteer at the compost station to help visitors; however, the museum does not have the support to do that daily. “The next step for us is we’d like to get little table signs throughout the café. Before you even get to the trash station, perhaps you’ve already sorted it while you’re sitting there and maybe had a chance to read more about why composting is important,” Willcox said (Willcox, personal communication, September 12, 2008). Finding the best way to lead by example involves experimentation and evaluation.

OMSI Green Design Exhibits

OMSI supports the values taught in its green theme exhibits by using sustainable design to fabricate them. OMSI uses several techniques to focus the greening of its exhibits including using: refurbished or reused materials; rapidly renewable materials; certified wood grown under environmentally responsible conditions; low-VOC materials; and recyclable materials. The museum also concentrates on recycling and reducing construction waste (OMSI, 2008d; OMSI, 2007d; OMSI, 2003; Willcox, personal communication, September 12, 2008). One exhibit, *Innovation Station*, especially illustrates these techniques.

Five years ago, OMSI first ventured into green design exhibits with the development of the large-scale, permanent exhibit, *Innovation Station*, (Willcox, personal communication, September 12, 2008). Currently on display in the museum's Turbine Hall, *Innovation Station* teaches visitors how technology and the physical sciences are used in daily life and how they can shape the future (OMSI, 2008a). At the beginning of the design process, the production team made decision that sustainable exhibit design would be a priority for the project. Their goal was to have eighty percent of the exhibit be composed of recycled materials or materials that can be recycled or reused at the end of the exhibit's lifetime. Much of the exhibit is made of aluminum, a material that is easily recycled (OMSI, 2003; Willcox, personal communication, September 12, 2008).

Corresponding with the recycling goal, minimizing waste was a major priority. To accomplish this, the production team designed *Innovation Station* to be modified easily. One technique was using bolts instead of glues. Bolting materials allows them to be separated during the lifetime and at end of the exhibit. With bolts, content panels can be

changed, added, or removed while maintaining the larger display structure. Upon exhibit removal, bolted materials can be separated and placed into appropriate recycling or waste streams. If glues were used to mount graphic panels on plywood, the plywood must be thrown away instead of recycled (Observation, September 12, 2008; OMSI, 2003; Willcox, personal communication, September 12, 2008).

Instead of plywood, *Innovation Station* uses medium-density plywood (MDF), a material that is formaldehyde-free and has low VOCs. OMSI did not need to paint the MDF because color was added during its production. Where paint was needed, OMSI used low-VOC paints. Additionally, plastic laminate was used as little as possible (Observation, September 12, 2008; OMSI, 2003; Willcox, personal communication, September 12, 2008).

Innovation Station components were designed for multiple purposes. For example, exhibit furniture is built with aluminum beams and bolts that fit together like an Erector Set. The beams can be shaped and reshaped to form custom structures. They have a lifetime that extends beyond the immediate need and can be used in subsequent exhibits. Additionally, the production team designed multi-purpose activity stations. Activity stations are tables that provide a hands-on learning experience for one person or a small group. The tabletops have identical sets of holes to bolt down various activity structures. With the tabletops' consistent design, activities could be switched out or moved without disrupting the larger exhibit structure (Observation, September 12, 2008; OMSI, 2003; Willcox, personal communication, September 12, 2008).

One display in *Innovation Station* creatively employs materials while having a green message. It examines what to do with electronic waste, or technology hardware,

when they break or become obsolete. The eye-catching and three-dimensional display stretches above visitors' heads and consists of computer towers, monitors, keyboards, and motherboards. The reused exhibit materials originate from OMSI's offices and staff member's homes. This display encourages visitors to find a use for their electronic waste while diverting it from the landfill (Observation, September 12, 2008).

OMSI Green Exhibit Certification

After the development of *Innovation Station* in 2005, OMSI faltered on its green exhibit design (Willcox, personal communication, September 12, 2008). According to Willcox, sustainability became a topic of conversation, not a priority in the exhibit department. Sustainability was no longer a goal at the start of exhibit development, reducing effectiveness of green efforts. While working on an animation exhibit, a supervisor asked Willcox to incorporate green practices when she was half way through the development process. Willcox believes she acted to the best of her ability to cut down vinyl elements; however, real impact could not be accomplished because plans were established and deadlines were approaching (Willcox, personal communication, September 12, 2008).

In order to help the museum evaluate the sustainability of exhibits in terms of their environmental impact, Willcox developed the OMSI Green Exhibit Certification guide. She was motivated by her "desire to have a measurable system where we could start holding ourselves accountable to the choices that we've made" (Willcox, personal communication, September 12, 2008). Willcox began writing the Green Exhibit Certification guide in December 2007 and created many drafts before finalizing it. The

guide is inspired by the LEED rating system and awards exhibits with no certification or with Platinum certification at the top, followed by Gold, Silver, Bronze, and Green, the minimum level (OMSI, 2008d; Willcox, personal communication, September 12, 2008). See Appendix H, OMSI Green Exhibit Certification Guide. Eight categories evaluate exhibits:

1. Use of rapidly renewable materials
2. Use of resources can be reused or have been reused from other sources
3. Use of recycled materials
4. End-life assessment measuring the portion of the exhibit that can be reused or recycled after the exhibit's life
5. Use of low-emitting materials
6. Use of certified wood
7. Design for conservation of energy
8. Use of regional materials

An exhibit receives zero to four points in each category and total points determine certification level. See Figure 4.01 for a breakdown of points and corresponding certification levels. One point is awarded if a few of the materials meet criteria; two points if some materials meet criteria; and three points if most of the materials meet the criteria. An exhibit receives four points if all of its materials meet category criteria. A perfect score is not possible because some of the categories conflict. For example, certified wood is not a rapidly renewable material. Therefore, an exhibit cannot receive full points for both the use of rapidly renewable materials and the use of certified wood (OMSI, 2008d; Willcox, personal communication, September 12, 2008).

Evaluation of an exhibit with the OMSI Green Exhibit Certification Guide is intended to be a team process, where leading exhibit staff assess the exhibit together. The use of the words “few,” “some,” and “most” are intentionally subjective in order for the evaluators to talk through each category. Discussion helps to achieve a consensual

evaluation while providing an opportunity to understand the exhibit's strengths and areas for improvement (Willcox, personal communication, September 12, 2008).

Figure 4.01

OMSI Green Exhibit Certification Levels	
<i>Points</i>	<i>Certification Level</i>
0 – 5	No Certification
6 – 10	Green Certification
11 – 18	Silver Certification
19 – 26	Gold Certification
27 – 32	Platinum Certification

Willcox used the Green Exhibit Certification guide to retroactively evaluate sixteen exhibits OMSI produced in the past ten years. So far, the highest any OMSI exhibit rates is silver, including the most recent exhibit, *Let's Get Active*, developed in summer 2008. Many of the sixteen past exhibits received zero points. OMSI exhibits have a way to go before earning a platinum certification for green design, but with the Green Exhibit Certification guide, OMSI can better understand how to get there. (Willcox, personal communication, September 12, 2008). It is OMSI's goal to have all exhibits qualify for green certification or higher by 2012 (OMSI, 2008d; Willcox, personal communication, September 12, 2008).

OMSI has discovered that green exhibit design has a learning curve. At one point, OMSI started using bamboo as a primary material for exhibit construction. Bamboo is a rapidly renewable material because it grows fast and does not deplete soil quality.

However, most bamboo is grown in China and has a significant environmental impact when shipped to the United States. Therefore, using a nonrenewable material that is purchased locally may be a more sustainable choice. To make the right decision, Willcox has found that she must stay informed (Willcox, personal communication, September 12, 2008).

OMSI is also learning that green exhibit design constitutes a series of tradeoffs. While OMSI wants exhibits to be green, it does not want to sacrifice the visitor experience. Exhibits still need to be big, colorful, and fun. Most importantly, exhibits need to be a rewarding educational experience for visitors. “Our bigger goals, even bigger than being green, is teaching our guests and exciting our guests about science and enticing them to walk through the door” (Willcox, personal communication, September 12, 2008). OMSI’s exhibit budget that has not increased as expectations for sustainability have. Sometimes the exhibit team must sacrifice sustainability for the visitor experience; sometimes elaborate design is cut for sustainability (Willcox, personal communication, September 12, 2008).

OMSI Case Study Summary

OMSI is a significant case study because the museum excels at green design exhibits. Its Green Exhibit Certification Guide is a valuable resource and can be used, or modified as necessary, by other museum institutions that are working on incorporating sustainability into their exhibitions. The guide offers concrete goals and techniques for green exhibit design. At the same time, it provides a way to measure the success of a green exhibit and holds the museum accountable for its sustainable practices. Through

evaluation, OMSI can continually improve the exhibit message in order to communicate effectively with visitors. The museum is flexible in changing its methods in creating green theme and green design exhibits. This is important because OMSI is still learning and experimenting with how to incorporate sustainability into its operations and exhibits. One lesson that OMSI has learned that may be useful for other institutions is to position sustainability as a priority and set specific goals for an exhibit or other project before it begins. If OMSI continues to expand its knowledge base and evaluates its success, I believe the museum will become a leader in green exhibit design.

4.02 CASE STUDY TWO:

Phipps Conservatory + Botanical Gardens

The Green Heart of Pittsburgh

Phipps Conservatory and Botanical Gardens (Phipps) is a museum organization located in Schenley Park, an urban green space in Pittsburgh, Pennsylvania. Phipps was founded in 1893 and is dedicated to horticulture display and interpretation (Phipps Conservatory [Phipps], 2008a). The conservatory became part of the green museum movement in 2005 when it began a \$36.6 million plan to add four buildings to its campus: a Welcome Center, Tropical Forest Conservatory, Special Events Pavilion, and Production Greenhouses. The board made the strategic decision that sustainability should be a priority of the institution and that all new construction should be green. Phipps argued that because it is dedicated to the study and conservation of plants, sustainability would support its mission. Over a century after its founding, Phipps was reinvented with the goal to be the greenest greenhouse (Phipps, 2008a; Devlin, 2007). The conservatory has chosen to make sustainability part of its mission:

To inspire and educate visitors with the beauty and importance of plants; to advance sustainability and worldwide biodiversity through action and research; and to celebrate its historic glasshouse.
(Phipps, 2008a).

In order to better understand how Phipps incorporates sustainability into its operations and exhibits, I interviewed Heather Mikulas, Education Specialist for Interpretation and Public Programming, on September 24, 2008. Mikulas has worked at Phipps for four years in various capacities, including Sustainability Coordinator and Green Team Chair. Mikulas directed the adoption of green practices at the conservatory to help make Phipps the green institution it is today.

Phipps Organizational Information

In 1893, industrialist Henry Phipps built a glasshouse of Victorian design as a gift to the City of Pittsburgh. The philanthropist wished the conservatory to be a source of education and pleasure for all people, stipulating that it must be open on Sundays so workers could visit on their day off. Since then, Phipps Conservatory has become a cultural institution in Pittsburgh. In 1976, the Victorian glasshouse was placed on the National Register of Historic Places. Today, Phipps is a 501(c)3 organization governed by a board of trustees and led by its current executive director, Richard V. Piacentini (Phipps, 2008a; NPS, 2008).

In 2006, the conservatory spent \$4,767,243 on program services out of a \$6,081,644 expense budget. Program services include exhibits and education programs for adults, children, and school groups (Phipps Conservatory and Botanical Gardens Inc., 2007). Since Phipps rewrote its mission statement to include sustainability, these programs often involve green themes. “All of our programming has an element of

sustainability. So anyone who comes and participates in our programming or if we do outreach, they're getting that message" (Mikulas, personal communication, September 24, 2008).

The conservatory has several permanent exhibit gardens as well as galleries for changing exhibits and seasonal events. Each garden is designed around a theme such as a garden type (Japanese Gardens), a specific plant (orchids), or an ecosystem (the desert). Gardens located inside the historic glasshouse include the Palm Court, Fern Room, Tropical Fruit and Spice Room, Victoria Room, and the Parterre de Broderie (a French style garden). There are also several outdoor gardens including the Discovery Garden designed especially for children's enjoyment and exploration (Phipps, 2008a).

Phipps produces exhibitions that change regularly with the seasons as well as temporary, single-show exhibits. It is a Phipps tradition to host a flower show every year for the four seasons: spring, summer, winter, and fall (Phipps, 2008a). Another regular exhibit occurs from spring to fall when one gallery is transformed into a Butterfly Forest. This exhibit invites families to walk through a tropical forest filled with bright flowers as butterflies flutter around their heads (Petrucelli, 2008; Phipps, 2008a). Recent temporary exhibits include a blockbuster comprising of glassworks by famed artist Dale Chihuly placed throughout conservatory gardens (Phipps, 2008a; Tascarella, 2008).

Chihuly at Phipps: Gardens and Glass ran nearly ten months from May 2007 to February 2008. This was the eighth Chihuly collaboration with a conservatory or public garden, the first being held in 2001 at Chicago's Garfield Park Conservatory. Throughout Phipps, colorful Chihuly glass mimicked plants and created surreal landscapes. The conservatory extended its hours for special night viewings with the lights illuminating the

glass. Visitation increased 152 percent during the show's span, bringing total yearly attendance for 2007 to 401,065. This is roughly double of the 2006 attendance of 199,852. Membership grew 56 percent, from 6,951 at the show's start to 10,870 by its close. Phipps made money from the Chihuly exhibit, despite its large budget. The conservatory earned \$3.7 million at gate, up from \$392,670 for the comparable period a year earlier (Tascarella, 2008).

In response to the unprecedented public enthusiasm of *Chihuly at Phipps: Gardens and Glass*, Phipps acquired twenty-six of the Chihuly pieces for permanent display including a large chandelier for its Welcome Center. Additionally, the conservatory set up a fund for future glass acquisitions (Gormly, 2008, July 10; Tascarella, 2008). This illustrates that Phipps is attuned to the interests of its community and is willing to change and spend resources to meet them. This flexibility has allowed Phipps to respond to the need to help create a culture of sustainability.

Phipps Green Facility

The Phipps facility consists of the thirteen-room Victorian glasshouse, plus a Botany Hall for educational programs, a Welcome Center, Tropical Forest Conservatory, Special Events Pavilion, and Production Greenhouses. There is a maintenance facility below the main grounds in a ravine called Panther Hallow. Facilities also include the Phipps Garden Center and administration building over two miles off-site (Phipps, 2008a). During the expansion, Phipps employed green construction techniques including: using recycled or local materials, using low- or no-VOC materials; and donating leftover

construction materials to a local resale store, Construction Junction (Green Building Alliance, 2008b; Phipps, 2008a; Phipps, 2008c; Piacentini, 2007).

In 2005, Phipps opened its LEED-certified silver Welcome Center. It is a high performance, energy and water efficient building that houses Phipps' café and gift shop. The 11,000-square-foot structure is set below grade with a glass dome resembling the Victorian glasshouse protruding above ground. The design follows historic structure regulations that require expansions to complement historic landmarks while being distinctly different. The below-ground design also conserves energy. It creates a green roof that provides a heat sink and keeps the building cool. The only area that requires air conditioning is the lower level because the dome is cooled through natural ventilation. The dome and the glass walls at the entrance allow daylight to illuminate the lobby, gift shop and café. When artificial light is needed, fixtures point down to limit light pollution. The Welcome Center's design reduces energy costs by forty percent. Phipps purchases wind power energy to run the center (Devlin, 2007; Fields, 2008; Phipps, 2008a; Phipps, 2008c; Rand 2007).

Phipps uses the Welcome Center's green roof to demonstrate and interpret sustainable landscaping. Its plants are native to the region and require little additional water or fertilizer. The green roof retains about fifty percent of rainfall, keeping it in the water table instead of it being channeled into the sewer system. The green roof gardens and the front lawn are not irrigated. The front lawn contains drought resistant grass that uses eighty-one percent less water than traditional lawns. The grass grows through an open-celled network of permeable, high-strength blocks made from recycled plastic materials. The grid protects the lawn when Phipps uses it for overflow parking during

peak visitation. Before construction began, Phipps moved two mature dawn redwood trees to make room for the Welcome Center. Instead of simply cutting them down, Phipps spent time and money to save the *Metasequoia glyptostroboides* trees, a species once thought to be extinct (Brophy & Wylie, 2008; Devlin, 2007, Fields, 2008; Phipps, 2008a; Phipps, 2008c).

A final green design element of the Welcome Center is its sidewalks. Under the sidewalks, heating pipes carry the conservatory's waste heat condensate. The pipes warm the sidewalks, melting snow and ice during Pittsburgh's fierce winters. The design reduces the use of fossil-fueled snowplows and environmentally unsafe de-icing chemicals and salts (Brophy & Wylie, 2008; Devlin, 2007, Fields, 2008; Phipps, 2008a; Phipps, 2008c).

During the second phase of its expansion, Phipps opened three new facilities in 2006: the Tropical Forest Conservatory, Production Greenhouses, and Special Events Pavilion. The Tropical Forest Conservatory is Phipps' largest exhibit and is devoted to a tropical ecosystem that changes every two years. Currently, it features Thailand's tropics, and in 2009 it will become the Amazon forest. It is a large, multi-level exhibit space with a treetop canopy walk that travels downward until it becomes a ground-level path through the forest. The exhibit also has a fish pond, a healer's hut, and a research station. It interprets not only the flora of the region, but also the culture (Observation, September 24, 2008; Phipps, 2008a)

The Tropical Forest Conservatory is not LEED-certified but it has many innovative green features. Phipps boasts that the Tropical Forest Conservatory is the "most energy efficient conservatory in a public garden in the world" (Phipps, 2008a,

phipps.conservatory.org/project-green-heart/green-heart-at-phipps/tropical-forest-conservatory.aspx). Conventional glasshouse conservatories consume enormous amounts of energy to heat and cool the structure while providing optimal plant-growing conditions year round. Traditional glasshouses suffer extremes in heat loss and gain because they have walls and roofs constructed entirely from single-pane glass. While double-pane glass or glass coated with various films provide more insulation, they block too much light for proper plant photosynthesis. To learn how to build a greener greenhouse, Phipps conducted a computational fluid dynamic study and consulted with experts. The findings led to a very unconventional conservatory (Devlin, 2007; Fields, 2008; Phipps, 2008a; Rand, 2007).

The research found that almost all direct winter sunlight enters buildings through south-facing walls, not rooftops. Plus, most heat is lost through the roof. Therefore, Phipps built its Tropical Forest Conservatory with an insulated, double-pane glass roof that slopes downward from a high, sixty-foot south wall of single-pane glass. The design saves energy while maintaining proper light levels for growing plants (Devlin, 2007; Fields, 2008; Phipps, 2008a; Rand, 2007; Togneri, 2008).

The Tropical Forest Conservatory is 100 percent passively cooled. Half of its 12,000 square foot roof opens to vent heat and humidity without energy-consuming exhaust fans. As hot air exits the roof, a vacuum effect occurs, sucking cool air in from 300-foot long Earth tubes. Earth tubes are concrete underground tunnels that funnel up air that is fifty-five degrees year round. The Tropical Forest Conservatory has energy blankets lining its roof. Energy blankets are special shades that block sun during summer and provide thermal insulation during winter. All of these energy-efficient technologies

are computer-controlled to provide optimal growing conditions and a comfortable environment for human visitors (Devlin, 2007; Fields, 2008; Phipps, 2008a; Rand, 2007).

To run the Tropical Forest Conservatory, Phipps has a five kilowatt solid oxide fuel cell that efficiently converts natural gas into electricity. It is two or three times more efficient in creating energy than combustion and has no harmful nitrous or sulfur emissions. Plus, it captures waste heat and uses it to warm Phipps' tempered water system. The fuel cell was funded by the state and by its manufacturer, Siemens Power Generation. It serves as a prototype to be used in further research. It is the first fuel cell in a conservatory or public garden in the world (Brophy & Wylie, 2008; Devlin, 2007; Fields, 2008; Phipps, 2008a; Rand, 2007).

The second facility constructed during the second phase of the expansion project was Phipps' Production Greenhouses. The production greenhouses are not open to public and provide a place to research and grow plants. They have 36,000 square feet of growing space and a quarantine area that holds new plants to ensure they are pest and disease free. The greenhouses feature energy efficient design with an open-roof system that eliminates the need for mechanical ventilation. They have computer-controlled temperature, humidity, and light levels that allow for sixteen different growing environments within eight ranges. This green design feature gives Phipps the opportunity to expand its mission by growing a larger quantity and wider variety of plants than previously possible (Brophy & Wylie, 2008; Devlin, 2007; Fields, 2008; Phipps, 2008a; Rand, 2007).

Finally, Phipps built its Special Events Pavilion during the second phase of the expansion project to host special events over the year. Phipps is a popular site for

individuals and outside organizations to rent for social or business functions. The 6,730 square feet Special Events Pavilion has a glass south wall that opens onto a side garden and sun terrace with views of downtown. It was constructed using sustainable materials such as bamboo flooring (Brophy & Wylie, 2008; Phipps, 2008a; Phipps, 2008c).

Currently, Phipps is in its third phase of its expansion project. On September 18, 2008, the conservatory broke ground on a \$20 million education, research, and administration complex called the Center for Sustainable Landscapes. The building will replace the maintenance facility in Panther Hollow and will be connected to the conservatory by a covered skywalk on the third floor. The Center is an ambitious project that expects to exceed LEED platinum certification requirements. It will be a net zero energy facility that generates all of its own energy with renewable resources. Also, it will be a net zero water building that captures and treats all of its water on site. The Center is a response to the Living Building challenge set forth by the Cascadia chapter of the US Green Building Council. If completed accordingly, the Center for Sustainable Landscapes will set a new standard for green building practices and operations, and will bring international recognition to Phipps and Pittsburgh (Cascadia Region Green Building Council, 2008; Devlin, 2007; Fields, 2008; Gormly, 2008, September 19; Phipps, 2008a).

With the construction of the Center for Sustainable Landscapes, the entire Phipps staff will be housed in the same complex for the first time (Phipps, 2008a). Currently, the education staff has offices in Phipps Garden Center over two miles away from the conservatory. Staff have to drive between the two buildings sometimes multiple times a day, causing an excess use of fossil fuels. To lessen its impact, Phipps purchased bus passes for all its employees (Mikulas, personal communication, September 24, 2008).

Phipps Operational Sustainability

Phipps has set institutional policy that provides direction for the institution's efforts to teach and model sustainability. It uses the Brundtland Commission's definition of sustainability and cradle to cradle design. The conservatory's goal is to be what it describes as the "Green Heart of Pittsburgh." Phipps calls this effort "Project Green Heart" which aims to inspire sustainability at Phipps, at home, and in the field (Phipps, 2008a; Phipps, 2008b; Phipps, 2008d).

To accomplish Project Green Heart's first goal of having a sustainable institution, Phipps recruits its employees to help make the institution sustainable. Periodically, the conservatory holds a contest that asks employees to submit new ideas for green practices for Phipps. The winning idea earns a prize that will help the winner live a more sustainable lifestyle. Past prizes include Energy-Star appliances and gift certificates to local home improvement stores. Heather Mikulas, Education Specialist for Interpretation and Public Programming, once won the contest after submitting the idea to provide staff with bus passes for travel between the main facility and Phipps Garden Center (Mikulas, personal communication, September 24, 2008).

Mikulas was chair of the conservatory's green team that initiated operational greening. She said that it is important to be opportunistic in communicating sustainable policies and expectations to the work force, "There's a lot of repetition involved because you really have to hit people with the message repeatedly" (Mikulas, personal communication, September 24, 2008). She put green reminders in the employee Web site, newsletter, break room, and bathrooms. When Phipps hires a new employee, he or she

must attend a separate, sustainability-specific training session within the first four months. However, not all of Phipps employees are dedicated to sustainability. “One of the biggest challenges is some people care and some people don’t,” said Mikulas. “And that’s true with staff. Most people are willing to do basic things like recycle, if you make it easy for them” (Mikulas, personal communication, September 24, 2008). Phipps tried to make sustainable habits easy for staff by providing environmental education and green supplies.

In the office, Phipps uses paper that contains at least thirty percent post consumer content. The conservatory’s newsletter and other mailings are “tree free” because they are emailed. When postal service mailings are necessary, they are printed on 100 percent recycled paper with soy-based inks. Facility maintenance is also sustainable with ninety percent of the cleaning products being nontoxic and Green Seal approved (Mikulas, personal communication, September 24, 2008; Phipps, 2008d). Green Seal is an independent nonprofit organization that promotes the manufacture and use of environmentally responsible products and services. Green Seal develop standards for products to meet in order to be certified as environmentally responsible. Green Seal certifies many types of products including paints, cleaning supplies, paper products, and construction materials (Green Seal, 2008).

In its gardens, Phipps uses sustainable gardening techniques. For example, in lieu of toxic pesticides, the conservatory practices Integrated Pest Management (IPM) by using a variety of natural methods to control pests and keep plants healthy. IPM includes targeted applications of soaps and oils for pest problems. If additional measures are

needed, Phipps uses the least toxic pesticide in a minimal and precise application (Mikulas, personal communication, September 24, 2008; Phipps, 2008d).

The conservatory uses organic fertilizers throughout most gardening operations. Phipps composts leaves, grass clippings, and other light organic materials onsite. This compost is spread on garden beds to enrich soils. Heavy or woody plant material must be shipped offsite to a large composting facility located in north Pittsburgh. Also composted at this facility, are the Phipps café's corn-based, biodegradable cups, plates, utensils, and straws. The café composts its pre-consumer food wastes in a worm bin on site. During educational programs, Phipps uses this vermicompost as fertilizer in demonstration gardens (Mikulas, personal communication, September 24, 2008; Phipps, 2008d).

In the café, Phipps offers local and organic cuisine. The conservatory has banned the use of disposable plastic water bottles on site. As an alternative, it sells reusable water bottles featuring the Phipps logo in its gift shop. Phipps encourages individuals and business who rent the Special Events Pavilion to use similar sustainable practices for special events. To accomplish this, the conservatory offers its resources and expert knowledge. For example, Phipps provides recycling bins at every special event. Phipps makes its corn-based compostable serveware and composting facility available to caterers. The conservatory also offers recommendations for caterers that have local or organic food and beverage options. Additionally, the conservatory offers green event tips on its web site applicable at any facility and to events of all kinds (Phipps, 2008a; Phipps, 2008d).

Project Green Heart's second aspect is sustainability at home, meaning that Phipps produces educational opportunities that inspire others to live a sustainable

lifestyle. The conservatory tries to provide green education in a variety of ways, including fee-based programs, exhibits, public outreach, and online information. On its Web site, a “Dr. Phipps” email helpline answers reader-submitted gardening and sustainability questions. Additionally, the conservatory’s gift shop sells *The Green Journal: A Personal Planbook of Eco-Friendly Tips and Ideas*. The book is a collection of tips and essays written by Phipps staff members that offer instructions on starting and sustaining an environmentally-friendly lifestyle (Phipps, 2008a)

Phipps has a broad range of educational classes for children and adults on sustainable gardening. Programs cover topics such as composting, organic gardening, invasive and native plants, plant and animal interactions, and “the right plant for the right place.” Plus, Phipps offers a Sustainable Horticulture certificate program designed especially for professionals in the landscaping and horticulture industry. It is composed of a series of core and elective courses, and upon completion students receive a certificate in Sustainable Horticulture (Mikulas, personal communication, September 24, 2008; Phipps, 2008a).

Phipps collaborates with local nurseries to promote what it calls “The Top 10 Sustainable Plants.” The top ten plants are noninvasive and require little water and fertilizer once established. Participating local nurseries tag the top ten plants with a Project Green Heart label. With this effort, Phipps can provide sustainability education to people who may never visit the conservatory (Mikulas, personal communication, September 24, 2008; Phipps, 2008a).

Project Green Heart also covers sustainability in the field, which means Phipps’ Botany in Action Program. With this program, Phipps provides grants for graduate

students to travel abroad for fieldwork study in ecology, botany, and ethnobotany. Beyond financial support, Botany in Action establishes ongoing relationships with sponsored students. It offers a mentorship program and aid to publish findings or promote them through public outreach and education. To date, twenty-nine researchers have received Botany in Action grants (Phipps, 2008a).

Finally, Project Green Heart markets Phipps' sustainability. The name "Project Green Heart" was coined by a marketing consultant who used the infectious title to help Phipps receive coverage in different industry magazines. It was a very successful campaign that put Phipps' sustainability efforts into publications such as the *Wall Street Journal*, *Christian Science Monitor*, *Glass Magazine*, *Architect Magazine*, *Eco-structure Magazine*, as well as several European publications (Devlin, 2007; Fields, 2008; Rand, 2007). When asked what Phipps does best in terms of sustainability, Mikulas said marketing. The marketing campaign has helped raise money for Phipps' green construction while increasing awareness for sustainability (Lindeman, 2008; Mikulas, personal communication, September 24, 2008; Phipps, 2008a).

Phipps Green Theme Exhibits

Phipps does not use much exhibit signage because it would disrupt the aesthetics of the plants (Observation, September 24, 2008; Mikulas, personal communication, September 24, 2008). The lack of signage is evidence of Phipps' grounding in horticulture; however, it limits Phipps' ability to have green theme exhibits. "There's a tension between all the sustainability stuff and construction and the fact that people come

here to see pretty flowers,” said Mikulas (personal communication, September 24, 2008). Phipps balances this tension by designing some gardens with signage and some without.

Phipps has green theme exhibit signage in the Tropical Forest Conservatory and inside and outside the Welcome Center. The Tropical Forest Conservatory is a green theme exhibit that interprets the ecosystem’s importance to its indigenous cultures and to the larger world. The exhibit explains why the ecosystem is worth conserving and offers ways individuals can help. Additionally, Phipps interprets the Tropical Forest Conservatory’s fuel cell with an interactive computer station that explains how the innovative green technology works (Observation, September 24, 2008; Mikulas, personal communication, September 24, 2008).

Heather Mikulas writes the text for Welcome Center’s green theme exhibits that lead by example. Outside, the signs explain Phipps’ sustainable gardening practices and how people can use these practices at home. Inside, they interpret the building’s green design and technologies and Phipps’ operational green practices. These signs are located places where people may wait—above water fountains, in the bathrooms, and next to benches. In the café, Phipps uses signage to instruct visitors how to sort their trash into the appropriate recycling, compost, and waste bins. Green theme exhibit signage is colorful and uses cartoons and graphics to aid interpretation (Observation, September 24, 2008; Mikulas, personal communication, September 24, 2008).

Even though Phipps puts a lot of resources towards sustainability education and exhibits, the conservatory does not evaluate them to know how effective they are. Mikulas said, “We haven’t done research into how it impacts our visitors, the people who come here to just see things... ..we’ve never done an exit survey to see if they have read

the signage or impacted it” (personal communication, September 24, 2008). Phipps has not changed green theme exhibit signage since its installation (Mikulas, personal communication, September 24, 2008).

Phipps Green Design Exhibits

The fact that Phipps does not have much exhibit signage and that most exhibit materials are plants limits the possibilities for green design exhibits. However, Phipps incorporates sustainability into exhibit design when it can. When the conservatory closes an exhibit, it tries to find a home for all unneeded plants. Usually Phipps will donate the plants to a nursery that can either keep or sell the plants (Mikulas, personal communication, September 24, 2008).

For exhibits materials that are not plants, Phipps choose those that are environmentally-friendly. In the past, Phipps relied on Styrofoam as a light-weight material to build exhibit elements. Today, the conservatory has banned Styrofoam in its exhibits (Mikulas, personal communication, September 24, 2008). Signage is printed with soy-based inks that have ultraviolet light protection. When possible, old exhibits are recycled in whole or in part (Phipps, 2008d). In the Tropical Forest Conservatory, signage has multi-purpose design. The frames are permanent while content boards are removable. When the tropical ecosystem changes after two years, new content boards fit within the multi-purpose frames. As with its green education efforts, Phipps does not evaluate the effectiveness of its green design exhibits (Mikulas, personal communication, September 24, 2008).

Phipps Case Study Summary

The Phipps case study illustrates that a museum will employ green exhibits as they are appropriate to its mission. Phipps does not interpret many of its exhibits, therefore it uses green theme and green design exhibits sparingly. Much of the conservatory's environmental education takes form in classes and public programs. Phipps shows that green theme exhibits and programs can complement each other. For example, the conservatory has both exhibits and programs for sustainable gardening, allowing Phipps to accommodate more visitors and a variety of learning styles. In general, Phipps stands out for its ability to communicate sustainability internally among its staff and outwardly to visitors, the community, and beyond. The conservatory uses multiple methods of communication, including the Web and its marketing department. However, with claims that Phipps is the "greenest greenhouse" and the "Green Heart of Pittsburgh," I am concerned that Phipps does not evaluate its efforts in sustainability. The conservatory needs to prove those claims by measuring and evaluating its practices.

4.03 CASE STUDY THREE:

Children's Museum of Pittsburgh

Play with real stuff

My final case study is the Children's Museum of Pittsburgh (CMP), located in the North Side neighborhood of Pittsburgh, Pennsylvania. This year CMP celebrates 25 years of delivering fun and educational experiences to youth (Children's Museum of Pittsburgh [CMP], 2008b). CMP is a nonprofit organization whose mission says:

CMP strives to nurture children's innate joy, creativity and curiosity. We provide developmentally appropriate exhibits, programs and opportunities for play both

inside and outside the museum. We serve as a resource for families and build meaningful partnerships with schools and community groups. (CMP, 2008b).

CMP completed an expansion in 2004, making it the largest silver LEED-certified museum in the country. CMP incorporates environmental, financial, and social sustainability into its exhibits, operations, programming, and facility design (Brophy & Wylie, 2008; CMP, 2008d).

An interview with Chris Siefert, Deputy Director, provided me with a deep understanding of CMP's green practices and exhibits. Siefert has sporadically worked at CMP since 1992 when he was a graduate student and employed at the museum part-time. Siefert was the Director of Exhibits from 1998 to 2000. From 2000 to 2004, he was Project Manager for the expansion while taking classes to become a LEED accredited professional. Siefert returned to CMP in 2007 at his current Deputy Director position, providing vision and management to the institution. In this position, Siefert describes himself as "the go-to person for all the green and sustainability issues" (Siefert, personal communication, September 25, 2008).

CMP Organizational Information

CMP offers exhibits and educational programs for children, school groups, and outreach audiences. CMP bases its exhibits on the philosophy that visitors should "play with real stuff." The philosophy is integrated into museum experiences where children interact with real things and processes in order to challenge their abilities. Exhibits and programs are open-ended and inquiry-based experiences that encourage reflective thinking and are not built around specific learning goals. The objective is to help children

understand the world and themselves better. Exhibits are multi-layered and appeal to a broad age range (CMP, 2008b).

Exhibits include a garage workshop, waterplay, a nursery, an outdoor playground, and Mister Rogers' Neighborhood, an homage to a Pittsburgh hero. CMP believes that seeing and producing art is an important component to child development, so the museum displays many permanent and changing artworks. Additionally, CMP has an art studio where children can experiment with painting, print making, paper making, and clay in self-guided activities and demonstrations. Finally, the museum has a traveling exhibit program that rents and sells exhibits to outside organizations (CMP, 2008b). In 2006, CMP spent \$1,487,774 on exhibits out of a \$5,954,844 expense budget (CMP, 2007a).

CMP Green Facility

It has always been the museum's mission to provide a healthy and stimulating environment for children. CMP has used nontoxic materials in its exhibits since its founding in 1983 (Judy, 2006, Werner, 2006). However, the museum gives credit to its facility expansion project for launching its efforts in sustainability. CMP saw green design as a natural extension of its mission and it committed to LEED early in the project. When the \$10 million project completed in 2004, it had linked two historic landmarks with a third structure to give the museum a total of 74,000 square feet of programmatic space. CMP is currently the largest LEED-certified silver museum in the country (Brophy & Wylie, 2008; CMP, 2008c; CMP, 2008d; Green Building Alliance, 2008a; Rosenblum, 2005; Rosenblum, 2006).

CMP opened operations in the basement of the Old Post Office building for the city of Allegheny. The building opened in 1898 as the main post office for Allegheny, a city that flourished independently until 1907 when it ceded into the city of Pittsburgh. Today Allegheny is known as Pittsburgh's North Side. The Old Post Office is listed on the National Register of Historic Places. The 20,000 square foot building of Italian Renaissance design is crowned with a four-story, copper domed rotunda. Today, the dome provides the ceiling for the museum's art studio (CMP, 2008b; NPS, 2008; Rosenblum, 2006).

The expansion project linked the Old Post Office to the neighboring Buhl Planetarium, a building of Art Deco design that is also listed on the National Register of Historic Places. The estate of Henry Buhl, a philanthropist from Allegheny, founded the Buhl Planetarium and Institute of Popular Science, which opened in 1939. For decades, the Buhl Planetarium was a virtual night sky for a chronically smoky city that rarely saw a clear one. The planetarium closed to the public in 1991. Throughout its lifetime, it used the Zeiss II Planetarium Projector, the last of its kind to be built and one of the last in existence. The Carnegie Science Center acquired the Zeiss projector and hopes to place it on permanent display. Now, the Buhl Planetarium houses CMP exhibits and administrative offices (CMP, 2008b; NPS, 2008; Rosenblum, 2006).

CMP built a contemporary structure to connect the two historic landmark buildings. It is a "lantern" building, composed of glass walls that allow natural light to illuminate public space (CMP, 2008b; Green Building Alliance, 2008a; Militelo, 2006; Rosenblum, 2005; Rosenblum, 2006). CMP allocated over \$500,000 to commission twelve artists for new interactive artworks for the expansion. The most prominent piece is

Articulated Cloud, designed by environmental artist Ned Kahn in collaboration with Koning Eizenberg Architecture. It is a poly carbonate screen that covers the facade of the connection building. The screen consists of tens of thousands of hinged square tiles that respond like waves as air currents blow across the building. The artwork raises environmental awareness by making invisible natural forces visible. With the building's lantern design, the piece can be seen inside the museum and out (CMP, 2008b; Lowry, 2005; Militelo, 2006; Rosenblum, 2005; Rosenblum, 2006).

The expansion project used green design. The facility's mechanical systems run about fifteen percent more efficient than traditional systems, and they contain no chlorofluorocarbons (CFCs), chemical compounds that deplete the ozone layer. The expansion uses forty percent less water than baseline, exceeding LEED requirements. Water conservation techniques include faucet aerators and dual flush toilets that conserve water with a low-flow flush option. CMP encourages alternative transportation by providing bicycle parking and locker rooms with a shower for staff. Plus, there are special museum-adjacent parking places reserved for employees who carpool. Other employees park in an off-site garage (CMP, 2008c; CMP, 2008d; Green Building Alliance, 2008a).

The expansion used a variety of environmentally-friendly materials. All construction materials contained near-zero VOCs and were certified formaldehyde-free. Over fifty percent of materials were locally manufactured and over ten percent contained recycled content. Additionally, almost eighty percent of wood used was harvested using sustainable forestry practices (CMP, 2008c; CMP, 2008d; Green Building Alliance, 2008a).

The expansion was an adaptive reuse of the historic landmark buildings. CMP maintained 100 percent of the planetarium's existing shell and more than fifty percent of the interior structure including walls and ceilings. CMP restored and reinstalled the Foucault Pendulum, a popular exhibit of the Buhl Planetarium, in its original position. Original seats from the Buhl's Science Theater have been restored and reused in CMP's theater (CMP, 2008c; CMP, 2008d; Green Building Alliance, 2008a; Rosenblum, 2006).

During the expansion, CMP salvaged items of value from the historic buildings. CMP extracted marble panels, brass fixtures, wood paneling, limestone veneer, and over 400 theater seats, among other materials. CMP wanted to make these materials to the community at large by donating them to a local resale organization, Construction Junction (Brophy & Wylie, 2008; CMP, 2008c; CMP, 2008d; Green Building Alliance, 2008a; Rosenblum, 2006). Construction Junction is Pittsburgh's only independent, non-profit resale organization. Its mission is to support and promote conservation through the reuse of building materials (Construction Junction, 2008). However, the City of Pittsburgh owns the both the Old Post Office and the Buhl Planetarium. At the time, there were laws that prohibited third parties from profiting from the sale of city property. These laws would require the planetarium's items of value to go to a landfill. CMP worked to changes them. The museum initiated a unique arrangement between the City and Construction Junction that allowed building materials to be resold at the nonprofit while the City received a percentage of the proceeds. Now, materials from all city government construction projects can be reused and recycled at Construction Junction (Brophy & Wylie, 2008; CMP, 2008c; CMP, 2008d; Green Building Alliance, 2008a; Rosenblum,

2006). CMP's expansion project diverted over sixty percent of its construction waste from landfills, but it also led to far-reaching conservation effects.

CMP has received positive feedback on its expansion project and sustainable programming, including several awards (Siefert, personal communication, September 25, 2008). They include the 2008 Platinum Green Power Award from Pennsylvania's Future (PennFUTURE), the 2008 Western Pennsylvania Environmental Award from the Pennsylvania Environmental Council, the 2007 Rudy Bruner Gold Medal Award for Urban Excellence, the 2006 National Preservation Honor Award from the National Trust for Historic Preservation, and the 2006 American Institute of Architects Honor Award for Architecture (CMP, 2008b; CMP, 2008c). "We have received a lot of complements," said Chris Siefert, Deputy Director. "But I think the biggest one is that we've had record crowds for the past four years. People just keep coming back here. They're not coming back here necessarily because we're a green museum, but because we are a comfortable and open place" (Siefert, personal communication, September 25, 2008).

CMP Operational Sustainability

As a result of the LEED expansion project, CMP made an institutional commitment to ongoing green programs and maintenance practices. The museum has adopted the three tenets of sustainability—environment, society, and economy—to guide its operations (CMP, 2008d; Siefert, personal communication, September 25, 2008).

One way the museum's commitment to environmental sustainability materializes is in its energy use. CMP purchases 100 percent of its electrical power from renewable sources. On its roof, there is a three kWh photo voltaic system (solar panels) that power

the globe lights in the museum's Grand Hall. Much of the exhibit space uses natural lighting. When artificial light is necessary, it is controlled with motion-detection sensors (CMP, 2008c; CMP, 2008d).

CMP has several education programs dedicated to environmental education for early childhood, youth, school, and outreach audiences. Many of the classes get children outside to experience nature. Often, local organizations visit the museum to lead environmental programs. As part of the silver LEED rating, CMP, in collaboration with community partners, offers a two-part professional development program for teachers on how green can be incorporated into school environmental curriculum (CMP, 2008a; CMP, 2008b).

CMP composts café food wastes inside a worm bin through vermicomposting. During the biweekly program *Worms are Wonderful*, museum visitors can feed the worms food scraps and learn about worm biology and composting. The Pennsylvania Resources Council custom-made the museum's worm bin that is home to 30,000 worms. The museum café also uses corn-based compostable cups and potato-based biodegradable utensils (CMP, 2008a; CMP, 2008d).

CMP has a commitment to financial sustainability. CMP aims to exceed the national standards of earn income for museums (fifty percent earned income and fifty percent unearned income). Its goal is to earn seventy percent of operating funds itself, while relying on only thirty percent from public funding. Right now CMP is close to its goal, with a 65/35 percentage (Siefert, personal communication, September 25, 2008).

Currently, CMP is focusing its efforts to social sustainability (Siefert, personal communication, September 25, 2008). The first of its two social sustainability projects is

the Allegheny Public Square Revitalization project. Allegheny Public Square is a sunken plaza in front of the museum that is dilapidated and underutilized. It is nearly an acre of brick and concrete surfaces, little green space and an inoperable fountain. In collaboration with city officials, community representatives, artists, architects and designers, CMP is transforming the square into a vibrant green space. The vision is to create a community space that accommodates the needs of North Side families and the museum (CMP, 2008a).

The Allegheny Public Square Revitalization project began in 2007 with a design competition. The competition included an event where people from nearby neighborhoods, community leaders, and museum staff, board, volunteers, and children and teens involved in museum programs could meet with the designers. The event gave competing designers an opportunity to gather community feedback to inform their proposals. Andrea Cochran Landscape Architecture won the competition and the firm's design will come to life in the near future. Plans include sustainable design, integrated public art, bioswale gardens, play areas, and open space and terraced seating for events (CMP, 2008a; Siefert, personal communication, September 25, 2008).

CMP's second social sustainability project is the Charm Bracelet Project. Pittsburgh's North Side has many cultural and entertainment opportunities, including the two major-league stadiums and several museums. However, these opportunities are spread out through diverse neighborhoods. In 2007, CMP initiated a collaboration among stakeholders, community leaders, area institutions, and city and government officials to brainstorm ideas on how to address the needs of the North Side. The Charm Bracelet Project developed from this collaboration that aims to unite the area's cultural and

recreation institutions that represent distinct “charms.” See figure 4.02 that lists the institutions involved in the Charm Bracelet Project. The charms will be linked through physical, programmatic, and symbolic connections to create a unified public cultural district. The Charm Bracelet Project will work to enhance the neighborhood's existing identity and to reclaim the lost historical identity of the City of Allegheny (CMP, 2008a; Siefert, personal communication, September 25, 2008). It is hoped that this project encourages a family environment and creative initiatives that address the needs the community. Siefert said, “We feel it’s vital to build these connections through these residential communities, through these neighborhoods, cross this district, one, for our own viability, but two, for the viability of the neighborhood” (Siefert, personal communication, September 25, 2008).

Figure 4.02

CMP Charm Bracelet Project Charms	
<ul style="list-style-type: none"> - Children’s Museum of Pittsburgh - Carnegie Science Center + Sports Works - The Andy Warhol Museum - The Mattress Factory - City of Asylum - The National Aviary - Allegheny Regional Carnegie Library of Pittsburgh 	<ul style="list-style-type: none"> - Allegheny Commons - Manchester Craftsmen’s Guild - New Hazlett Theater - Kayak Pittsburgh-Venture Outdoors - Artist Image Resource - Photo Antiquities Museum - Sarah Heinz House - North Side Leadership Conference

Siefert said that CMP is devoted to social, environmental, and fiscal sustainability because “we feel it is an extension of our mission, it’s who we really are, and we need to do it” (Siefert, personal communication, September 25, 2008). He believes that overall, most CMP employees are committed to the mission of sustainability. He attributes this to

the museum's practice of hiring younger professionals. "We really value younger people's ideas and innovation because that's where it typically comes from," he said (Siefert, personal communication, September 25, 2008). However, Siefert recognizes the few skeptics on staff, "It's funny, they're either the far left or the far right." He said that some staff members believe that the museum is not doing enough for sustainability while others believe that its green practices are not necessary (Siefert, personal communication, September 25, 2008).

CMP employees can volunteer to serve on the green committee that responsible for implementing sustainable strategies across museum departments. Whenever the museum begins a new green project, it designates a project manager who leads and monitors progress (Siefert, personal communication, September 25, 2008). One of the green committee's most recent initiatives is establishing the museum as a collection site for recyclables from the community. CMP also recycles within staff operations and public space (Brophy & Wylie, 2008).

CMP Green Theme Exhibits

Even though CMP accomplishes a lot with its efforts in environmental, social, and economic sustainability, the museum has chosen not to interpret its sustainable practices because it believes that does not align with its mission. There is almost no signage anywhere in the museum. CMP exhibits are about doing things, not reading things (Siefert, personal communication, September 25, 2008). The only place where green practices are interpreted is on small tabletop signs in the café. These three-sided signs cover topics such as CMP's community recycling program, adaptive reuse of historic

buildings, and LEED certification (Observation, September 25, 2008; Siefert, personal communication, September 25, 2008).

CMP does provide information about its sustainable practices, not in the museum, but on its Web site. The CMP Web site has four interfaces, each designed especially for targeted audiences: kids, parents, educators, and “museum geeks.” The home page for each interface has a representative graphic of the museum facility. Users can rollover different hot spots on the graphic that describes a museum feature, often related to its green design and practices. Additionally, each interface has a page dedicated to the green museum that goes into depth on CMP’s sustainable practices (CMP, 2008b).

CMP has a few green theme exhibits. They include the *Articulated Cloud* artwork that responds to wind currents. Additionally, CMP is planning to redesign its waterplay exhibit to include environmental themes but plans are currently in the early stages. In the outdoor exhibit *The Backyard*, there are two green theme exhibits that demonstrate how solar panels work. One exhibit is a treehouse that children can climb. There are solar panels on its roof that soak up sun in the day to power the blue lights that illuminate the treehouse at night. In a second exhibit, a solar panel produces power to spin a wheel on top of a tall, red pole. Connected to the solar panel are two rubber flaps—one with holes and one of solid rubber. When children flip the flap with holes over the solar panel, the spinning wheel slows down. Next, children cover the panel with the solid mat to stop the wheel. Then, children can experiment by covering the solar panel with their hands and bodies. This exhibit teaches that the amount of sunlight determines the strength of solar panels’ power (Observation, September 25, 2008; Siefert, personal communication, September 25, 2008).

CMP Green Design Exhibits

While green theme exhibits may be outside the organization's mission, green design exhibits aligns directly with CMP's goal to provide a safe and engaging environment for children. CMP's uses green exhibit design because its visitors are children who use all their senses to explore, putting their hands and mouths on everything. The museum has found that kid-friendly equates to environmentally-friendly. In CMP exhibitions, all materials are non-toxic. Plus, all paints, adhesives, sealants, carpets and composite wood used in exhibits are certified as formaldehyde-free and containing low or zero VOCs. Most of the museum's exhibit furniture and other structures are made from rapidly-renewable wheat board composite. When carpet is used, it is made from natural wool (CMP, 2008c; CMP, 2008d; Judy, 2006; Siefert, personal communication, September 25, 2008; Werner, 2006).

CMP's nursery exhibit, designed for the museum's youngest visitors, is an example of when the museum changed an exhibit material to align with sustainability. In the nursery there is a circular bin filled with bird seed that older infants and young toddlers can shift and filter through different devices. This exhibit used to contain rice instead of bird seed. After CMP considered the unequal distribution of food and resources in the world, the museum made a conscious choice to switch materials. CMP found that bird seed functioned as well as rice in the exhibit, while costing less. The choice ended up being socially, environmentally, and financially sound (Observation, September 25, 2008; Siefert, personal communication, September 25, 2008).

CMP exhibits are green in more ways than just materials. The museum employs reuse in many of its exhibits. For example, the museum salvaged an old bowling alley and converted it into a slide for the exhibit *The Attic*. Additionally, historic building materials are employed to produce an engaging and artistic environment. The Pittsburgh History and Landmarks Foundation provided stained glass windows and other building artifacts salvaged from the Buhl Planetarium and other historic properties to decorate the inside and outside of the museum. The museum has also adapted exhibits to the existing space provided by the historic buildings. The Buhl Planetarium's dome was not modified for its current role as ceiling for the exhibit *The Garage*. CMP built twisting wire tracks that travel around the dome. Visitors feed balls onto the tracks and watch as take off on a journey around the dome. The combination of today's technology within historic landmark buildings makes for a unique experience (CMP, 2008b; CMP, 2008c; CMP, 2008d; Observation, September 25, 2008; Siefert, personal communication, September 25, 2008).

CMP Case Study Summary

Like Phipps, CMP shows that green practices must align with a museum's mission. Even though green theme exhibit signage does not relate the philosophy "play with real stuff," CMP still gets the word out about its green practices. With a unique formula of green theme exhibits that contain no text, green design exhibits, Web site content, public programs, classes, and art, CMP uses a variety of methods to communicate sustainability. Additionally, CMP illustrates that museums can be effective facilitators of social sustainability as well as environmental sustainability. I am looking

forward to seeing how CMP's social sustainability projects—Allegheny Public Square Revitalization and the Charm Bracelet—come into fruition and what innovative projects the museum has in the future.



Chapter five

conclusions + recommendations

5.01 Restating the Problem and Purpose

The goal of this project was to investigate the relationship between sustainability and museums, with a focus on museum exhibitions, in order to produce guidelines that could possibly inform museum professionals in their efforts to green their institutions. To accomplish this, I conducted three case studies of leading green museums: the Oregon Museum of Science and Industry (OMSI), Phipps Conservatory and Botanical Gardens (Phipps), and the Children's Museum of Pittsburgh (CMP). Supported by a literature review, case study data collected through interviews, on-site observations, and document analysis informed answers to my research questions:

1. What is sustainability?
2. Why should museums as institutions be concerned with sustainability?
3. What green practices are museums currently practicing in their administration and exhibitions?
4. How are museums communicating their green efforts to the public?
5. How are museum exhibits used to educate visitors about sustainability concepts?
6. What green design techniques are used in the development of green exhibits?

Answers to these questions informed a response to my main research question: How are green museums producing green exhibitions? Findings of this research are non-generalizable considering the small sample size compared to the diversity of the museum field. However, they provide valuable insights into the activities of a new trend in arts administration—green museums.

5.02 Summary of Findings: Research Questions and Answers

The responses to my research questions provide essential information to understanding green museums and green exhibitions. Answers to research questions are

based on similarities of the literature review and collected data, as well as a comparison of case studies.

What is sustainability?

This project shows that sustainability is a broad topic best understood within a specific context (Link, 2006; United Nations, 1987; Worts, 2006). Museums as institutions provide the context to sustainability in this research. For museums, sustainability means a culture of sustainability where human values, behaviors, and beliefs reflect a knowledgeable and respectful relationship with the natural environment so that future generations may enjoy a quality of life similar, or better, to contemporary society. A culture of sustainability promotes a healthy environment, an equitable society, and a prosperous economy (Link, 2006; Scarpino, 2004; United Nations, 1987; Worts, 2003; Worts, 2004; Worts, 2006). Museums are participants in and facilitators of a culture of sustainability.

Each museum will likely have a different understanding of what sustainability means and how it manifests itself in museum operations. It is important for museum administrators to define sustainability as it relates to their specific institution. An articulated and apt definition provides direction for a museum's efforts in sustainability (Brophy & Wylie, 2006; Brophy & Wylie, 2008; Wylie & Brophy, 2008). Both OMSI and CMP use the three tenants of sustainability (environment, society, and economy) to guide their green efforts. However, the product of that definition—each museum's green practices—is very different. This may be due to how each museum articulated their sustainable policy. OMSI's policy focuses its efforts to carbon dioxide emission

reduction, waste reduction and prevention, green exhibit production, and sustainable public education—goals that are mostly related to environmental sustainability (Willcox, personal communication, September 12, 2008). On the other hand, CMP is focusing its current sustainability projects to social sustainability (Siefert, personal communication, September 25, 2008).

CMP taught me that museum sustainability is not limited to the environmental sphere. When I began this project, environmental sustainability was the focus. Now I believe that the three tenants of sustainability may form a definition that is especially useful to the museum field, (Hawkes, 2001; Link, 2006; McDonough & Braungart, 2002; Worts, 2006). CMP embodies this meaning well. The museum has accomplishments, ongoing projects, and future goals related to sustainability of the natural environment, its community, and institutional financial stability (Siefert, personal communication, September 25, 2008). The three tenets of sustainability broaden the reach of green museums by providing opportunities to positively impact the social and economic spheres of sustainability.

Finally, sustainability in a museum context also indicates green design (McDonough & Braungart, 2002; Mendler & Odell, 2000). All three case studies are housed in facilities that either had some green design features and technologies, or were LEED-certified. Museums are prominent institutions in Western society. When museums use sustainable design and green technologies in their facilities, they increase public awareness of the relationship between the built and natural environments. Additionally, green design is incorporated into museum exhibitions. OMSI, Phipps, and CMP develop green design exhibits with environmentally-friendly materials while incorporating the

three Rs (reduce, reuse, and recycle). Employing sustainable design in exhibitions benefits the natural environment and the people inside the museum.

Why should museums as institutions be concerned with sustainability?

The professional and public interest in green museums shows that sustainability is a pertinent issue to museum administration. It is a new issue, but it is likely to gain strength. In order to remain competitive and relevant in the profession and to the public, museums should consider incorporating sustainability into their operation (Brophy & Wylie, 2006; Brophy & Wylie, 2008; Wylie & Brophy, 2008).

Sustainability requires humans to adapt to current environmental challenges by changing their culture in terms of values, attitudes, and habits concerning the environment (Worts, 2006). Museums can help to facilitate this change through encouragement and education. Certain roles and characteristics position museums with a responsibility to be active in sustainability.

Museums create and transmit culture through the preservation of collections and through their programming (Gurian, 1999; Skramstad, 1999; Sullivan, 1994). Therefore, green museums can thoughtfully create a culture of sustainability through the choice of objects to collect and the choice of programming to produce. For example, Phipps was formerly dedicated solely to horticulture, the aesthetic study of plants, presenting its collections to the public in terms of their beauty. Today Phipps is heavily involved in sustainability. When visitors attend the conservatory, they experience the beauty of plants while learning about human's role in the global ecosystem. Phipps teaches environmental

education, helping to create a culture of sustainability (Mikulas, personal communication, September 24, 2008).

Museums are educators that reach large and diverse audiences; therefore, they can teach sustainability to a wide variety of people (AAM, 1992; Gurian, 1999; Munley, 1999; Skramstad, 1999). OMSI has signage that instructs visitors to sort and throw away café trash into the appropriate recycling, compost, and waste streams. The museum teaches visitors to recycling and composting methods in order to encourage these habits at home. Each day, OMSI welcomes new visitors who are exposed to sustainability education. Green museums spread sustainable knowledge among a wide audience (Willcox, personal communication, September 12, 2008).

A final characteristic to address is that museums are forums to discuss pressing, contemporary issues (Gurian, 1999; Munley, 1999; Ševčenko & Russell-Ciardi, 2008; Skramstad, 1999). With its Charm Bracelet Project, CMP invited a variety of community stakeholders to the museum to discuss methods of uniting neighborhood cultural and recreational institutions in order to strengthen the community at large. CMP became a forum of civic engagement to address community needs and promote social sustainability (Siefert, personal communication, September 25, 2008). Green museums use civic engagement and community forums to advance a culture of sustainability.

What green practices are museums currently practicing in their administration and exhibitions?

Each museum will incorporate sustainability in different ways. Museum missions will determine what green practices are used, interpreted for visitors, and to what extent

(Brophy & Wylie, 2006; Brophy & Wylie, 2008; Wylie & Brophy, 2008). At its core, museum sustainability is about decisions. A museum's board, management, and personnel will decide whether or not to incorporate sustainability into institution operations. If so, then sustainability will be a factor in all administrative and programmatic decisions. A sustainable choice is analyzed in light of its intended and unintended consequences on the natural, social, and economic environment. The best way to make a sustainable decision is be informed.

The greening of a museum is a constantly evolving process. Museums often start their efforts in sustainability with “low hanging fruit,” or projects that are relatively easy to identify and accomplish (Brophy & Wylie, 2008). Then, organizations move on to larger, more difficult projects. For example, CMP had to establish an effective recycling program within the organization before becoming a drop-off site for community recyclables (Siefert, personal communication, September 25, 2008).

Projects that are easy to achieve in one museum may be difficult in another (Brophy & Wylie, 2008). When OMSI installed bioswales in its parking lot, it had support from the City of Portland and the Bureau of Environmental Services. They provided the museum with knowledge and resources that made the bioswale project relatively easy and successful (Willcox, personal communication, September 12, 2008). On the other hand, CMP is planning to install bioswales for its Allegheny Square Revitalization project. CMP Deputy Director Chris Seifert said that the museum needs to conduct its own research and consult with experts to help implement the project. Seifert mentioned the possibility of talking with the City of Portland for advice (Siefert, personal communication, September 25, 2008). Even though CMP's bioswales are a small part of

a larger project, installing bioswales at CMP is more difficult than it was at OMSI. Green museums share a common goal—sustainability—but their individual steps to get there will be different.

My case studies clearly show that each green museum will have unique strengths and weaknesses. OMSI excels at green design exhibits with its Green Exhibit Certification guide (Willcox, personal communication, September 12, 2008). With Project Green Heart, Phipps is strong in its efforts to educate the public about sustainability and the institution's green practices (Mikulas, personal communication, September 24, 2008). CMP does its best work in social sustainability with its Charm Bracelet Project and Allegheny Public Square Revitalization project (Siefert, personal communication, September 25, 2008). I believe there is not one green museum that is the best or most accomplished among my case studies and among green museums throughout the nation. Each is unique. However, the quality of a museum's green practices can be analyzed. Museums must thoughtfully plan, implement, and evaluate their sustainable practices. If museums don't do this, then they can injure their reputations, as well as environmental health, social justice, and economic viability. Additionally, green museums must never be involved in greenwashing because it takes advantage of the public's trust in the museum and the hope for a culture of sustainability.

How are museums communicating their green efforts to the public?

Museums communicate their green efforts through a combination of programs, exhibits, Web sites, and marketing. Using multiple methods of communication increases effectiveness and utilizes the museum's maximum potential (Brophy & Wylie, 2008).

Green museum will have a different mix of communication tools: OMSI has exhibits about environmental themes and that interpret the museum's sustainable practices; Phipps offers exhibits that explore ecosystems and that explain the conservatory's green efforts, plus classes, Web content, and an active marketing department; finally, CMP has experiential exhibits about sustainable concepts, environmental education classes, and Web content.

Web sites are especially important because they are a world-wide medium capable of reaching people who may never visit a museum. Plus, Web sites are a virtual medium that does not require consumption of paper or other physical resources. Green museums should be creative in the design of their Web sites. CMP's Web site illustrates the museum's green practices and targets the message to children, parents, teachers, and museum professionals through the use of multiple interfaces (CMP, 2008b). Phipps' Web site offers educational resources for living a sustainable lifestyle (Phipps, 2008a). On the other hand, OMSI does not have Web site content devoted to its green practices, restricting its ability to communicate sustainability (OMSI, 2008a).

My case studies taught me that green museums must make a concentrated effort to communicate their green practices not only to the public, but within their organization as well. When museums adopt sustainability as a guiding principle, it is intended to be holistic in scope with sustainability running through all departments (Brophy & Wylie, 2006; Brophy & Wylie, 2008; Wylie & Brophy, 2008). Although it is desired to have full participation from staff, it is likely that not all museum employees will be committed to sustainability. All three case studies admitted that they did not have 100 percent participation from staff (Mikulas, personal communication, September 24, 2008; Siefert,

personal communication, September 25, 2008; Willcox, personal communication, September 12, 2008). The people that work at a museum are diverse and include board members, management, researchers, educators, maintenance personnel, and volunteers. An employee's commitment to sustainability will vary and depend upon individual values, beliefs, and habits, as well as characteristics like age and occupation. Heather Mikulas, Education Specialist for Interpretation and Public Programming at Phipps, said that in order to increase staff participation, museums must make compliance to green practices easy and rewarding. Expectations for conduct must be communicated clearly and repeatedly (Mikulas, personal communication, September 24, 2008).

How are museum exhibits used to educate visitors about sustainability concepts?

Museum exhibits communicate sustainability through content and design. A green theme exhibit explores a topic related to sustainability. One type of green theme exhibit interpret a museum's green technology and sustainable practices This green theme exhibit leads by example encouraging museum visitors to live a sustainable lifestyle (Brophy & Wylie, 2006; Brophy & Wylie, 2008). Green theme exhibits are not appropriate for every museum. CMP has chosen not to interpret its sustainable practices because the museum produces fun and challenging experiences while using very little signage. At the same time, CMP is considering employing environmental themes in the redesign of its waterplay exhibit. The museum feels that this green theme exhibit aligns with its mission because it will use experiences, not words, to demonstrate sustainable

concepts (Siefert, personal communication, September 25, 2008). A museum's mission will determine if and what type of green theme exhibits is displayed.

Green design exhibits communicate sustainability through their design (Brophy & Wylie, 2006; Brophy & Wylie, 2008). It may not be obvious to the casual visitor because green design often looks similar to traditional design (Matthiessen & Morris, 2007; McDonough & Braungart, 2002; Mendler & Odell, 2000; U.S. Green Building Council, 2008). However, museums attract a diverse audience, indicating that some visitors will probably have knowledge about green design. Some green design techniques can be observed by casual visitors. For example, OMSI uses old traveling exhibit shipping crates as tables for permanent exhibit activities. Visitors cannot miss this interesting and sustainable exhibit furniture (Willcox, personal communication, September 12, 2008).

What green design techniques are used in the development of green exhibits?

Green design exhibits try to mitigate a museum's affect on the environment (Bell & Sarna, 2008; Brophy & Wylie, 2008; Exhibitor Magazine Group, 2007; Gray, 2008; Madison Children's Museum, 2008; McLean, 1993). Much of green exhibit design focuses on the use of environmentally-friendly materials and the three Rs—reduce, reuse, and recycle. Green exhibits contain materials that have low volatile organic compounds (VOCs). Museums can experiment with the cradle to cradle design and try to eliminate exhibit waste by design. While eliminating waste may be a tall order, museums can reduce it by designing exhibits furniture for multiple purposes. Green museums can learn green design techniques from one another. OMSI provides a good example of green

exhibit design. Its techniques include the use of: refurbished or reused materials; rapidly renewable materials; certified wood grown under environmentally responsible conditions; low-VOC materials; local materials; and recyclable materials. The museum also concentrates on recycling and reducing construction waste, designing exhibits for energy efficiency, and incorporating multi-purpose design into exhibit furniture (Willcox, personal communication, September 12, 2008).

How are green museums producing green exhibitions?

Green exhibits are a small part of the whole green museum (Brophy & Wylie, 2008). Museum administration must decide if green exhibits are appropriate for the institution. If so, then the relevancy of green exhibits must be compared to other sustainable projects. Management will decide how much time and resources it will devote to greening the exhibit department. It should not be considered “bad” if green exhibits are not the priority of the institution. Time and resources may be better used in another sustainable project that has greater benefits, aligns better with the museum’s mission, or is easier to accomplish. For instance, green exhibits are not the priority at Phipps because its exhibits largely use plants and materials. Instead, Phipps devotes a majority of its time and resources to sustainable programming (Mikulas, personal communication, September 24, 2008).

Like green museums themselves, green exhibit design is an evolving process. Most exhibit professionals do not have formal education in green design (Exhibitor Magazine Group, 2007). Green design exhibits developed at OMSI because one staff member was motivated to hold exhibit construction accountable to sustainability

(Willcox, personal communication, September 12, 2008). Even though OMSI provided the most plentiful data on green design exhibits, the museum has not finalized its green design methodology. In museums, green design exhibits often evolve organically. As exhibit developers learn and experiment, green exhibit design will improve.

Finally, green design exhibits involve give and take. Some design considerations may have to be sacrificed for sustainability. For example, OMSI often scales back the physical size of the exhibit in order to conserve resources. Jessica Willcox, OMSI Creative Director in the Exhibits Department, said that while sustainability is a goal, the one thing that cannot be sacrificed is the visitor's experience (Willcox, personal communication, September 12, 2008). A green design exhibit that does not engage visitors will fail to accomplish its intended goal of facilitating a culture of sustainability.

5.03 Recommendations

From the analysis of the collected data and the answers to my research questions, I developed a set of recommendations applicable to green museums and green exhibits.

Share Information

OMSI, Phipps, and CMP all said staying informed is the biggest challenge to planning and applying sustainable practices at their museums (Mikulas, personal communication, September 24, 2008; Siefert, personal communication, September 25, 2008; Willcox, personal communication, September 12, 2008). Therefore, I suggest that green museums engage in an active and open dialogue about their efforts in sustainability. Communication across institutions would provide learning opportunities

and allow for experimentation. I recommend establishing a medium of communication for green museums. By having a single, known forum, a green museum community could grow. The Internet could act as the community forum. Web sites, blogs, and wikis can connect green museum professionals across the nation and around the globe. A green museum community would provide knowledge and motivation for its members and make museum sustainability a collaborative, supportive process. The Professional Interest Committee on Green Museums through the American Association of Museums may be the appropriate party to facilitate the community.

Partnerships

Sustainability has effects far beyond the museum walls. To help achieve their goals, green museums can partner with environmental nonprofits and other like-minded organizations. Collaborations with outside organizations could be mutually beneficial. For example, the partnering organization could provide the museum with expert knowledge while the museum could be a venue for the organization's educational programming. Collaborations with outside organizations and sharing information among museums will allow the green museum movement to grow.

Commit to Sustainability at Project Commencement

The Brundtland Commission's definition of sustainability suggests that planning and foresight are important to a sustainable society (World Commission on Environment and Development, 1987). The same is true for museums. OMSI found that it is important to commit to sustainability before a project begins. The reason their exhibit Innovation

Station was so successful was because the design team set specific green goals before any work was done. In subsequent exhibits, sustainability became an afterthought, reducing effectiveness of any green efforts. Now OMSI's Green Exhibit Certification guide provides clearly defined goals and measurements for success.

Evaluation

Museum sustainability involves planning and evaluation. Without evaluation, a green museum does not know the effectiveness of its green practices or its sustainability education. Both OMSI and Phipps use signage in their cafés to help visitors sort trash, recyclables, and compost. OMSI has evaluated its signage by recording how often and why visitors make a mistake when sorting their café waste. Then, OMSI changed the wording and graphics of its signage to improve results. On the other hand, Phipps has never evaluated the effectiveness of its café signage. Therefore, the conservatory does not know what is effective and what is not working. In order for green museum exhibits and practices to have the biggest possible impact, they must be evaluated.

Accreditation

Museum sustainability is an evolving process within a single institution and within the larger museum profession. At this time, there are no specific requirements that qualify or exclude an institution in being a "green museum." Sustainability may become a required museum practice and a condition of accreditation. If this is true, then there is a need for formalized standards and regulations for green museums. Creating and monitoring regulations would be a difficult process. However, standards would ensure

quality and commitment from museums. Regulations may be a long-term goal, attainable only after sustainability has been better established in museums.

Formal Education

Sustainability could be integrated into museology curriculum at the university level, especially if sustainability becomes a required professional practice. Course work could include learning about sustainable theories, environmentally conscious exhibition techniques, or environmental education methodology. It could be interdisciplinary with collaboration among academic departments and with university-based museums. Beyond sustainability, museum professionals should be prepared to adapt to the pressing issues of contemporary society. Museology programs should teach students how to best facilitate civic engagement concerning political or controversial issues in a public setting with among diverse audiences.

Experiment with New Ideas

All three case studies show that museums are good venues for testing new ideas: OMSI installed bioswales that led to changes in Portland's water management regulations; Phipps is testing out a fuel cell; and CMP worked to change city laws that now allow for reuse and resale of government property. Museums are research-based institutions that receive public money and provide social service. Museums can offer space for researching innovative ideas that could benefit humans and the environment. Sustainability itself is a new idea, and is constantly evolving. Green museums are an experiment in process.

Research

My final recommendation is for the research on sustainable museums to grow. It is a new trend in arts administration and there are many opportunities to expand and strengthen research on green museums. Museum sustainability will grow and evolve over time through research and experimentation.

5.04 Final Thoughts

In conclusion, I feel fortunate to have researched green museums and green exhibits. As an emerging museum professional, I plan to support the green museum movement by encouraging sustainable practices in my future place of employment. Green museums are a new and exciting movement in arts administration and I am looking forward to observing how it grows. My research has prepared me to detect emerging trends in the museum field and to actively support those I find significant. By studying green museums, I have realized the importance of museums' ability to adapt to contemporary issues in order to stay relevant in the twenty-first century and beyond.

References

- Abeyasekera, K. (2006.) *Sustainable exhibit design: Guidelines for designers of small scale interactive and travelling exhibits*. Lincoln, UK: The author.
- American Association of Museums. (2008). *American Association of Museums Web site*. Retrieved April 11, 2008, from www.aam-us.org
- American Association of Museums. (1992). *Excellence and equity*. Washington, D.C.: The Association.
- Associated Press. (2008). California science museum reopens with green theme. Retrieved September 25, 2008, from www.cnn.com/2008/TRAVEL/09/24/museum.makeover.ap/
- Association of Zoos and Aquariums. (2008). *The guide to accreditation for zoological parks and aquariums: 2008 edition*. Retrieved April 20, 2008, from www.aza.org
- Barrett, M. J. & Sutter, G. C. (2006, January). A youth forum on sustainability meets *The Human Factor*: Challenging cultural narratives in schools and museums. *Canadian Journal of Science, Mathematics and Technology Education*, 9-23.
- Bell, S. & Sarna, M. (2008). Building green exhibits. *Greenexhibits.org*. Retrieved October 30, 2008, from www.greenexhibits.org/connect/building_greener_exhibits.shtml
- Bernstein, F. A. (2007, March 28). From Michigan: A clean-running museum. *The New York Times*, H 18.
- Brophy, S. S. (2006, September 13). "Green money:" The funding landscape for museums thinking about going green. *Philanthropy News Digest*. Retrieved

- January 16, 2008, from
<http://foundationcenter.org/pnd/tsn/tsn.jhtml?id=156500003>
- Brophy, S. S. (2007, April 25). Board & staff: Welcoming the green revolution in your museum. *Philanthropy News Digest*. Retrieved January 16, 2008, from
<http://foundationcenter.org/pnd/tsn/tsn.jhtml?id=176400001>
- Brophy, S. S. & Wylie, E. (2006, September/October). It's easy being green: Museums and the green movement. *Museum News*, 38-45.
- Brophy, S. S., & Wylie, E. (2008). *The green museum: A primer on environmental practice*. Lanham, MD: AltaMira Press.
- California Association of Museums. (2008). *Green museums initiative*. Retrieved October 4, 2008, from
www.calmuseums.org/conferences_and_workshops/2007GMI.html
- Cascadia Region Green Building Council. (2008). *The living building challenge: In pursuit of true sustainability in the built environment, version 1.3*. Retrieved November 1, 2008, from www.cascadiagbc.org/lbc
- Center for Naval Analysis Corporation. (2007). *National security and the threat of climate change*. Retrieved May 15, 2007, from <http://securityandclimate.cna.org>
- Children's Museum of Pittsburgh. (2008a). *Children's Museum of Pittsburgh sustainable programming*. Pittsburgh, PA: The museum.
- Children's Museum of Pittsburgh. (2008b). *Children's Museum of Pittsburgh Web site*. Retrieved August 2, 2008, from www.pittsburghkids.org

- Children's Museum of Pittsburgh. (2008c). *Green buildings case studies: Children's Museum of Pittsburgh*. Pittsburgh, PA: The museum.
- Children's Museum of Pittsburgh. (2008d). *Children's Museum of Pittsburgh: How we are green*. Pittsburgh, PA: The museum.
- Children's Museum of Pittsburgh. (2007a). 2006 Form 990: Return of organization exempt from income tax. Retrieved October 20, 2008, from the GuideStar database.
- Children's Museum of Pittsburgh. (2007b). *In the community: 2006-2007 annual report*. Pittsburgh, PA: The museum.
- Clark, C. (2004). Museums, the environment, and public history. In M. V. Melosi, & P. Scarpino (Eds.), *Public history and the environment* (pp. 127-139). Malabar, FL: Krieger Publishing Company.
- Construction Junction. (2008). *Construction Junction Web site*. Retrieved September 15, 2008, from www.constructionjunction.org/
- Creswell, J. W. (2003). *Research design (2nd ed.)*. Thousand Oaks, CA: Sage Publications.
- De Varine, H. (2006). Ecomuseology and sustainable development. *Museums & Social Issues*, vol.1, no. 2, 225-232.
- Devlin, K. (2007, November). Greening a greenhouse. *Glass Magazine*, vol. 57, no. 11.

- Eilperin, J. (2007). U.N. report warns warming will harm timber industry. *The Seattle Times*. Retrieved May 3, 2007, from http://seattletimes.nwsources.com/html/nationworld/2003669257_warming17.html
- Exhibitor Magazine Group. (2007). An inconvenient booth: The economic impact of the green movement on the trade show industry. Retrieved July 12, 2008, from www.exhibitoronline.com/topics/greenexhibiting.asp
- Fields, K. J. (2008, October). New window to the world. *Eco-structure magazine*, 22-26.
- Goering, L. (2007, May 5). Climate change: Scientists say there is hope. *The Seattle Times*. Retrieved May 18, 2007, from http://seattletimes.nwsources.com/html/nationworld/2003694499_warming05.html
- Gormly, K. B. (2008, July 10). Phipps acquires pieces of Chihuly glass art. *Pittsburgh Tribune-Review*.
- Gormly, K. B. (2008, September 19). Phipps new building to be super green. *Pittsburgh Tribune-Review*.
- Gray, S. F. (2008). Feeling green about museum exhibits. Retrieved August 10, 2008, from www.exhibitbuilder.net/FeelingGreen.asp
- Green Building Alliance. (2008a). Case studies: Children's Museum of Pittsburgh. Retrieved September 20, 2008, from www.gbapgh.org/Case_Studies.asp?Method=6786&ID=9
- Green Building Alliance. (2008b). Case studies: Phipps Conservatory and Botanical Gardens Welcome Center. Retrieved September 20, 2008, from www.gbapgh.org/Case_Studies.asp?Method=6786&ID=33

- Green Seal. (2008). *Green Seal Web site*. Retrieved October 13, 2008, from www.greenseal.org
- Gurian, E. H. (1999). What is the object of this exercise? A meandering exploration of the many meanings of objects in museums. In G. Anderson (Ed.), *Reinventing the museum: Historical and contemporary perspectives on the paradigm shift*. (pp. 269-283). Lanham, MD: AltaMira Press.
- Hall, C.T. (2007). A garden in the sky: S.F. museum's roof puts green building techniques to the test. *San Francisco Chronicle*. Retrieved May 20, 2007 from www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2007/05/12/MNGGTPPKM01.DTL
- Hawkes, J. (2001). *The Fourth Pillar of Sustainability: Culture's essential role in public planning*. Melbourne: Common Ground Publishing Pty., Ltd.
- Hopey, D. (2008, July 14). Phipps ends sale of bottled water. *Pittsburgh Post-Gazette*.
- Intergovernmental Panel on Climate Change. (2007). *Mitigation of Climate Change*. Retrieved May 31, 2007, from www.ipcc.ch
- Johnson, Kimberly. (2008). One in four mammals at risk of extinction. *National Geographic News*. Retrieved October 6, 2008, from <http://news.nationalgeographic.com/news/2008/10/081006-mammals-extinction.html>
- Judy, D. (2006). Green Unseen. *Hand to Hand*, vol. 20, 7.
- Kociolek, P.J. (2006). A sustainable academy: The new California Academy of Sciences. *Museums & Social Issues*, vol.1, no. 2, 191-202.

- Lindeman, T. F. (2008, February 24). Environmental movement finds a place in companies' marketing/promotional plans. *Pittsburgh Post-Gazette*.
- Lincoln, Y. S. & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hills, CA: Sage Publications.
- Link, T. (2006). Models of sustainability: Museums, citizenship, and common wealth. *Museums & Social Issues*, vol.1, no. 2, 173-190.
- Lowry, P. (2005, January 25). A better play time: Expanded Children's Museum packs in more fun and creativity. *Pittsburgh Post-Gazette*, B1.
- Matthiessen, L.F. & Morris, P. (2007). Cost of green revisited: Reexamining the feasibility and cost impact of sustainable design in the light of increased market adoption. Retrieved January 16, 2008, from www.davislangdon.com/USA/Research/ResearchFinder/2007-The-Cost-of-Green-Revisited/
- McDonough, W. & Braungart, M. (2002). *Cradle to cradle: Remaking the way we make things*. New York: North Point Press.
- MacPherson, I., Brooker, R. & Ainsworth, P. (2000). Case study in the contemporary world of research: Using notions of purpose, place, process and product to develop some principles for practice. *International Journal of Social Research Methodology*, 3, (1), 49-61.
- Madison Children's Museum. (2008). *Greenexhibits.org*. Retrieved June 3, 2008, from www.greenexhibits.org
- McLean, K. (1999). Museum exhibitions and the dynamics of dialogue. In G. Anderson (Ed.), *Reinventing the museum: Historical and contemporary perspectives on the paradigm shift*. (pp. 193-211). Lanham, MD: AltaMira Press.

- McLean, K. (1993). *Planning for people in museums exhibitions*. Washington, D.C.: Association of Science-Technology Centers.
- Mendler, S.F. & Odell, W. (2000). *The HOK guidebook to sustainable design*. New York: John Wiley & Sons, Inc.
- Militelo, A. & Katz, L. D. (2006, June). Kids' collage. *Lighting Design & Application*, 47-52.
- Munley, M. E. (1999). Is there method in our madness? Improvisation in the practice of museum education. In G. Anderson (Ed.), *Reinventing the museum: Historical and contemporary perspectives on the paradigm shift*. (pp. 243-247). Lanham, MD: AltaMira Press.
- National Park Service. (2008). *National Register of Historic Places Web site*. Retrieved October 13, 2008 from www.nps.gov/nr/
- Neuman, L. W. (2006). *Social research methods: Qualitative and quantitative approaches (6th ed.)*. Boston: Pearson Education, Inc.
- Oregon Museum of Science and Industry. (2008a). *Oregon Museum of Science and Industry Web site*. Retrieved August 2, 2008, from www.oms.edu
- Oregon Museum of Science and Industry. (2008b). *OMSI becomes nation's first science museum to earn Salmon-Safe Certification*. Retrieved August 2, 2008, from www.oms.edu
- Oregon Museum of Science and Industry. (2008c). *OMSI debt history FAQ*. Retrieved August 2, 2008, from www.oms.edu

Oregon Museum of Science and Industry. (2008d). *OMSI green exhibit certification: A model for evaluating exhibit sustainability*. Portland, OR: The museum.

Oregon Museum of Science and Industry. (2007a). 2006 Form 990: Return of organization exempt from income tax. Retrieved October 20, 2008, from the GuideStar database.

Oregon Museum of Science and Industry. (2007b). *OMSI: Independent auditor's report and financial statements*. Portland, OR: The museum.

Oregon Museum of Science and Industry. (2007c). *OMSI: Reach*. Portland, OR: The museum.

Oregon Museum of Science and Industry. (2007d). *OMSI exhibits: Sustainability focus*. Portland, OR: The museum.

Oregon Museum of Science and Industry. (2003). *Innovation Station: Design brief*. Portland, OR: The museum.

Petrucelli, A. W. (2008, June 2). Keep of the butterflies, and please don't eat the chocolate flamingoes. *Pittsburgh Post-Gazette*.

Phipps Conservatory. (2008a). *Phipps Conservatory and Botanical Gardens Web site*. Retrieved August 2, 2008, from <http://hipps.conservatory.org/>

Phipps Conservatory and Botanical Gardens. (2008b). *Energy reduction strategies*. Pittsburgh, PA: The institution.

Phipps Conservatory and Botanical Gardens. (2008c). *Phipps Conservatory and Botanical Gardens: The green heart of Pittsburgh*. Pittsburgh, PA: The institution.

Phipps Conservatory and Botanical Gardens. (2008d). *Phipps green initiatives*. Pittsburgh, PA: The institution.

Phipps Conservatory and Botanical Gardens Inc. (2007). 2006 Form 990: Return of organization exempt from income tax. Retrieved October 20, 2008, from the GuideStar database.

Piacentini, R. V. (2007). Greening a garden. *Public Garden*, vol.22, no. 4, 17-38.

Portland Bureau of Environmental Services. (2005, January 6). *Oregon Museum of Science and Industry: Parking lot swales*. Retrieved September 9, 2008, from www.portlandonline.com/bes/index.cfm?c=44463&

Rand, J. P. (2007, November). Breathing easy. *Architect Magazine*, 43-46.

Rosenblum, C. L. (2005, January). Children's Museum grows up. *Pittsburgh History & Landmarks Foundation News*, 8.

Rosenblum, C. L. (2006, September/October). Going green: Saving old buildings in Pittsburgh the environmentally correct way. *Preservation*.

Savage, D. G. (2007). High court tells Bush: Take action on global warming. *The Seattle Times*. Retrieved April 4, 2007, from http://seattletimes.nwsources.com/html/nationworld/2003648624_scotus03.html

Scarpino, P. (2004). The creation of place over time: Interpreting environmental themes in exhibit format. In M. V. Melosi, & P. Scarpino (Eds.), *Public history and the environment* (pp. 139-153). Malabar, FL: Krieger Publishing Company.

- Scheiner, T.C. (1997). Museum ethics and the environment: In search of a common virtue. In G. Edson (Ed.) *Museum ethics*. (pp. 178-186). New York: Routledge.
- Seattle Times new services. (2007). Softened climate report riles some scientists. *The Seattle Times*. Retrieved April 11, 2007, from http://seattletimes.nwsources.com/html/nationworld/2003655878_warming07.html
- Ševčenko & Russell-Ciardi. (2008, February). Sites of conscience: Opening historic sites for civic dialogue. *The Public Historian*, Vol. 30, No. 1, 9-15.
- Skramstad, H. (1999). An agenda for museums in the twenty-first century. In G. Anderson (Ed.), *Reinventing the museum: Historical and contemporary perspectives on the paradigm shift*. (pp. 118-132). Lanham, MD: AltaMira Press.
- Stake, R. E. (1995). *The art of case study research*. Thousand Oaks, CA: Sage Publications.
- Sullivan, R. (1994). Evaluating the ethics and consciences of museums. In G. Anderson (Ed.), *Reinventing the museum: Historical and contemporary perspectives on the paradigm shift*. (pp. 243-247). Lanham, MD: AltaMira Press.
- Sutter, G. C. (2006). Thinking like a system: Are museums up to the challenge? *Museums & Social Issues*, vol.1, no. 2, 203-218.
- Tascarella, P. (2008, March 7). Phipps Conservatory looks to top successful Chihuly glass show with chocolate. *Pittsburgh Business Times*.
- Togneri, C. (2008, January 17). Phipps' tropical forest goes "beyond green." *Pittsburgh Tribune-Review*.

- United States Green Building Council. (2008). LEED rating system. *U.S. Green Building Council*. Retrieved October 12, 2008, from www.usgbc.org
- Verschuren, P. J. M. (2003). Case study as a research strategy: Some ambiguities and opportunities. *International Journal of Social Research Methodology*, 6, (1), 121-139.
- Weil, S. E. (1990). Rethinking the museum: An emerging new paradigm. In G. Anderson (Ed.), *Reinventing the museum: Historical and contemporary perspectives on the paradigm shift*. (pp. 74-79). Lanham, MD: AltaMira Press.
- Weil, S. E. (1995). Creampuffs and hardball: Are you really worth what you cost or just merely worthwhile? In G. Anderson (Ed.), *Reinventing the museum: Historical and contemporary perspectives on the paradigm shift*. (pp. 343-347). Lanham, MD: AltaMira Press.
- Werner, J. (2006). Go green and get real. *Hand to Hand*, vol. 20, 6.
- World Commission on Environment and Development. (1987). *Our common future*. Paris: UNESCO. Retrieved May 31, 2007, from www.un.org/documents/ga/res/42/ares42-187.htm
- Worts, D. (1998). On museums, culture and sustainable development. In F. Lisette (Ed.), *Museums and Sustainable Communities: Canadian Perspectives*. (pp.21-27). Quebec: International Council on Museums - Canada.
- Worts, D. (2001). Art and sustainability in Nunavut. *Muse*, vol. xix/1, 20-23.
- Worts, D. (2003). On the brink of irrelevance?: Art museums in contemporary society. In Tickle, L., et al. (Ed.), *Researching Visual Arts Education in Museums and Galleries*. Dordrecht: Kluwer Academic Publishers.

Worts, D. (2004). Museums in search of a sustainable future. *Alberta Museums Review*, 40-57.

Worts, D. (2006). Fostering a culture of sustainability. *Museums & Social Issues*, vol.1, no. 2, 151-172.

Wylie, E. (2007, February 15). Advancing your mission with a green message. *Philanthropy News Digest*. Retrieved January 16, 2008, from <http://foundationcenter.org/pnd/tsn/tsn.jhtml?id=170300002>

Wylie, E. & Brophy, S. S. (2008, January/February). The greener good: The enviro-active museum. *Museum*, 40-47.

Zipp, Y. (2008, April 9). Museums sprout 'green' architecture. *The Christian Science Monitor*. Retrieved April 15, 2008, from www.csmonitor.com/2008/0409/p13s03-sten.html

Zongker, B. (2007, May 22). Committee to examine Smithsonian exhibit. *San Francisco Chronicle*. Retrieved May 26, 2007, from www.sfgate.com/cgi-bin/article.cgi?f=/n/a/2007/05/22/national/a164214D49.DTL

Zongker, B. (2007, May 21). Smithsonian accused of altering exhibit. *The Washington Post*. Retrieved May 26, 2007, from www.washingtonpost.com/wp-dyn/content/article/2007/05/21/AR2007052100860.html

Appendix A: Greening Guidelines

Exhibit Development

- Commit to sustainability at the beginning of the development process
- Set achievable but ambitious goals for sustainability
- Evaluate success
- Brainstorm future goals
- Stay informed

Design

- Design for resource efficiency
- Design for reuse of exhibit furniture
- Design furniture for multiple purposes
- Design for deconstruction
- Use bolts, not glues
- Eliminate extraneous design

Materials

- Use materials that can be recycled
- Use recycled materials
- Use locally produced building materials
- Use rapidly renewable materials
- Use sustainably-harvested wood
- Use salvaged materials
- Use durable materials
- Use materials with low or zero VOCs
- Use nontoxic cleaning products
- Avoid the use of toxic materials
- Optimize materials use through careful planning
- Stop using materials known to be harmful to the natural environment
- Research environmentally-friendly alternatives

Construction

- Reduce construction waste
- Recycle construction waste when possible
- Separate materials into appropriate waste streams

Appendix B: Definitions

Accreditation: awarded by the American Association of Museums to recognize museums' commitment to excellence, accountability, high professional standards, and continued institutional improvement (American Association of Museums, 2008).

American Association of Museums (AAM): a national organization, representing the full scope of museums and their paid and nonpaid staff, which is dedicated to enhancing the value of museums to their communities through leadership, advocacy, and service (American Association of Museums, 2008).

Bioswales: landscaped areas filled with trees, shrubs, and other plants that capture stormwater and clean it of silt and pollution before releasing it into the watershed (Wylie & Brophy, 2008; OMSI, 2008).

Blockbuster: an elaborate, temporary exhibition covering a topic of high interest. It has a high expense budget but it generates revenue for a museum by attracting large crowds and media attention (McLean, 1993; McLean, 1999).

Brownfield: land that was used for industrial purposes and that may have environmental damages (Wylie & Brophy, 2008; OMSI, 2008).

Brundtland Commission: also known as the World Commission on Environment and Development, a United Nations commission that met in 1987 to address the concern of the deterioration of the human and natural environment. Its report, *Our Common Future*, defined sustainability as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Link, 2006; United Nations, 1987; Worts, 2006).

Cradle to cradle design: A model where waste is eliminated through product design (McDonough & Braungart, 2002).

Culture: common values, beliefs, history, mythology, rituals, symbolic objects, and built heritage of a given human group which take form in action (Worts, 2004).

Culture of sustainability: a society where human values, beliefs, and behaviors reflect the interconnection among the natural environment, human populations, and the future (Worts, 2003; Worts, 2004; Worts, 2006).

Downcycling: the recycling of a material into a product of lesser quality (McDonough & Braungart, 2002).

Exhibit: a single-component display. The word is often used interchangeably with “exhibition” (McLean, 1993; McLean, 1999).

Exhibition: a display containing multiple components. Museum exhibitions shows things, are a medium of communication, and are experiences, not products (McLean, 1993; McLean, 1999).

Formaldehyde: a toxic chemical added to products for preservation purposes that is a volatile organic compound harmful to human health (Madison Children’s Museum, 2008).

Fourth pillar: a theory that adds culture, the creation and transmission of human values, beliefs, and purpose of life, in the three pillars of sustainability. It asserts that cultural vitality is just as important to a sustainable society as environmental responsibility, social equity, and economic viability (Hawkes, 2001).

Glasshouse: a building where plants are cultivated, also called a greenhouse or a hothouse (Piacentini, 2007; Rand, 2007).

Green: objects or processes that are environmentally benign. Word often used interchangeably with “sustainable” (Brophy & Wylie, 2006; Brophy & Wylie, 2008; & Wylie & Brophy, 2008).

Green exhibit: an exhibit that covers a topic related to sustainability and/or that uses sustainable design in its construction (Brophy & Wylie, 2006; Brophy & Wylie, 2008; Madison Children’s Museum, 2008; & Wylie & Brophy, 2008).

Green design exhibit: a museum exhibit that uses green design principles in its construction, use, and disposal (Brophy & Wylie, 2006; Brophy & Wylie, 2008; Gray, 2008; Madison Children’s Museum, 2007; & Wylie & Brophy, 2008).

Green museum: a museum organization engaged in green business practices, eco-friendly facility management, and sustainable educational programming (Brophy & Wylie, 2006; Brophy & Wylie, 2008; California Association of Museums, 2008; & Wylie & Brophy, 2008).

Green Seal: an independent nonprofit organization that promotes the manufacture and use of environmentally responsible products and services through a certification program (Green Seal, 2008).

Green team: composed of volunteers who plan, implement, communicate, and evaluate sustainable choices within a given organization (Brophy & Wylie, 2008).

Green theme exhibit: a museum exhibit that explores a topic related to sustainability (Brophy & Wylie, 2006; Brophy & Wylie, 2008; Clark, 2004; Link, 2006; Scarpino, 2004; & Wylie & Brophy, 2008).

Greenwashing: exaggerating green properties or arbitrarily selecting the green aspects and ignoring the non-green aspects (Brophy & Wylie, 2008).

Horticulture: the study of plant aesthetics (Phipps, 2008a).

Indoor air quality: the quality of air within buildings as it relates to the health and comfort of human occupants. Indoor air pollution is associated with allergens, bacteria, chemicals, mold, and VOCs. Indoor air quality can be improved with proper ventilation, low toxicity building materials, and green design (USGBC, 2008).

Leadership in Energy and Environmental Design (LEED): the LEED Green Building Rating System is a third-party certification program based on its nationally accepted benchmarks for the design, construction and operation of high performance green buildings (USGBC, 2008).

Living Building Challenge: developed by the Cascadia Region Green Building Council, attempts to raise the bar of green design and define the highest level of sustainability in the built environment by encouraging projects to go beyond LEED platinum certification requirements (Cascadia Region Green Building Council, 2008).

Museum: a legally nonprofit organization that is essentially educational in nature, guided by a mission, and that collects, preserves, and interprets patrimony (American Association of Museums, 2008).

National Register of Historic Places: the official list of the United States' historic places worthy of preservation that is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources (National Park Service, 2008).

Patrimony: an object or objects of value that represent humanity's natural and cultural heritage (De Varine, 2006; Scheiner, 1997).

Permanent exhibit: a museum installation designed to last five to ten years or longer that covers a topic important to the museum, its collections, or its original research (McLean, 1993; McLean, 1999).

PIC-Green: one of the American Association of Museums' professional interest committees. Its mission is to support green museum initiatives through dialog, sharing data and case studies, and networking that leads to professional development and environmentally sustainable innovations (American Association of Museums, 2008).

Rapidly renewable material: a product made from plants that regenerate themselves quickly and easily, usually within a ten-year cycle or shorter (Madison Children's Museum, 2008).

Sustainability: a way of life that meets the needs of the present and future generations by balancing the needs of the natural environment, society, and economy through the recognition that human individual and collective behavior affects and is affected by the earth (Link, 2006; United Nations, 1987; Worts, 2003; Worts, 2004; Worts, 2006).

Sustainable design: construction materials and processes that reduce environmental impacts, use resources efficiently, reduce waste, and are not harmful to human health (Mendler & Odell, 2000).

Sustainably harvested wood: wood products come from well-managed forests (Madison Children's Museum, 2008).

Temporary exhibit: a museum exhibition designed for a short time period that covers topics of current or special interest (McLean, 1993; McLean, 1999).

Three R's: reduce, reuse, and recycle—the waste management hierarchy that lists strategies according to their importance (McDonough & Braungart, 2002).

Three tenets of sustainability: also known as the three pillars or spheres of sustainability, a theory that says sustainability will be achieved when three tenets—environment, society, and economy—are appropriately balanced (Link, 2006; United Nations, 1987; Worts, 2006).

Traveling exhibit: a temporary exhibition one museum rents from another (McLean, 1993; McLean, 1999).

Triple bottom line: a measure of success using the three spheres of sustainability: environment, society, and economy (Link, 2006).

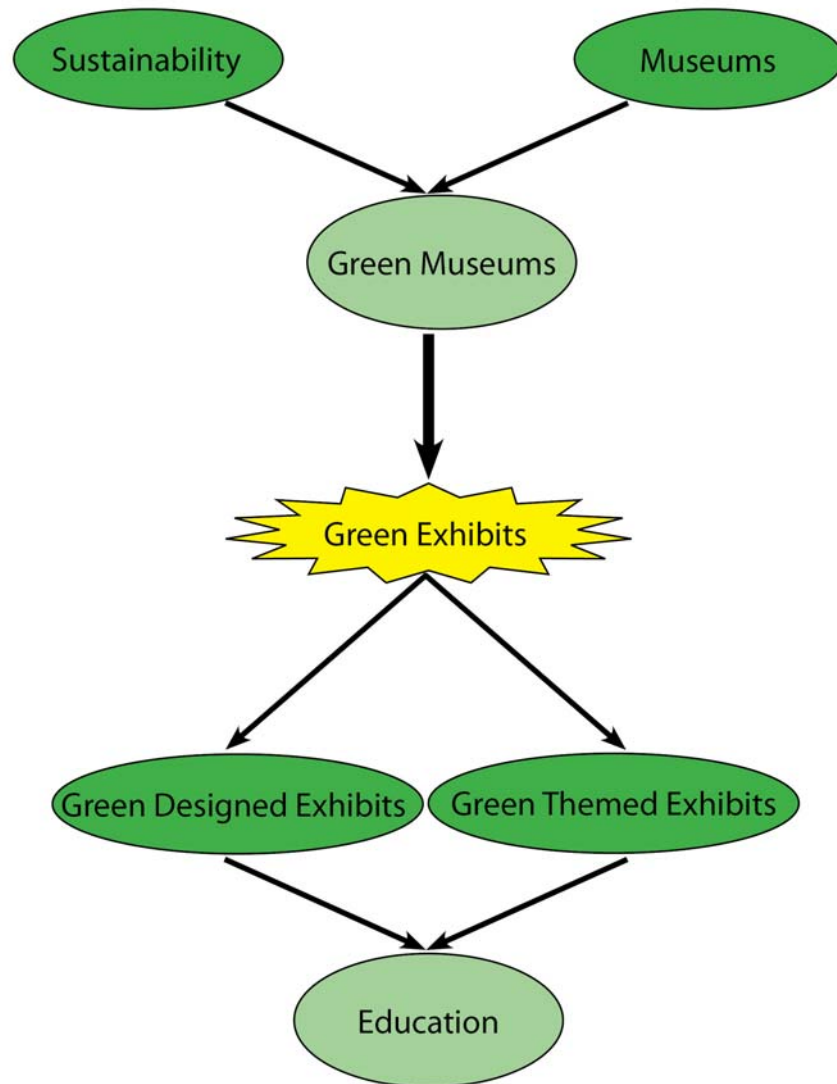
True cost: the combination of social, environmental, and economic costs weighed against the benefits associated with a choice (Madison Children's Museum, 2008).

U.S. Green Building Council (USGBC): a non-profit organization dedicated to promoting sustainable building design and construction (USGBC, 2008).

Vermicomposting: a composting method that uses worms to break down compost to create a nitrogen- and phosphorus-rich fertilizer (Brohpy & Wylie, 2008).

Volatile Organic Compounds (VOCs): materials that slowly release toxic gasses into the atmosphere that are harmful to human and environmental health (Gray, 2008; Madison Children's Museum, 2008; McLean 1993).

Appendix C: Conceptual Framework Schematic



Appendix D: Data Collection Schematic

Multi-Instrumental Qualitative Approach		
<i>Data Collection Method</i>	<i>Data Source</i>	<i>Data to Collect</i>
Literature Review	Books, journals, trade publications, magazines, etc.	<ul style="list-style-type: none"> - Definitions - Museum roles + characteristics - Exhibit roles + characteristics - Green museum practices - Green exhibit practices
Document Analysis	Case studies' Web sites, brochures, 990 tax forms, internal communications, press releases, etc.	<ul style="list-style-type: none"> - Case studies' internal structure, mission, history, budget, etc. - Case studies' public programs, exhibits, special events, etc. - Green practices
In-Depth Interviews	Key informants: <ul style="list-style-type: none"> - Willcox - Mikulas - Siefert 	<ul style="list-style-type: none"> - Greening methods + practices of museum/exhibits - Processes of greening - Successes + weaknesses - Communication techniques - Personal experiences + views
Observation	Case study institutions: <ul style="list-style-type: none"> - OMSI - Phipps - CMP 	<ul style="list-style-type: none"> - Visual evidence of green operational practices - Visual evidence of green exhibit practices - Green education content + techniques - Visitor experience

Appendix E: Research Timeline

Fall 2007

- Completed final research proposal
- Completed human subjects compliance application materials

Winter 2008

- Submitted human subjects application
- Began literature review
- February: Interviewed Sarah Brophy and Elizabeth Wylie

Spring 2008

- Converted proposal into chapter drafts
- Continued literature review
- May 23: Presented initial findings at Transforming Museums Conference in Seattle

July 2008

- Identified case study museums
- Collected materials for document analysis

August 2008

- Contacted case study museums
- Prepared detailed outline of research document
- Continued with document analysis and literature review

September 2008

- 12: Interviewed Jessica Willcox and conducted observations at OMSI
- 24: Interviewed Heather Mikulas and conducted observations at Phipps
- 25: Interviewed Christ Siefert and conducted observations at CMP

October 2008

- Completed data collection
- Completed chapters 1 and 2
- 31: Presented findings for Arts Administration staff and cohorts

November 2008

- Completed chapters 3, 4, and 5
- Wrote full first draft of the final document

December 2008

- Submitted final document as three bound copies and one PDF file on CD

Appendix F: Data Collection Tools + Content Analysis

Appendix F.01: Document Analysis

Case Study:

Date:

Key Descriptor:

Document Type:

Reference Citation:

Document Location:

Key Points:

<i>Coding</i>	<i>Information</i>	<i>Notes</i>

Appendix F.02: Interview Protocol

Case Study:

Date:

Key Descriptor:

Interviewee Information:

Received consent to interview by: ____ Oral ____ Written from

Consent to: ____ Quote interviewee ____ Record audio

Interview Location:

Notes on Interview Context:

Key Points:

<i>Coding</i>	<i>Information</i>	<i>Notes</i>

Thank you ____

Member check ____

Appendix F.03: Semi-Structured Interview Questions

Green Museum Questions

1. Why did your museum want to go green?
2. Within your museum, whose support did you need in order to go ahead with greening and what kind of support did they give?
3. How did your museum first start going green?
4. What kind of external support or aid was necessary?
5. How do you evaluate the success of your museum-wide sustainability efforts?
6. Have you received any reaction to your sustainability from your visitors? From other constituents?
7. How does your museum get the word out about its green practices?
8. What sustainability efforts is your museum currently working on?
9. How much are museum employees involved in sustainability? Board members? Volunteers?
10. How do you communicate your sustainable practices to your staff?
11. What scholarship or resources do you use to inform your operational green practices?
12. What do you feel are your strengths and weakness of your museum-wide sustainability efforts?

Green Exhibit Questions

1. Why did you want to use sustainable design practices in your exhibit department?
2. What has your museum done to use sustainable design practices in its exhibits?
3. What museum-wide sustainable efforts does your museum use exhibits or signage to explain to visitors?
4. Do your permanent exhibits feature any content about sustainability?
5. What scholarship or resources do you use to inform your green practices?

6. How do you evaluate your green exhibit practices?
7. Have you encountered any specific difficulties or successes related to green exhibits?
8. How is the design process different for a green exhibit?
9. How do choose materials for green exhibits?
10. How do costs of green exhibits compare to regular exhibits?
11. Do you educate visitors about your green exhibit practices? Why or why not?
12. What recommendations would you give to other museums interested in creating a green exhibit department?

Appendix F.04: Observation Protocol

Case Study:

Date:

Key Descriptor:

Activity:

Activity Location:

Participant(s):

Consent to: ____ Photograph facilities

Details:

Key Points:

<i>Coding</i>	<i>Information</i>	<i>Notes</i>

Appendix G: Recruitment Letters and Consent Forms

Appendix G.01: Introductory Email

To: <SUBJECT EMAIL ADDRESS>
 Fr: Rachel D. Byers <rbyers1@uoregon.edu>
 Subject: Graduate Research Participation Request—Green Museums & Green Exhibits:
 Communicating Sustainability through Content & Design
 Date:

Dear <SUBJECT NAME>:

Hello, I am a graduate student focusing on museum studies in the Arts and Administration Program at the University of Oregon. For my master's research project, *Green Museums & Green Exhibits: Communicating Sustainability through Content & Design*, I am exploring how museums are applying sustainable practices in their exhibition departments.

During my analysis of existing literature and websites, I learned that <NAME OF ORGANIZATION> is a leader in designing and constructing green exhibits. With your experience as <JOB TITLE> at <NAME OF ORGANIZATION>, you would be a tremendously significant resource for my research. I would like to invite you to participate in my research project by allowing me to interview you and show me your museum's exhibition space. The interview will take approximately one hour and with your permission will be audio-taped and photographed. After the initial interview, it is possible I will contact you with follow-up questions, either over the phone or email, according to your preference.

Your help in my project is entirely voluntary. To express your interest in participating, please contact me via email, rbyers1@uoregon.edu, or telephone, (541) 337-6727. If you are willing to be part of the project I will send you the consent forms in the mail. Thank you for your time, and please contact me with any questions.

Sincerely,

Rachel D. Byers
 Candidate, MS Arts Administration
 University of Oregon
 1376 W. 6th Ave, Unit F
 Eugene, OR 97402
 (541) 337-6747
rbyers1@uoregon.edu

The transmission of data via email is inherently not secure, so confidentiality of data cannot be expected in this communication.

Appendix G.02: Interview Recruitment Letter

Name
Address
City/State/Zip
Date

Dear <SUBJECT NAME>:

You are invited to participate in a research project titled *Green Museums & Green Exhibits: Communicating Sustainability through Content & Design*, conducted by Rachel Byers from the University of Oregon's Arts and Administration Program. The purpose of this study is to explore how museums are applying sustainable practices in their exhibition departments.

Within the context of global warming and environmental degradation, a movement for a more sustainable future is building. Some museums are responding by incorporating sustainable concepts and green practices in their administration, including their exhibition departments. However, specific and practical information on how to implement sustainable efforts is lacking in the literature of this new and blossoming field. To begin to address the need for practical guidelines that will aid other museums desiring to green their exhibition departments, this study aims to compile an analysis of sustainable exhibition techniques and theory. It involves research on museums with existing green exhibit departments in order to: identify the process, costs, and benefits involved in transforming an exhibit department into a green entity; identify and assess green practices, materials, and designs used in current museum exhibitions; and evaluate efforts to educate museum visitors about sustainable exhibitions.

You were selected to participate in this study because of your leadership position with <NAME OF ORGANIZATION> and your experiences with and expertise pertinent to sustainability within the museum's exhibit department. If you decide to take part in this research project, you will be asked to provide relevant organizational materials and participate in an in-person interview, lasting approximately one hour, during winter 2008. If you wish, interview questions will be provided beforehand for your consideration. Interviews will take place at <NAME OF ORGANIZATION>, or at a more conveniently located site. Interviews will be scheduled at your convenience. In addition to taking handwritten notes, with your permission, I will use an audio tape recorder for transcription and validation purposes. After the interview, it is requested that you give a guide tour of the exhibition space and offices. This will provide observable evidence of the concepts and theory discussed during the interview. With your consent, photographs will be taken of key visual examples for presentation and archival purposes. You may also be asked to provide follow-up information through phone calls or email.

If you have any questions, please feel free to contact me at (541) 337-6747 or rbyers1@uoregon.edu, or Dr. Janice Rutherford at (541) 346-2296. Any questions regarding your rights as a research participant should be directed to the Office for the Protection of Human Subjects, University of Oregon, Eugene, OR 97403, (541) 346-2510. Thank you in advance for your interest and consideration. I will contact you shortly to speak about your potential involvement in this study.

Sincerely,

Rachel D. Byers
Candidate, MS Arts Administration
University of Oregon
1376 W. 6th Ave, Unit F
Eugene, OR 97402
(541) 337-6747
rbyers1@uoregon.edu

Appendix G.03: Interview Consent Form

Green Museums & Green Exhibits: Communicating Sustainability through Content & Design

Rachel Byers, Principal Investigator
University of Oregon Arts and Administration Program

You are invited to participate in a research project titled *Green Museums & Green Exhibits: Communicating sustainability through Content & Design* conducted by Rachel Byers from the University of Oregon's Arts and Administration Program. The purpose of this study is to explore how museums are applying sustainable practices in their exhibition departments.

Within the context of global warming and environmental degradation, a movement for a more sustainable future is building. Some museums are responding by incorporating sustainable concepts and green practices in their administration, including their exhibition departments. However, specific and practical information on how to implement sustainable efforts is lacking in the literature of this new and blossoming field. To begin to address the need for practical guidelines that will aid other museums desiring to green their exhibition departments, this study aims to compile an analysis of sustainable exhibition techniques and theory. It involves research on museums with existing green exhibit departments in order to: identify the process, costs, and benefits involved in transforming an exhibit department into a green entity; identify and assess green practices, materials, and designs used in current museum exhibitions; and evaluate efforts to educate museum visitors about sustainable exhibitions.

You were selected to participate in this study because of your leadership position with <NAME OF STUDY ORGANIZATION> and your experiences with and expertise pertinent to sustainability within the museum's exhibit department. If you decide to take part in this research project, you will be asked to provide relevant organizational materials and participate in an in-person interview, lasting approximately one hour, during winter 2008. If you wish, interview questions will be provided beforehand for your consideration. Interviews will take place at <NAME OF ORGANIZATION>, or at a more conveniently located site. Interviews will be scheduled at your convenience. In addition to taking handwritten notes, with your permission, I will use an audio tape recorder for transcription and validation purposes. After the interview, it is requested that you give a guide tour of the exhibition space and offices. This will provide observable evidence of the concepts and theory discussed during the interview. With your consent, photographs will be taken of key visual examples for presentation and archival purposes. You may be asked to provide follow-up information through phone calls or email.

There are minimal risks associated with participating in this study. Your consent to participate in this interview, as indicated below, demonstrates your willingness to have your name used in any resulting documents and publications. **Within the arts and cultural sector, there is a museum community where members know one another on personal and professional levels. The use of participants' names in written**

documents creates the possibility that the individual's comments, as a representative of his or her institution, will displease his or her colleagues and supervisors. It may be advisable to obtain permission to participate in this interview to avoid potential social or economic risks related to speaking as a representative of your institution. **Research data, including audio recordings, transcriptions, and photographs, will be kept by the primary investigator for archival purposes, future educational reference, and documenting career development.** Your participation is voluntary. If you decide to participate, you are free to withdraw your consent and discontinue participation at any time without penalty.

I anticipate that the results of this research project will be of value to museums and the cultural sector as a whole. However, I cannot guarantee that you personally will receive any benefits from this research.

If you have any questions, please feel free to contact me at (541) 337-6747 or rbyers1@uoregon.edu, or Dr. Janice Rutherford at (541) 346-2296. Any questions regarding your rights as a research participant should be directed to the Office for the Protection of Human Subjects, University of Oregon, Eugene, OR 97403, (541) 346-2510.

Please read and initial each of the following statements to indicate your consent:

- _____ I consent to the use of audiotapes and note taking during my interview.
- _____ I consent to my identification as a participant in this study.
- _____ I consent to the potential use of quotations from the interview.
- _____ I consent to the use of information I provide regarding the organization with which I am associated.
- _____ I wish to have the opportunity to review and possibly revise my comments and the information that I provide prior to these data appearing in the final version of any publications that may result from this study.
- _____ I consent to give the researcher a guided tour of exhibition space and offices to provide visual examples of concepts.
- _____ I consent to the use of photography during the guided tour.

Your signature indicates that you have read and understand the information provided above, that you willingly agree to participate, that you may withdraw your consent at any time and discontinue participation without penalty, that you have received a copy of this form, and that you are not waiving any legal claims, rights or remedies. You have been given a copy of this letter to keep.

Print Name: _____

Signature: _____ Date: _____

Thank you for your interest and participation in this study.

Sincerely,

Rachel D. Byers
Candidate, MS Arts Administration
University of Oregon
1376 W. 6th Ave, Unit F
Eugene, OR 97402
(541) 337-6747
rbyers1@uoregon.edu



OMSI GREEN EXHIBIT CERTIFICATION

A Model for Evaluating Exhibit Sustainability

The **Oregon Museum of Science and Industry (OMSI)** in Portland, a national leader in science exhibit design and production, has created a tool that can help museums evaluate the sustainability of exhibits.

Inspired by the Leadership in Energy and Environmental Design (LEED) rating system, which is the “gold standard” used in building design and construction, OMIS’s Green Exhibit Certification rates an exhibit in terms of its environmental impact.

The Green Exhibit Certification awards 0–4 points when evaluating each of eight elements common in exhibit design:

1. **Rapidly Renewable Materials.** Does the exhibit use resources that renew themselves quickly in nature, such as bamboo, cork, sunflower seed composite, and wheatboard?
2. **Resource Reuse.** Is the exhibit designed with materials that can be reused in other exhibits when this one is retired? And/or does this exhibit reuse materials from other sources?
3. **Recycled Content.** Does the exhibit use recycled materials rather than plastic laminates and acrylics, which are not yet made of recycled materials?
4. **End-life Assessment.** What portion of the exhibit can be reused or recycled at the end of the exhibit’s life? For example, does the exhibit use a modular construction that can be updated or modified with new content?
5. **Low-Emitting Materials.** Does the exhibit use low- or zero-Volatile Organic Compound (VOC) paints, adhesives, and sealants?
6. **Certified Wood.** Does the exhibit use wood harvested from forests that have been managed in environmentally responsible ways?
7. **Conservation.** Is the exhibit designed for energy efficiency, including types of lighting, motion sensors which turn off electrical elements when not in use, etc.?
8. **Regional Materials.** Does it use regional materials that support the economy and reduce environmental impacts from transportation of materials?

An exhibit’s total number of points determines its level of certification. For example, an exhibit that scores 6–10 points receives a “green” certification while one that scores 19–26 points receives a “gold” certification.

OMSI’s goal is to have all OMIS-built exhibits qualify for green certification or higher by 2012. Our hope is that the OMIS Green Exhibit Certification programs may help other museums worldwide plan exhibits with environmental considerations in mind and that it can also be a resource in the renting and buying of exhibits.

OMSI GREEN EXHIBIT CERTIFICATION

0 - 5	No Certification
6 - 10	Green Certification
11 - 18	Silver Certification
19 - 26	Gold Certification
27 - 32	Platinum Certification

NEW PROJECT - EXAMPLE

Example of Green Exhibit Certification Process for New Projects

- Step 1. As the timeline, budget, and deliverables are being established, the design and production teams decide on the certification goal.
- Step 2. The designer specifies materials, mindful of the goal.
- Step 3. The production lead oversees implementation of specifications.
- Step 4. Once exhibit opens, a certification assessment is done using the checklist. The design manager, lead designer, production manager, and production lead each assess the exhibit.
- Step 5. Scores are reviewed and a final assessment is given.
- Step 6. Certification is awarded.

CHECKLIST

RAPIDLY RENEWING MATERIALS

Intent: To reduce the use and depletion of finite raw materials and long-cycle renewable materials by seeking rapidly renewable alternatives. Examples: bamboo, cork, sunflower seed composite, and wheatboard.

Does the exhibit use rapidly renewable materials for:

- ☐ 0 None of the construction materials
- ☐ 1 A few of the construction materials
- ☐ 2 Some of the construction materials
- ☐ 3 Most of the construction materials
- ☐ 4 All of the construction materials

List the rapidly renewable materials used:

RESOURCE REUSE

Intent: To reduce demand for virgin materials and to reduce waste, thereby reducing impacts associated with the extraction and processing of virgin resources. Examples: furniture (benches, stools), aluminum extrusion, metal legs, speakers, buttons.

Does the exhibit reuse resources in:

- ☐ 0 None of the components
- ☐ 1 A few of the components
- ☐ 2 Some of the components
- ☐ 3 Most of the components
- ☐ 4 All of the components

List materials that are reused:

RECYCLED CONTENT

Intent: To increase the demand for construction materials that have incorporated recycled content, thereby reducing the impacts associated with the extraction and processing of virgin materials. Examples: regrind HDPE, recycled rubber flooring, steel, aluminum.

Does the exhibit use material with recycled content for:

- ☐ 0 None of the construction materials
- ☐ 1 A few of the construction materials
- ☐ 2 Some of the construction materials
- ☐ 3 Most of the construction materials
- ☐ 4 All of the construction materials

List recycled materials and their approximate percentage of recycled content:

CHECKLIST

END LIFE ASSESSMENT

Intent: To reduce the amount of waste that ends up in the landfill. Examples: using 80/20 for structures; not adhering graphics to acrylic so acrylic can be recycled; modular construction so exhibit could be modified with new content,

What portion of the exhibit materials can be reused or recycled at the exhibit's end life?

- ☐ 0 None of the materials
- ☐ 1 A few of the materials
- ☐ 2 Some of the materials
- ☐ 3 Most of the materials
- ☐ 4 All of the materials

List strategies for reusing or recycling materials:

LOW-EMITTING MATERIALS

Intent: To reduce the quantity of materials that emit Volatile Organic Compounds (VOCs), either in processing or after installation, because of their threat to the environment and indoor air quality. Strategies include using low- or zero-VOC paints, adhesives, and sealants and choosing formaldehyde-free medium-density fiberboard (MDF). Materials to avoid include polyvinyl chloride (PVC), rated by Greenpeace as the most toxic plastic, as well as styrene and sintra. Polyethylene and polypropylene are less harmful alternatives.

Did the exhibit choose low-emitting materials for:

- ☐ 0 None of the materials
- ☐ 1 A few of the materials
- ☐ 2 Some of the materials
- ☐ 3 Most of the materials
- ☐ 4 All of the relevant materials

List low-emitting materials used:

CERTIFIED WOOD

Intent: To encourage environmentally responsible forest management.

Does the exhibit use wood certified by the Forest Stewardship Council (FSC) as an alternative to standard wood products in:

- ☐ 0 None of the components
- ☐ 1 A few of the components
- ☐ 2 Some of the components
- ☐ 3 Most of the components
- ☐ 4 All of the components

List applications of certified wood and approximate percentage of total lumber used:

GreenExhibit Certification

CHECKLIST

CONSERVATION

Intent: To design exhibits that conserve energy, water, and materials. Examples: Exhibits that turn off when not in use, using motion sensors to activate components, choosing durable consumables with longer life-expectancy, using large banners to create environments instead of structures, using LEDs over fluorescents.

Does the exhibit use electricity, water, and materials responsibly by limiting unnecessary waste in:

- ☐ 0 None of the components
- ☐ 1 A few of the components
- ☐ 2 Some of the components
- ☐ 3 Most of the components
- ☐ 4 All of the components

List strategies for limiting wasteful use of power, water, and materials:

REGIONAL MATERIALS

Intent: To increase demand for building materials and products that are extracted and/or manufactured within the region (500 mile radius), thereby supporting the regional economy and reducing the environmental impacts resulting from transportation.

Does the exhibit make use of locally available materials for:

- ☐ 0 None of the construction materials
- ☐ 1 A few of the construction materials
- ☐ 2 Some of the construction materials
- ☐ 3 Most of the construction materials
- ☐ 4 All of the construction materials

List materials that were extracted or manufactured locally:

Total Score:

Insert total score from all sections.
Refer to chart at right for certification level.

OMSI GREEN EXHIBIT CERTIFICATION

0 - 5	No Certification
6 - 10	Green Certification
11 - 18	Silver Certification
19 - 26	Gold Certification
27 - 32	Platinum Certification