

State University of New York College at Buffalo - Buffalo State University

Digital Commons at Buffalo State

Museum Studies Theses

History and Social Studies Education

12-2021

Museums & Environmental Sustainability: Are They Doing Enough?

Alexandra M. Dwyer
dwyeram02@mail.buffalostate.edu

Advisor

Dr. Cynthia Conides

First Reader

Dr. Cynthia Conides

Second Reader

Renee Pratt

Department Chair

Andrew D. Nicholls, Ph.D.

Recommended Citation

Dwyer, Alexandra M., "Museums & Environmental Sustainability: Are They Doing Enough?" (2021).
Museum Studies Theses. 35.
https://digitalcommons.buffalostate.edu/museumstudies_theses/35

Follow this and additional works at: https://digitalcommons.buffalostate.edu/museumstudies_theses



Part of the [Archival Science Commons](#), and the [History Commons](#)

Museums & Environmental Sustainability: Are They Doing Enough?

By

Alexandra M. Dwyer

An Abstract of a Thesis
In
Museum Studies

Submitted in Partial Fulfillment
Of the Requirements
For the Degree of

Master of Arts
December 2021

State University of New York
College at Buffalo
Department of History and Social Studies Education
Museum Studies Program

Abstract

As the world continues to be affected by the rapid rates of climate change, institutions from every sector are transitioning to become more sustainable by reducing or eliminating their harmful habits on the ecosystem. Whether by their own accord or external pressure from current legislative action to cut carbon emissions, institutions are shifting towards a sustainable future. For museums there are additional unique reasons to adopt sustainability into various aspects with their institution. The most influential reason is that museums have a responsibility as community leaders and change makers. However, looming questions remain: Are museums doing enough? Are these cultural hubs willing improve to comply with new sustainability standards? What is preventing museums from pursuing these goals? This paper aims to obtain the answers to the previous questions through extensive research on sustainability in museums as it pertains to daily operations and physical structures and investigating three museums within Buffalo, New York.

This research began with defining the term sustainability, its history, and current events that is creating this need for sustainable actions. It transitions to provide numerous sustainability practices, technologies, and programs that museums across the country have successfully implemented. I reveal my findings from interviews conducted with employees from three different museums. I provide a critique for these institutions whilst comparing them to museums nationwide and give potential suggestions on how they can improve their sustainability efforts. The purpose of this study is to hold these institutions accountable and to inspire new and creative ways to become more environmentally conscious. My hope for this research is to encourage the reader to investigate their local museums' sustainable efforts and collaborate on possible solutions.

Museums & Environmental Sustainability:
Are They Doing Enough?

By

Alexandra M. Dwyer

A Thesis
in
Museum Studies

December 2021

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Arts

State University of New York
College at Buffalo
Department of History and Social Studies Education
Museum Studies Program

Approved By:

Cynthia Conides, Ph.D.
Associate Professor Emerita of History
Founding Director of Museums Studies
Thesis Advisor

Andrew D. Nicholls, Ph.D.
Professor History
Chair of Department of History

Kevin J. Miller, Ed.D.
Dean of the Graduate School

TABLE OF CONTENTS

Introduction	1
Literature Review	3
Chapter One: What is Environmental Sustainability?	15
Climate Change and its Impact	17
The Importance of Environmental Sustainability	21
Combating the Negative Effects of Climate Change	22
International Parties for Environmental Sustainability	25
History of Environmental Sustainability in the United States	28
Current Events	33
Discussion	35
Chapter Two: Museums and Environmental Sustainability	36
Why Should Museums Go Green?	36
Leadership and Changemakers	36
Mandates for Environmental Sustainability	38
Going Green: A Cost Effective Solution	43
International Museums Lead by Example	46
How Can Museums Go Green?	50
Mission Statement	51
Institutional Governance	53
Physical Structure and Operations	56
Energy	56
Water	62

Physical Materials	63
Space	65
Sustainable Metrics and Programs	66
Landscape and Maintenance Practices	69
Discussion	70
Chapter Three: Case Studies: Buffalo Museums and their Sustainable Efforts	72
The Buffalo and Erie County Botanical Gardens	72
Interview	75
Critique	77
The Buffalo Zoo	81
Interview	83
Critique	87
The Buffalo Museum of Science	89
Interview	91
Critique	95
Summary	99
Conclusion	103
Bibliography	107

Introduction

Environmental sustainability has become a prominent and important conversation as Global Warming's devastating effects persist. In general, communities and institutions are striving to limit their environmental footprint in an attempt to combat the negative effects of a changing climate. Museums are no exception. Each year, more museums are adopting sustainability within various aspects of their institution. But the question is, are museums doing enough? This thesis will examine how museums have started their environmental sustainability journey, what have they done so far, and what they strive to do in the future. It discusses how museums have responded to the green movement. This paper provides examples of current practices and new sustainable technologies that can help museums obtain their sustainable goals. The objective of this research is to encourage more museums to become environmentally sustainable.

Chapter One defines the term environmental sustainability and the importance of this lifestyle. Providing extensive research on climate change and its negative impacts due to human activity and industrialization. The chapter discusses solutions to combat the mistakes of the past through reparation of damages, usage of natural and reusable resources, and more. It provides a brief history of environmental legislative measures within the United States including current events, such as the President Joseph Biden readmitting the United States into the Paris Agreement and attending the COP26 conference.

Chapter Two focuses on environmental sustainability within museums. There are numerous museums that have already begun to operate sustainably, while others still believe that their institution is unable to participate. This chapter explains why all museums should pursue an improvement in sustainability. I explain the numerous benefits of adopting sustainable practices

and technologies to modify the museum's physical space and daily operations. Then I answer the important question of how museums can adapt a sustainable lifestyle.

The third and final chapter contains a case study of three prominent institutions in Buffalo, New York. I reached out to three different types of museums to see what their thoughts on environmental sustainability are and how that translates to their physical structures and daily operations. Then I will compare them to other exceptional museums across the nation. The interviews also demonstrate that sustainability can be obtained regardless of collection, category, size, or funding. After my critiques, I offer suggestions on how they can improve their sustainability efforts based on my research from the previous two chapters. The inclusion of these findings on a local level is important if for no other reason than to inspire others to hold accountable the prominent institutions within their own hometown.

By providing information on the current state of climate change, how museums throughout the country have adopted sustainable practices, and the numerous benefits for museums, I hope inspire institutions that have yet to start their green journey to pursue it and encourage others to increase their efforts. It is time for museums to address the concerns of climate change and the ability within themselves to take action against it. This project is a call to action for both museums and their communities.

Literature Review

I started my research by reading *The Green Museum: A Primer on Environmental Practice* by Sarah S. Brophy and Elizabeth Wylie. Sarah S. Brophy is a Principal of bMuse, an environmental sustainability consultancy for museums.¹ “Sarah advises on institutional greening and provides planning support, green-team coaching, LEED-EB services, and green product and program development. She also creates grant-development plans and prepares grant applications for green projects.”² Elizabeth Wylie has spent more than three decades in the museum field as curator, director, and business developer. Wylie also has a consultancy firm, WYLIE projects, for sustainability planning within several industries, including cultural non-profits.³ The book is a comprehensive guide that provides resources and various solutions for museums seeking to implement environmentally sustainable changes and green practices. These professionals encourage museums to take the first step towards environmental sustainability by discussing the numerous benefits that accompany this practice and sharing success stories of museums in the United States. The book refers to several case studies within the United States (non-profit, private, government and international), and covers different types of museums (zoos, aquariums, recreational parks and educational facilities) at different stages in their establishment and budget needs. The *Green Museum* illustrates the tangible ways museums can alter their space and practices to be implemented immediately if desired. However, the authors express the importance of creating a sustainability plan and incorporating it into mission statements in order to ensure it remains of the utmost importance. This book was the perfect resource for my paper. I found it particularly helpful with the sometimes puzzling sustainability related terms and

¹ Sarah S. Brophy and Elizabeth Wylie, *The Green Museum: A Primer on Environmental Practice*, (Maryland: Rauman & Littlefield Publishers, 2013) 299.

² Ibid, 299.

³ Ibid, 300.

programs. The book is full of recommended resources for professionals to pursue further research such as American Alliance of Museums and PIC-Green, Association of Zoos and Aquariums Green Practices Scientific Advisory Group, the National Park Service's Sustainable Operations, and more. The case studies were particularly fascinating to read about as they provided great examples of museums that successfully implemented sustainable changes and explained the problems along the way.

Another helpful and thought-provoking source by Sarah Sutton formerly known as Sarah Brophy, entitled *The Evolving Responsibility of Museum Work in the Time of Climate Change, Museum Management and Curatorship*. This article was an excellent addition to my research because of Sutton's concrete guidelines for combatting climate change that pertain exclusively to the museum world. Rather than the seemingly vague governmental guidelines, this article gave me multiple examples of how museums are already implementing change for good, and what information could be shared with a museum immediately upon its journey towards net zero. Sutton lists numerous institutions that she commends for their efforts, including the Australian Museum, the California Academy of Sciences and the Art Gallery of Ontario. The article goes into great detail on the Nordic Museum in Seattle, Washington. Sutton sites the building's "energy-efficient air source heat pump technology reducing energy use 24% below baseline according to energy codes."⁴ A museum that will be constructed in the near future should reference this article as a green guide. This article emphasizes that the architect's design can have great energy savings for a museum. Additionally, a heat pump system is an easy retrofit for any institution to make. Sutton goes on to say that the Nordic Museum strives to be 50% below

⁴ Sarah Sutton, "The Evolving Responsibility of Museum Work in the Time of Climate Change, Museum Management and Curatorship," Routledge: Taylor & Francis Group 35 No.6 (2020): 619.

baseline levels by 2030 and approaching net zero by 2050, if not sooner.⁵ I found these institutions' efforts to all be great examples that other museums can reference on their green journey.

Mike Murawski's *Museums as Agents of Change* focuses on museum's influence in society. I decided to include this book to make the point that museums are not neutral. Whether through exhibitions or daily operations, museums need to advocate for a sustainable future due to the devastating data climate change has produced. But museums need to do more than advocate, they need to implement their sustainable ideas to set an example to the community and inspire change. Museums are agents of change because they have credibility and leadership within their community. This book explains the importance of that role as it relates to social justice, but it can be applied to several areas such as environmentalism. This book is a great resource to encourage institutions that have yet to tap into their potential as change makers. It is a powerful reminder that museums are active spaces for connection and help to foster dialogue that can inspire change. As Murawski puts it "Museums have the potential to tell new and diverse histories; amplify and marginalize voices; celebrate unheard stories; and recognize the creativity, knowledge, expertise, and lived experience that is already thriving within their local communities. They can be spaces for acknowledging and reflecting on different, and for bridging divides...Now is the time for us to become change makers and realize the potential of museums as transformative spaces of human connection, care, listening, and deep learning."⁶

⁵ Ibid, 620.

⁶ Mike Murawski, *Museums as Agents of Change: A Guide to Becoming a Changemaker*, Maryland: Rowman & Littlefield Publishers, 2021. xid.

The U.S. Sustainability Alliance's article entitled *A Century of American Sustainability* highlights several key events that led up to our society's current state of sustainability. Measures put in place by the government to increase the country's sustainability are not exclusive to recent history. In fact, numerous laws have been put in place and expanded upon for over a century. "For example, in the early 1900s President Theodore Roosevelt created the U.S. Forest Service, which established 51 federal bird reservations, four national game reserves, 150 national forests, and five national parks. And the National Park Service was created, covering 401 national parks and protecting 400 endangered species."⁷ The article mentions the Soil Conservation Act and the Federal Water Pollution Control Act of the 1930's and 1940's, the first Earth Day celebration in the 1970's, the protection of 405 million acres of wetlands in the 1990's, and 235 million acres of land protected in the 2000's as key events that have improved sustainability within the United States.⁸ This article illustrates a the timeline of the United States' evolution in sustainability. This helps to show that we are not the first generations to care about the condition of the environment. In fact, our efforts can be traced back over a century. While the list of accomplishments is encouraging to see, there is no secret that the list needs to grow substantially in the future.

Rachel Carson's *Silent Spring* is a well-researched exposé of the pesticide industry and the country's ignorance towards their harm. In 1962, the now historic book was published exposing several industries for their misuse of chemicals. Carson was among the first to warn of harm from dichlorodiphenyltrichloroethane (DDT), a chemical often used in pesticides. In doing so, she faced harsh opposition from the United States Department of Agriculture (USDA), even

⁷" A Century of Environmental Sustainability," *U.S. Sustainability Alliance*, August 20, 2021, <https://thesustainabilityalliance.us/a-century-of-american-sustainability/>.

⁸ Ibid

calling her research propaganda.⁹ Instead of surrendering her beliefs, she researched for years on the subject, and its results are the inspiration for this book. *Silent Spring* is important because it is a very early example of the public recognizing that certain practices could be harmful to the Earth. Carson's effort and bravery led to numerous legislative actions to protect the environment and the public's health. The book was one of the first of its kind and it raised questions amongst the population about what humans are contributing to the destruction of our planet and our health. The publication of this book is a monumental turning point for environmental sustainability.

I utilized the United States' National Aeronautics and Space Administrations (NASA) website to gather data about climate change and the effects of global warming. NASA is a great place to start searching for information regarding climate change and the need for environmental sustainability. I referred to a trio of articles, "Climate Change: How Do We Know", "Global Warming", and "What is Climate Change?", all containing pertinent information. The first article states, "Earth's climate has changed throughout history. The article lists facts and information on global temperature increase, thinning ice sheets, and warming oceans, among other topics. The second of the three articles continues to explain the global warming that currently exists on earth. It lists causes and effects of global warming, and future consequences of actions that may already be irreversible.¹⁰ The article was beneficial to refresh my knowledge on global warming and study the data, and the articles are written in easily understandable manner, and provide evidence to back up statistics throughout. The article touches on the greenhouse effect, depleting ozone layer, rising sea levels as well as consequences to all living things. The final article explains the

⁹ Rachel Carson, *Silent Spring*, (Boston: Houghton Mifflin Company, 1962), 31.

¹⁰ Global Warming," *National Aeronautics and Space Administration*, accessed October 6th, 2021, <https://earthobservatory.nasa.gov/features/GlobalWarming>.

entire scope of climate change, the connectivity of different ecosystems across earth and the impacts of climate change upon them. The article elaborates on the difference between climate change and the cyclical changes throughout time. It lists causes of climate change as well as predictions of what will happen to the earth because of it. NASA can closely track the effects of climate change through numerous satellites in Earth's orbit.¹¹ NASA has a trusted reputation and their presentation of data, causes and effects throughout these three articles is extremely thorough, and encompasses numerous aspects needed to understand the full scope of climate change.

To gather additional evidence of the impacts of climate change, I referenced the website of the Environmental Protection Agency (EPA). The EPA is a government run organization that is in place to ensure that, "Americans have clean air, land and water; National efforts to reduce environmental risks are based on the best available scientific information; Federal laws protecting human health and the environment are administered and enforced fairly, effectively and as Congress intended; Environmental stewardship is integral to U.S. policies concerning natural resources, human health, economic growth, energy, transportation, agriculture, industry, and international trade, and these factors are similarly considered in establishing environmental policy."¹² Chemicals in the marketplace are reviewed for safety by the EPA. Before listing examples, they explain their views as to why the change in climate is important, "More extreme variations in weather are also a threat to society. More frequent and intense extreme heat events can increase illnesses and deaths, especially among vulnerable populations, and damage some

¹¹ "What is Climate Change?" *National Aeronautics and Space Administration*, May 14th, 2014, <https://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-climate-change-k4.html>.

¹² "Our Mission and What We Do," *National Environmental Agency*, accessed September 20th, 2021, <https://www.epa.gov/aboutepa/our-mission-and-what-we-do>.

crops. While increased precipitation can replenish water supplies and support agriculture, intense storms can damage property, cause loss of life and population displacement, and temporarily disrupt essential services such as transportation, telecommunications, energy, and water supplies.”¹³ The EPA lists visible effects of climate change including; an increase in frequency of extreme high and low temperatures, an increase in heat waves and droughts, but also in heavy precipitation, an increase in tropical storm activity, and an increase in flooding. The EPA stresses that scientists believe that extreme events such as the examples they list will only become more frequent.

Another prevalent source chosen for this research is *The Earth Charter*. *The Earth Charter* was completed in the spring of 2000 at the UNESCO headquarters in Paris, France. The contents of this document contain ideology that would impact the world in a greatly influential way through multiple facets. At its core, “The Earth Charter is a declaration of fundamental ethical principles for building a just, sustainable and peaceful global society in the 21st century.”¹⁴ The charter attempts to tackle racial issues, poverty, sexism, crime and many other controversial topics. But its greatest influence can be placed upon climate change and its control. Under the umbrella of climate change, *The Earth Charter* strives to discover and implement sustainable ways of living and human development.¹⁵ Its core values believe that one of the most important facets of change is through education. They believe that the dangers of negative effects on the environment should be more prevalent among the education of children.¹⁶ However, this

¹³ “Climate Change Indicators: Weather and Climate,” *Environmental Protection Agency*, accessed October 9th, 2021. <https://www.epa.gov/climate-indicators/weather-climate>.

¹⁴ “The Earth Charter,” *Earth Charter International Council*, accessed August 30th, 2021, https://earthcharter.org/wp-content/uploads/2020/03/echarter_english.pdf?x79755.1.

¹⁵ Ibid

¹⁶ Ibid, 2.

education should not be limited just to children, or to any one group of adults. Instead, it should be inclusive to all forms of life. Museums are informal education institutions that can be used a vehicle to achieve that goal. The theme of inclusion for all is prevalent throughout the document. They believe that all organisms should be considered when focusing upon development of a society, and that all organisms are equal and hold value to the Earth.¹⁷ Included amongst their plans for the betterment of the Earth and all its inhabitants is a desire to manage nonrenewable resource use, while also focusing our attention on renewable resources and their usage and development.¹⁸ Additionally, they strive to persuade businesses and governments to join their cause. The voluntary effort of each and every member of society, can reshape the future of the Earth in a positive way for all. I found *The Earth Charter* to be particularly interesting because not only do they aim to tackle climate change, but numerous other societal problems, and persuade others to understand that all of these problems are interconnected as one. Their mission and values align with those of museums.

The *Paris Agreement* was created by the United Nations in 2015 and was originally signed by 175 nations across the world. Since its release, additional countries have signed the document, totaling 196 countries, including the United States and China.¹⁹ The *Paris Agreement* is a legally binding international treaty focused on combating climate change.

Article 2 states the objective of this agreement, "...in enhancing the implementation of the Convention, including its objective, aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty,

¹⁷ Ibid, 3.

¹⁸ Ibid, 4.

¹⁹ "Paris Agreement," *United Nations*, accessed July 19th, 2021, https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf, 6.

including by: Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change; increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production; and making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.”²⁰

The agreement aims to decrease greenhouse gas emissions as soon as possible to achieve a climate neutral world by 2050.²¹ Implementation of the *Paris Agreement* requires economic and social transformation. They provide financial assistance for countries at an economic disadvantage “because large-scale investments are required to significantly reduce emissions.”²² The *Paris Agreement* works on a five year cycle of increasingly ambitious climate action plans.²³ The countries had to submit their plans for climate action in 2020, these plans are known as nationally determined contributions (NDCs).²⁴ I appreciated this treaty’s usage of written guidelines, making it very clear to all who read the expectations of all parties involved. Additionally, I feel that with 196 countries involved in the carrying out its contents, it allows all countries to hold each other accountable. Climate change is affecting everyone, and the *Paris Agreement* lays out what each governing body’s duties are to reduce it. This guideline can be particularly useful to other entities as well, including businesses and museums, as their institutions should be striving toward the same goals. The *Paris Agreement* influenced current

²⁰ Ibid, 3.

²¹ Ibid

²²“ The Paris Agreement,” United Nations Framework Convention on Climate Change, accessed August 11th, 2021, <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>.

²³ Ibid

²⁴ Ibid

events within the United States such as President Joseph Biden signing the Global Methane Pledge and creating a bill to cut carbon emissions, better standards to capture pollution, and more at the COP26 Conference. The rejoining of the *Paris Agreement* also influenced the creation of the *Memorandum of Understanding* instituted by the American Alliance of Museums.

In October 2020, The American Alliance of Museums, signed the Climate Heritage Network's document entitled *Memorandum of Understanding* (MOU). This document acknowledges the *Paris Agreement* and proceeds to explain the significance of the agreement relating to cultural heritage, which falls under the spectrum of museums.

This memorandum's most vital piece is the "Expression of Commitment", "The signatories to this MOU (hereinafter referred to as "the Parties") commit to strengthening their efforts to address climate change and support communities in achieving the de-carbonization goals and other ambitions of the Paris Agreement, emphasizing (i) that arts, culture and heritage are both impacted by climate change and an asset for climate action; and (ii) that arts, culture and heritage (including sites and landscapes, institutions and collections as well as creativity, intangible heritage, traditional ways of knowing and practices) constitute an invaluable resource to help communities reduce GhG emissions and strengthen adaptive capacity, even while the risks to those resources from climate impacts must also be addressed."²⁵

It outlines a plan of action for increasing environmental sustainability within cultural heritage such as, replicating and spreading better practices and new approaches, connecting to experts on the topic of climate change, using building metrics and indicators to help track

²⁵“Memorandum of Understanding (MOU),” Climate Heritage Network, accessed June 26th, 2021, <https://www.aam-us.org/wp-content/uploads/2017/11/AAM-2020-Climate-Heritage-Network-MOU-Final-.pdf>. 2.

progress, and sharing innovative models for financing climate adaptation.²⁶ Because the AAM signed this memorandum, all museums throughout the U.S. are now strongly encouraged to join the cause. Additionally, they are to find ways to engage cultural and heritage institutions on the issues of climate change. This document proves to be useful to my research because in order to reach AAM accreditation, museums have to abide by their list of standards and recommendations. Now that AAM is committed to this cause, I predict that environmental sustainability will be a requirement of the accreditation process in the future. This is especially significant for museums that strive to be accredited by the AAM. Accreditation increases a museum's credibility and value to funders, communities, and peers. Approximately 1,000 of 35,000 have achieved accreditation.

The next document is President Joseph Biden's *Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis*. President Joseph Biden released this order as part of his first 100 days in office in an effort to fulfill his promise on combating the climate crisis. The executive order is organized into 8 sections (Policy; Immediate Review of Agency Actions taken between January 20th, 2017 - January 20th 2021; Restoring National Monuments; Arctic Refuge; Accounting for the Benefits of Reducing Climate Pollution; Revoking the March 2019 Permit for the Keystone XL Pipeline; Other Revocations; General Provisions). Specific measures taken by this document to reduce climate change include reinstating President Obama's Executive Order to ban oil and gas drilling in the Bering Sea, as well as revoking the permit for the Keystone XL pipeline in an effort to reduce tar sand oil emissions. Revoking the pipeline alone saves 178.3 million metric tons of greenhouse

²⁶ Ibid, 3.

gas emissions each year.²⁷ This executive order is included in this thesis because it is a topic of current events written on how leadership in the United States is going to approach environmentalism. Their decisions will have a direct impact on everyone, including non-profits. These actions are going to change the American standard of how we utilize energy for the next four years and beyond. This federal document highlights any immediate plans and revocations to combat damaging practices. The document directly references the ideals put forth in the *Paris Agreement* throughout.

All of these sources, dated and current, illustrate the need for environmental sustainability and the importance of it. I have chosen these sources to help frame my thesis accordingly: define environmental sustainability and its history, provide data on the effects of global warming, pollution and more, discuss current events that coincide with this topic, and examine the best practices for museums from the past and present. This research will aid me in my final chapter when I critique three local museums on their environmental efforts and find the answer to the question: Are they doing enough?

²⁷“ Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis,” *The White House*, January 20th, 2021, <https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/20/executive-order-protecting-public-health-and-environment-and-restoring-science-to-tackle-climate-crisis/>.

Chapter One:

What is Environmental Sustainability?

The United States Environmental Protection Agency (EPA) defines sustainability as “meeting today's needs without compromising the ability of future generations to meet their needs. It is about taking action to protect our shared environment—air, water, land, and ecosystems—in ways that are economically viable, beneficial to human health and well-being, and socially just in the long term.”²⁸ *The Green Museum* describes environmental sustainability as “Practices that rely on renewable or reusable materials and processes that are green or environmentally benign. Many also use the definition of providing for our needs today in a way that does not limit the ability of future generations to meet their needs.”²⁹ The key takeaway of the definition is that it is mankind's responsibility to conserve Earth's natural resources and ecosystems because of their vital benefits for the continuation of all species.

The term sustainability entered our vocabulary in 1969, during the creation of the National Environmental Policy Act (NEPA) with the desire to “create and maintain conditions under which humans and nature can exist in productive harmony, that permits fulfilling the social, economic, and other requirements of present and future generations.”³⁰ It is important to understand that there are three connected elements that propel the sustainability framework: environment, economy, and society.³¹ The environment provides ecological goods and services to both the economy and our society. The environment provides raw materials to build shelters, pollinates crops and vegetation for us to eat, decomposes waste and recycles it for new growth,

²⁸ “Sustainability and the ROE,” *United States Environmental Protection Agency*, accessed September 14th, 2021, <https://www.epa.gov/report-environment/sustainability-and-roe>.

²⁹ Brophy and Wylie, *The Green Museum* 279.

³⁰ *Ibid*

³¹ *Ibid*

and much more. The economy produces goods and services, many of which are dependent on the environment for the function of society. The key aspect of this relationship is our society because it “It generates wastes that are deposited into the environment or recycled to the economy. It regulates the economy and protects the environment.”³² This system shows that our relationship with the environment directly impacts us. Therefore, we need to make responsible decisions about how we utilize the environment if we want to improve the health and well-being of our species.

The primary goals of environmental sustainability are to reverse the harmful effects of climate change, reduce pollution, and other environmental factors that harm the health of the human race. But even more so, sustainability is about improving and maintaining the health of the land, sky, and the sea. Nature has rights that need to be recognized and protected. It is each individual’s responsibility to encourage others to learn the term of environmental sustainability and to put it into action for the benefit for humanity.

Other important terms related to sustainability that will be referenced throughout this paper are green, biodegradable, carbon footprint, recycle, and renewable. Green, as defined by the source, “refers to products and behaviors that are environmentally benign,” and green design refers to building and design methods that reflect green ideals.³³ Green is often used interchangeably with sustainability. The word biodegradable refers to the ability “to break down completely and naturally into safe materials for the environment.”³⁴ Carbon footprint is “a measure of the impact human activity has on the environment in terms of the amount of greenhouse gases produced, measured in units of carbon dioxide.”³⁵ The term recycle means to

³² Ibid

³³ Brophy and Wylie, *The Green Museum*, 280.

³⁴ Ibid, 277.

³⁵ Ibid, 278.

“transform into something else either another version of itself, or into another useable material.”³⁶

Lastly, a renewable resource is “a resource that regenerates or somehow replaces or repeats itself, preferably rapidly.”³⁷ All of these words are integral components of sustainability and are important to this topic.

Climate Change and its Impact

It is critical to understand that environmental sustainability was developed in order to adapt to and combat climate change. Without climate change, there is no environmental sustainability. Climate change is the “change in usual weather found in a place,”³⁸ such as an increase or decrease in the amount of rainfall or temperature.³⁹ Generally, climate change refers to the fluctuation of the Earth’s overall temperature. Scientists measured the Earth’s average temperature to be 1.5 degrees Celsius higher than the pre-industrial era.⁴⁰ The increase in temperatures is melting snow and ice at the north and south poles at a rapid rate. This leads to flooding in areas unable to hold the excess water and contributes to rising ocean levels. It is a perfect example of how small changes result in dramatic effects. The average number of heat waves per year, as well as their average duration have more than doubled since 1920, and eight of the ten most powerful hurricanes recorded have occurred since 1990.⁴¹

³⁶ Ibid, 283.

³⁷ Ibid

³⁸ “What is Climate Change?” *NASA*, accessed September 27th, 2021, <https://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-climate-change-k4.html>.

³⁹ Ibid

⁴⁰ “Paris Agreement” *United Nations*, accessed July 19th, 2021, https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf. 3.

⁴¹ Ibid

Whereas weather can change within a few hours, the climate transformed through millions of years of change.⁴² Just in the last 650,000 years there have been seven cycles of glacial advance and retreat, with the abrupt end of the last ice age about 11,700 years ago marking the beginning of the modern climate era — and of human civilization.”⁴³ The heat trapping nature of carbon dioxide became noticeable in the mid 1800’s. They estimate that carbon dioxide is accumulating into the air at a rate 250 times higher than pre-human eras.⁴⁴ When this paper addresses climate change, it refers to human activity that contributes to its acceleration. Burning fossil fuels (gas, coal, oil, petroleum) and deforestation is the biggest threat to the climate.⁴⁵ These are finite resources and release high levels of carbon into the atmosphere, which increase the temperature.⁴⁶ Everyday people use gas to power vehicles, heat and cool commercial and residential buildings, and cook food with appliances.

The effects of climate change are increasingly more severe as we continue to rely heavily on the burning of fossil fuels. Increase in sea level, coastal flooding, droughts, extreme heat, and an increase in the frequency and intensity of storms, are just a few of its results.

The following are some statistics on climate change worth reviewing that inform this thesis.

⁴² NASA, “What is Climate Change?”

⁴³ “Climate Change: How Do We Know?” *National Aeronautics and Space Administration*, accessed October 6th, 2021, <https://climate.nasa.gov/evidence/>.

⁴⁴ “Climate Change: How Do We Know?” *National Aeronautics and Space Administration*, accessed October 6th, 2021, <https://climate.nasa.gov/evidence/>.

⁴⁵ Ibid

⁴⁶ Ibid

- “Around the world, 24% of deaths can be traced back to avoidable environmental factors, according to the World Health Organization. People need clean air to breathe, fresh water to drink, and places to live that are free of toxic substances and hazards.”⁴⁷
- “The Intergovernmental Panel on Climate Change (IPCC) Special Report indicates that global energy-related emissions from building operations are responsible for approximately 28% of energy related carbon emissions, with further 11% incurred through the materials and construction process.”⁴⁸
- From 800,000 years ago until 1950, the atmospheric carbon dioxide levels had never exceeded 300 parts per million (ppm). In 1950, that threshold was surpassed, and in the time since levels have raised an additional 100 ppm, nearly double the average of the previous 800 millennia.⁴⁹
- “Most of the warming occurred in the past 40 years, with the seven most recent years being the warmest. The years 2016 and 2020 are tied for the warmest year on record.”⁵⁰
- “Global sea level rose about 8 inches (20 centimeters) in the last century. The rate in the last two decades, however, is nearly double that of the last century and accelerating slightly every year.”⁵¹
- The acidity of the ocean’s surface has increased by 30% since the beginning of the Industrial Revolution. This is a direct result of an increase of carbon dioxide in the air being absorbed by the water.⁵²

⁴⁷ “What is Environmental Sustainability?” *Sphera*, July 22nd, 2021, <https://sphera.com/glossary/what-is-environmental-sustainability/>.

⁴⁸ “Memorandum of Understanding (MOU),” *Climate Heritage Network*, accessed June 26th, 2021, <https://www.aam-us.org/wp-content/uploads/2017/11/AAM-2020-Climate-Heritage-Network-MOU-Final-.pdf>. 2.

⁴⁹ “Climate Change: How Do We Know?” *NASA*, accessed October 6th, 2021, <https://climate.nasa.gov/evidence/>.

⁵⁰ *Ibid*

⁵¹ *Ibid*

⁵² *Ibid*

- Industries burning heavy fossil fuels, heat production for buildings (gas, coal, etc.), deforestation and the agricultural industry account for 70% of Greenhouse gas emissions worldwide.⁵³
- “The [Intergovernmental Panel on Climate Change] estimates that 20-30 percent of plant and animal species will be at risk of extinction if temperatures climb more than 1.5° to 2.5°C.”⁵⁴
- “Even if greenhouse gas concentrations stabilized today, the planet would continue to warm by about 0.6°C over the next century because of greenhouses gases already in the atmosphere.”⁵⁵
- “According to the National Oceanic and Atmospheric Administration, in 2015 there were 10 weather and climate disaster events in the United States—including severe storms, floods, drought, and wildfires—that caused at least \$1 billion in losses. For context, each year from 1980 to 2015 averaged \$5.2 billion in disasters (adjusted for inflation). If you zero in on the years between 2011 and 2015, you see an annual average cost of \$10.8 billion.”⁵⁶

While any single effect of climate change can have grave consequences on society, when you take into account that all of these effects are impacting the Earth at the same time, it helps to put into the context the severity of this crisis. Whether it be rising sea levels forcing millions of houses and establishments to be overtaken, or an increase in the frequency and strength of natural disasters, climate change will soon affect everyday life for each human being on earth.

⁵³ “Global Greenhouse Gas Emissions Data,” *EPA*, accessed October 6th, 2021, <https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data>.

⁵⁴ “Global Warming,” *NASA*, accessed October 6th, 2021, <https://earthobservatory.nasa.gov/features/GlobalWarming>.

⁵⁵ *Ibid*

⁵⁶ Melissa Denchak, “Consequences and Effects of Global Warming,” *Natural Resources Defense Council, Inc.*, March 15th, 2016, <https://www.nrdc.org/stories/are-effects-global-warming-really-bad>.

Climate change needs to be slowed, as its effects are already impacting many regions of the Earth.

This data has driven scientists, environmentalists and governments to action for decades. Now, concerns are escalating, and have been since the turn of the millennium. The science behind climate change will become increasingly important as the data is likely to worsen in the near future. Society's response to these concerning statistics through green practices is the backbone of sustainability.

The Importance of Environmental Sustainability

The current problems caused by climate change that we are experiencing are expected to worsen over time. Exponential population growth has led to increased farming. Intensive farming practices can cause land depletion leading to a scarce food supply. Increased use of fossil fuels will lead to more severe weather patterns including increases in floods, violent storms, heat waves and droughts.⁵⁷ This will impact the growing seasons of crops and plants which are needed for food and oxygen. Pollution has and will continue to affect the quality of our land, air, and water which will undoubtedly impair the quality of our lives.

Sustainability is a promise to provide a safe and healthy environment in which future generations can live in and enjoy. The Earth is not a possession that we own, but it is something we utilize and explore with others. By adopting sustainable practices, it shows compassion and respect for others. We as a society should strive to leave planet Earth healthier and cleaner than we found it.

⁵⁷ "Climate Change Indicators: Weather and Climate," *Environmental Protection Agency*, accessed October 9th, 2021, <https://www.epa.gov/climate-indicators/weather-climate>.

Combating the Negative Effects of Climate Change

Through education and the dissemination of scientific data, citizens and companies have the ability to manage their resource consumption. Many institutions and individuals have adapted the familiar motto Reduce, Reuse, Recycle. This basic principle is important to conserving our natural resources (energy, water, natural raw materials, and space). For example, turning off the light when exiting a room, opting for recyclable or biodegradable packaging, utilizing reusable cloth bags for groceries, shopping secondhand, carpooling, and switching to electric power instead of gas or coal can all have profound effects on sustainability. The most effective thing a person can do is to use restraint when making purchases. Being mindful to only buy what is necessary and considering purchasing quality products that will last is the best practice to follow.

Another type of recycling that is often overlooked is composting. Food waste in landfills burns fossil fuels during transport and emits methane as well. According to a study at Princeton University, methane is about 30 times more potent than carbon dioxide.⁵⁸

Composting is the physical breakdown of organic matter such as plants and produce. Bacteria and fungi eat the organic matter which is then turned into energy rich nutrients that attracts millipedes, springtails, beetles, ants and earthworms. All of these organisms add nutrients back into the soil that feed plants, so they produce flowers, fruits, and seeds. Composting promotes more flavorful, nutrient dense food.⁵⁹ The benefits of composting are preserving an ecosystem, revitalizing poor soil, fertilizing plants, lessening waste in landfills, supporting sustainable agriculture, and most of all, reducing carbon footprint.⁶⁰ Institutions can discourage

⁵⁸ Princeton University, "A more potent greenhouse gas than carbon dioxide, methane emissions will leap as Earth warms," *ScienceDaily*, accessed October 7th, 2021, www.sciencedaily.com/releases/2014/03/140327111724.htm.

⁵⁹ "About the Farmer Pirates," *Farmer Pirates*, accessed October 7th, 2021, <http://www.farmerpirates.com>.

⁶⁰ Ibid

food waste by utilizing compost bins or using an off-site program if there is no land or space available. For example, the Farmers Pirates is a cooperative of urban farmers in Buffalo, New York that collects compost to use in their gardens to grow food.⁶¹ The cooperative believes in growing healthy foods within the city and making affordable, quality compost accessible.⁶² The group collects food scraps and organic materials from households and business throughout the city and the surrounding suburbs.⁶³ They bring the scraps to their compost site on the East Side of Buffalo, offering both residential (a five gallon bucket and compostable liner) and commercial pickup (32 gallon totes on wheels, rates vary).⁶⁴ Their compost consists of food waste, manure, straw, hay, and wood chips.⁶⁵ Compost is also sold by the Farmers Pirates to the general public for use in personal gardens and landscapes.

A composting program allows people to contribute food waste and receive compost as an exchange. The compost can be used in an edible or foliage/flower garden. Incorporating a garden in private yard space can be extremely beneficial. Plants purify the air we breathe by intaking carbon dioxide, chemicals, and even bacteria through its leaves, while also releasing oxygen and water back into the atmosphere through the process of photosynthesis. The roots of the plants soak up any chemicals or heavy metals that may accumulate in the soil. Soil is dependent on root systems to prevent soil erosion. The roots acts as an anchor, binding soil together, so rain and storms cannot wash or blow it away.⁶⁶ Any decaying organic matter that touches the ground replenishes nutrients into the soil.⁶⁷

⁶¹ Ibid

⁶² Ibid

⁶³ Ibid

⁶⁴ Ibid

⁶⁵ Ibid

⁶⁶ Audrey Throne, "The Environmental Benefits of Gardening," *US Green Technology*, December 7th, 2020, <https://usgreentechnology.com/environmental-benefits-gardening/>.

⁶⁷ Ibid

Where there is a habitat, there is wildlife. A garden attracts pollinators which are necessary for fruits, vegetables and flowers to grow and reproduce. Plants provide wildlife protection from predators and weather. Also, trees and shrubs provide great shade by blocking the sun. If placed near structures, they can help cool the building and reduce the use of an air conditioner. A special benefit of growing an edible garden is that it reduces money spent on food. Some staple vegetable and herbs can be grown year-round in pots too.

There are several ways people can adjust their lives to be more environmentally sustainable. It is essential to realize any small change can make a huge impact, but it has to be done in unison with our neighbors, friends, family, and even strangers. With that being said, the most widespread change is through the creation of environmental regulations and their enforcement. Most companies will not volunteer to change their practices, especially if they are making high profit. Every year we see increasing consequences of global warming in the biosphere and how it directly affects us. Climate Heritage Network's *Memorandum of Understanding (MOU)* states that "... now more than ever businesses need to invest in environmentally sustainable and socially responsible practices, like using clean energy and paying living wages, to secure a livable future."⁶⁸ Join the movement and vote people into office who stand for environmental sustainability and justice. Support companies that are evolving towards sustainability as it sends a message that consumers value the environment. Holding institutions accountable to the same standards whether it be a construction company or a museum, will be vital in the efforts of achieving widespread sustainability.

⁶⁸ Climate Heritage Network, "Memorandum of Understanding (MOU)."

International Parties for Environmental Sustainability

The Earth Charter, was created in March of 2000 at UNESCO headquarters in Paris, France.⁶⁹ The development of the *Earth Charter* declares the promotion of “sustainable ways of living and a global society founded on a shared ethical framework that includes respect and care for the community of life, ecological integrity, universal human rights, respect for diversity, economic justice, democracy, and a culture of peace.”⁷⁰ All of these elements are necessary to implement if we wish to live in a sustainable world. This document is grounded in truth, stating that humans depend on a healthy global ecosystem in order to ensure the survival of our species.⁷¹ We must recognize that the Earth’s beneficial but finite resources are depleting due to our “patterns of production and consumption.”⁷² This leads to fighting over these limited resources causing the gap between economic classes to widen and social injustices to continue. The abuse of resources leads to the potential mass extinction of our species. This document proclaims the notion of universal responsibility, by “recognize[ing] that all being are interdependent and every form of life has value regardless of its worth to human beings” and to “accept that with the right to own, manage, and use natural resources comes the duty to prevent environmental harm and to protect the rights of people.”⁷³ Another important aspect to take away from this document is how to instill Ecological Integrity, by making “responsible parties liable for environmental harm.”⁷⁴ They aim to discourage and prevent the emission of pollutants and

⁶⁹ “The Earth Charter,” *Earth Charter International Council*, accessed August 30th, 2021, https://earthcharter.org/wp-content/uploads/2020/03/echarter_english.pdf?x79755.

⁷⁰ *Ibid*

⁷¹ *Ibid*

⁷² *Ibid*

⁷³ *Ibid*

⁷⁴ *Ibid*

disposal of excess waste.⁷⁵ This document shares similar values with the *Paris Agreement*, and should both be recognized as powerful documents for the future of sustainability.

A remarkable event happened on December 12th, 2015, in Paris, France. The *Paris Agreement*, the first of its kind was enacted. A legally binding treaty to tackle the pressing issues of rapid climate change through the combating of greenhouse gas emissions that contribute to global warming.⁷⁶ The ultimate goal of the treaty is for the world to reach net zero emissions by 2050.⁷⁷ Net Zero, as defined by the Environmental Protection Agency, is when a structure consumes “only as much energy as is produced, achieving a sustainable balance between water availability and demand, and eliminating solid waste sent to landfills.”⁷⁸ When Net Zero is reached, a structure is operating at peak sustainability, creating as little waste as possible and wasting no unnecessary energy. 175 world leaders signed the *Paris Agreement*. All of these leaders recognize the negative impacts of climate change and are committing to the cause for the health and well-being of everyone. Their compassion is turned into a plan that requires cooperation and coordination in order to achieve the following objectives:

- (a) “Holding the increase in the global average temperature to well below 2 °C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;

⁷⁵ Ibid

⁷⁶ United Nations, “Paris Agreement.”

⁷⁷ “Climate Action,” *United Nations*, accessed July 19th, 2021, <https://www.un.org/en/climatechange/paris-agreement>.

⁷⁸ “Net Zero Resources,” *United States Environmental Protection Agency*, accessed December 12th, 2021. <https://www.epa.gov/water-research/net-zero-resources>.

- (b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production; and
- (c) Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.”⁷⁹

The document states that it recognizes specific needs and special situations of the least developed countries to obtain access to funding and technology needed to participate.⁸⁰ It encourages the developed countries to become role models by adapting “sustainable lifestyles and sustainable patterns of consumption and production” and by aiding these countries in need.⁸¹

To do this, the agreement states that they must utilize the best available scientific knowledge and “affirm to the importance of education, training, public awareness, public participation, public access to information and cooperation at all levels on the matters addressed in this Agreement.”⁸² Within the agreement, each party shall meet every five years thereafter to discuss “their actions and support in accordance with relevant provisions of this Agreement, as well as enhancing international cooperation for climate action.”⁸³ In 2020, countries submitted their climate action plan, or National Determined Contributions (NDCs).⁸⁴ Their leaders outlined how each individual country plans to reduce greenhouse gas emissions and how their governments will adapt to effects of climate change. The *Paris Agreement* works on a five year

⁷⁹ *United Nations*, “Paris Agreement.” 3.

⁸⁰ *Ibid*, 1.

⁸¹ *Ibid*, 2.

⁸² *Ibid*, 2.

⁸³ *Ibid*, 19.

⁸⁴ *Ibid*, 4.

cycle of increasingly ambitious climate action plans.⁸⁵ The parties are encouraged to submit additional long-term strategies to strengthen their support of the agreement. There will be a global conference in 2023 where the Parties shall meet to discuss matters further.⁸⁶ Furthermore, the document discusses the importance of transparency of the countries' current actions and future plans.⁸⁷ Thus the creation of the enhanced transparency framework (ETF).

The creation of the *Paris Agreement* is crucial because it inspires new laws and actions by governments across the globe. The *Paris Agreement* is a mutual agreement binding humans all over the world together, no matter their country, race, culture or religion. The only effective way to heal and restore the Earth is to work together to search for and implement creative and safe solutions. With the agreement in place and the support of numerous nations, humanity can be comforted into knowing that the future does not have to be bleak.

History of Environmental Sustainability in the United States

Our society has begun taking steps towards a sustainable future, due to governmental action, from as early as the 19th century. One of the earliest efforts to protect the environment was the Act of March 1st, 1872.⁸⁸ This act established Yellowstone National Park in the Territories of Montana and Wyoming. The protection of this park inspired President Theodore Roosevelt to commission the U.S. Forest Service in 1905. This law was created to federally protect land from both residential and commercial development. The U.S. Forest Service established 51 federal bird reservations, 4 national game reserves, 150 national forests, and 5

⁸⁵ Ibid

⁸⁶ Ibid, 19.

⁸⁷ *United Nations*, "Paris Agreement"

⁸⁸ "A Quick History of the National Park Service," *The National Park Service*, May 14th, 2018, <https://www.nps.gov/articles/quick-nps-history.htm>.

national parks.⁸⁹ The National Park Service was created in Congress and signed by President Woodrow Wilson on August 25, 1916.⁹⁰ The Park Service is in charge of 401 national parks and the protection of 400 endangered species.⁹¹

Over the next three decades, three influential conservation programs that addressed pollution were created; Soil Conservation Service (1935), Federal Water Pollution Control Act (1948), and the Air Pollution Control Act (1955).⁹² Laws and regulations acknowledge nature's rights and enforce the protection of those rights.

In 1962, Rachel Carson released her research publication titled *Silent Spring* that highlighted the effects of pesticides in the chemical industry on the environment and people.⁹³ Sustainability initiatives boomed during this time, including the National Wilderness Preservation System of 1968 and the Solid Waste Disposal Act of 1965.⁹⁴ Due to public pressure, lawmakers banned DDT (organochlorine insecticide) and influenced the creation of the National Environmental Policy Act (NEPA) on January 1, 1970 and the U.S. Environmental Protection Agency (EPA) on December 2nd, 1970 under President Richard Nixon.

Both the EPA and NEPA serve very important roles in the United States. Federal agencies are required to consult NEPA before any physical decisions are put forth that may have potential environmental effects.⁹⁵ The EPA is responsible for collecting data through research and testing which aids their environmental assessment and can be used to educate others about the environment. For example, employees will measure the air, water, and soil quality, as well as

⁸⁹“ A Century of Environmental Sustainability.” *U.S. Sustainability Alliance*, August 20, 2021, <https://thesustainabilityalliance.us/a-century-of-american-sustainability/>.

⁹⁰ The National Park Service, “A Quick History of the National Park Service.”

⁹¹ *Ibid*

⁹² *Ibid*

⁹³ Rachel Carson, *Silent Spring*, Houghton Mifflin Company, 1962.

⁹⁴ *U.S. Sustainability Alliance*, “A Century of Environmental Sustainability.”

⁹⁵ “Welcome,” *National Environmental Policy Act*, accessed September 15th, 2021, <https://ceq.doe.gov>.

observe wildlife habitats and vegetation. This group develops, upholds and enforces environmental laws.⁹⁶ The agency collaborates with businesses, non-profits, and governments on a pollution prevention program and energy conservation effort.⁹⁷

On April 22, 1970, America celebrated its first Earth Day to bring attention to and promote environmental sustainability. In 1976, Resource Conservation and Recovery Act (RCRA) was passed with guidance on how to control the “generation, transportation, treatment, storage, and disposal of hazardous waste.”⁹⁸ This law gave the EPA authority to set strict standards in regards to waste handling. The EPA then set forth the Clean Water Act, the Federal Pesticides Act, the Clean Air Act, the Endangered Species Act, and the National Scenic Trails Acts in the following years.

In 1990, the federal government passed Executive Order 13123 on the topic of Efficient Energy Management.⁹⁹ Establishment of the Conservation Reserve Program took place during this time as well. “The U.S. Green Building council (USGBC) is a non-profit organization that was founded in 1993 by a group of architects, engineers, and construction experts to transform the way building were designed and operated.”¹⁰⁰ In the 2000s, the EPA established standards for the use of renewable biofuels.¹⁰¹ The USDA’s Agricultural Marketing Service has established its own standards for organic foods.¹⁰²

⁹⁶ “Our Mission and What We Do,” *National Environmental Agency* online, accessed September 20th, 2021, <https://www.epa.gov/aboutepa/our-mission-and-what-we-do>.

⁹⁷ Ibid

⁹⁸ “Summary of the Resource Conservation and Recovery Act,” *National Environmental Agency*, accessed September 20th, 2021, <https://www.epa.gov/laws-regulations/summary-resource-conservation-and-recovery-act>.

⁹⁹ Brophy and Wylie, *The Green Museum*, 27.

¹⁰⁰ Ibid

¹⁰¹ U.S. Sustainability Alliance, “A Century of Environmental Sustainability.”

¹⁰² Ibid

Executive Order 13514 signed in October 2009 mandated sustainability goals for federal agencies. It required federal agencies “to submit a 2020 greenhouse gas pollution reduction target within 90 days, and to increase energy efficiency, reduce fleet petroleum consumption, conserve water, reduce waste, support sustainable communities, and leverage Federal purchasing power to promote environmentally- responsible products and technologies.”¹⁰³ The General Services Administration required that new construction or renovated facilities be certified LEED Gold.¹⁰⁴

Arguably the guideline most prominent in the United States’ current stance on environmental sustainability is the *Paris Agreement*. On April, 1st, 2016 the U.S, agreed to the terms and conditions of the treaty. This was great news considering the U.S. represents almost 15% of global carbon emissions from fossil fuels, second only to China with 30%.¹⁰⁵ In 2012, President Barack Obama created a Climate Action Plan which helps to incorporate means to cut carbon pollution not limited to:

- “Makes up to \$8 billion in loan guarantee authority available for a wide array of advanced fossil energy and efficiency projects to support investments in innovative technologies;
- Expands the President’s Better Building Challenge, focusing on helping commercial, industrial, and multi-family buildings cut waste and become at least 20 percent more energy efficient by 2020;

¹⁰³ Brophy and Wylie, *The Green Museum*, 249.

¹⁰⁴ Ibid, 27.

¹⁰⁵ "This Interactive Chart Shows Changes in the World's Top 10 Emitters," *World Resources Institute*, December 10th, 2020, <https://www.wri.org/insights/interactive-chart-shows-changes-worlds-top-10-emitters>.

- Sets a goal to reduce carbon pollution by at least 3 billion metric tons cumulatively by 2030 – more than half of the annual carbon pollution from the U.S. energy sector – through efficiency standards set over the course of the Administration for appliances and federal buildings;
- Commits to partnering with industry and stakeholders to develop fuel economy standards for heavy-duty vehicles to save families money at the pump and further reduce reliance on foreign oil and fuel consumption post-2018”¹⁰⁶

Additionally, there is a section in the plan preparing the United States for the Impacts of Climate Change:

- “Directs agencies to support local climate-resilient investment by removing barriers or counterproductive policies and modernizing programs; and establishes a short-term task force of state, local, and tribal officials to advise on key actions the Federal government can take to help strengthen communities on the ground;
- Launches an effort to create sustainable and resilient hospitals in the face of climate change through a public-private partnership with the healthcare industry;
- Maintains agricultural productivity by delivering tailored, science-based knowledge to farmers, ranchers, and landowners; and helps communities prepare for drought and wildfire by launching a National Drought Resilience Partnership and by expanding and prioritizing forest- and rangeland- restoration efforts to make areas less vulnerable to catastrophic fire; and

¹⁰⁶ “FACT SHEET: President Obama’s Climate Action Plan,” *The White House*, June 25th, 2013, <https://obamawhitehouse.archives.gov/the-press-office/2013/06/25/fact-sheet-president-obama-s-climate-action-plan>.

- Provides climate preparedness tools and information needed by state, local, and private-sector leaders through a centralized “toolkit” and a new Climate Data Initiative.”¹⁰⁷

150 years have passed since the protection of Yellowstone National Park, and in the time since, the United States’ efforts to protect our environment have grown greatly. From Theodore Roosevelt’s achievements to today’s *Paris Agreement*, only one thing is certain; There is more work to be done.

Current Events

In 2014, President Barack Obama dedicated three billion dollars to the Green Climate Fund with hopes of raising \$100 billion per year by 2020.¹⁰⁸ Three days before Obama left office, he made a second installment of \$500 million dollars to the Green Climate Fund.¹⁰⁹ A lot of progress had been made during this time regarding sustainability, until The United States withdrew from the *Paris Agreement* on June 1st, 2017, under the Donald Trump Administration. The argument for this decision is that it would harm the U.S. economy, and put the U.S. "at a permanent disadvantage".¹¹⁰ It was not until recently, that current President Joseph Biden signed an executive order on his first day in office, January 20, 2021, rejoining the U.S. in the agreement. The Executive Order on Protecting Public Health and the Environment and Restoring

¹⁰⁷ Ibid

¹⁰⁸ “FACT SHEET: United States Support for Global Efforts to Combat Carbon Pollution and Build Resilience,” *The White House*, November 15th, 2014, <https://obamawhitehouse.archives.gov/the-press-office/2014/11/15/fact-sheet-united-states-support-global-efforts-combat-carbon-pollution->

¹⁰⁹ “Barack Obama transfers \$500 million to the Green Fund in attempt to protect the Paris Deal,” *The Guardian*, January 17th, 2017, <https://www.theguardian.com/us-news/2017/jan/18/barack-obama-transfers-500m-to-green-climate-fund-in-attempt-to-protect-paris-deal>.

¹¹⁰ “Paris climate deal: Trump announces US will withdraw”. *BBC News*. June 1, 2017, <https://www.bbc.com/news/world-us-canada-40127326>.

Science to Tackle the Climate Crisis' discussions are broken down into 8 sections (Policy, Immediate Review of Agency Actions taken between January 20th, 2017 - January 20th, 2021, Restoring National Monuments, Arctic Refuge, Accounting for the Benefits of Reducing Climate Pollution, Revoking the March 2019 Permit for the Keystone XL Pipeline, Other Revocations, General Provisions). Specific measures taken by this document to reduce climate change include reinstating President Obama's Executive Order to ban oil and gas drilling in the Bering Sea, as well as revoking the permit for the Keystone XL pipeline in an effort to reduce tar sand oil emissions. Revoking the pipeline alone saves 178.3 million metric tons of greenhouse gas emissions per year.¹¹¹

This federal document highlights any immediate plans and revocations to combat damaging practices. President Biden is making America more sustainable, and doing it swiftly. He states a plan to find ways to reduce greenhouse gases (carbon, nitrous oxide, and methane). Not only is he considering advancement toward environmental justice, but he addresses how the environment plays a role in public health. This document holds the U.S. to a new standard for climate action. Instead of allowing sustainability to be voluntary for individuals to pursue if they so desire, it will slowly become law through the federal governmental to incorporate sustainable practices in businesses and homes. To set an example, the White House utilized solar panels on the roof. These combined actions will change the American standard of how we utilize energy for the next four years and hopefully into perpetuity.

While the U.S. has introduced laws to protect the environment for well over a century, our population is still experiencing extreme effects of climate change. As a nation, we need to

¹¹¹“ Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis.” *The White House*, January 20th, 2021, <https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/20/executive-order-protecting-public-health-and-environment-and-restoring-science-to-tackle-climate-crisis/>.

ask the imperative question; Are we doing enough? Environmental laws should be taken more seriously by both businesses and individuals. Industries must further their regulations in order to ensure global warming does not exponentially increase. World leaders must inspire their citizens to take climate change seriously and adopt a more sustainable lifestyle. While the *Paris Agreement* and *Earth Charter* are fantastic entities for the United States to be involved in, there is still quite a large amount of work to be done. Humanity in the United States and across the globe must work together, unifying with one goal to combat the continuation of an already existing crisis.

Discussion

Climate change has become much more of an issue now than it was over a century ago when President Roosevelt initiated The U.S. Forest Service. It is important for us to understand the entire scope of the issues surrounding climate change. The data, history and current events that surround the looming crisis are all necessary to fully understand the concerns. Additionally, it can be even more important to understand the idea of environmental sustainability, in order to ensure that we do not succumb to the effects of global warming. Businesses and industries must do their part as well or else the effort will be for naught, as they are the biggest producers of greenhouse gases. Museums are no different in that they must participate in the worldwide evolution towards net zero and implement sustainable practices in their daily operations to do so. Beyond that, museums possess the ability to not only change themselves, but to educate their visitors and lead by example. Museums taking initiative and going green can positively impact their surrounding communities in a profound way.

Chapter Two:

Museums and Environmental Sustainability

Why Should Museums Go Green?

We all contribute to climate change in one form or another, but some institutions create more pollution than others. It is estimated that about 12 million metric tons of carbon are emitted each year by museums in the United States alone.¹¹² Museums, especially prominent ones, are notorious for expansion projects. The IPCC Special Report "indicates that global energy related emissions from building operations are responsible for approximately 28% of energy-related carbon emissions, with a further 11% incurred through the materials and construction process."¹¹³ Museums utilize an incredible amount of energy to regulate the temperature and humidity of their collections, and are contributing to carbon emission rates just like nearly every institution in the world. For most, the energy bill is the second largest item in the budget after salaries.¹¹⁴ Not to mention, exhibition materials more often than not are also depleting resources. However, museums are now presented with a chance to prove themselves as humane leaders with a commitment to changing their unsustainable habits.

Leadership and Changemakers

The role museums have in society has evolved and continues to evolve in order to stay relevant and properly serve its visitors and community. Museums are no longer just storage

¹¹² Joyce Lee, Frances Morris, Leonardo Menezes, and Andrés Roldán, *American Alliance of Museums*, "Looking Ahead: Embracing Sustainability and Resiliency for a Better Tomorrow," September 22nd, 2021, <https://www.aam-us.org/2021/10/21/looking-ahead-embracing-sustainability-and-resiliency-for-a-better-tomorrow/>.

¹¹³ *Climate Heritage Network*, "Memorandum of Understanding (MOU)", 2.

¹¹⁴ Sarah Sutton, "The Evolving Responsibility of Museum Work in the Time of Climate Change, *Museum Management and Curatorship*," *Routledge: Taylor & Francis Group*, 2020. Vol. 35, No.6, 622.

houses teeming with rich and exotic treasures, rather they are educational institutions that explore a variety of topics through interactive and dynamic displays. The directors, curators, collection managers, and staff members have the authority to choose controversial topics that bring attention to social issues. By presenting a message through an exhibition or programming, a large group of people can be reached, thus influencing a change. Some museums have already begun to touch upon the pressing issue of climate change. But it is time to encourage all museums, their leadership, and their staffs to incorporate an element of environmental sustainability into their everyday practices. Whether it is dedicating efforts to create a more sustainable exhibition space, integrating sustainability into the mission, or simply swapping current materials for more energy efficient ones, museum leadership has within them the ability to enact change.

Mike Murawski, author of *Museums as Agents of Change: A Guide to Becoming a Changemaker*, and Co-creator of #MuseumsAreNotNeutral believes all museums need to start “recognizing the essential need for museums to lead and take action rather than just follow, react to, and reflect the times in which we live.”¹¹⁵ Climate Change is happening now and all museums have the influence to become environmental activists and stewards of the Earth.

Most museums are non-profits and are educational institutions that are accessible to every person regardless of age, gender, ethnicity, and class. Because of this dedication to its visitors and community, they have become highly valued within society. The public expects these institutions to honor the truth and to lead by example. This is why it is important for museums to be at the forefront of the green movement. To lead by example is an impactful way for any institution to convey a message that is important to them.

¹¹⁵ Murawski, *Museums as Agents of Change*, xvi.

Arguably the easiest step is to implement environmental sustainability into the mission statement, because every decision made by the museum leadership must be guided by its mission. Museums can create programs that encourage its community to evolve into a more sustainable culture and provide resources for those who do not have the means to go green. In order to maintain that leadership role, museums must stay relevant and encourage advocacy. Not only does this engage the public, but it also attracts visitors and gains the museum public support. This will be discussed in further detail in Chapter Three.

Mandates for Environmental Sustainability

Although there is no federal requirement in the U.S. for museums to abide by a universal sustainability standard, there are several regulations and certification plans that should be followed. At the beginning of 2021, President Biden announced the re-entry of the United States into the *Paris Agreement*. Biden has met with political leaders from various countries to discuss how they are approaching cutting carbon emissions along with other harmful types of pollution. Biden attended the G20 Summit in Rome, Italy and the 26th UN Climate Change Conference of the Parties (COP26) in Glasgow, Scotland from October 30th to November 12th, 2021. The G20's purpose is address global environmental and economic issues and propose solutions. The purpose of COP26 conference is to "secure global net zero by mid-century and keep 1.5 degrees within reach, adapt to protect communities and natural habitats, mobilize finances, and work together to deliver."¹¹⁶ There is talk of a reconciliation bill that will designate billions in support for solar and wind energy and electric vehicles. Inspired by the events at COP26, Biden and his team have signed the Global Methane Pledge which requires participants to cut 30 percent in

¹¹⁶ "COP26 Explained," *UN Climate Change Conference UK 2021 in Partnership with Italy*, accessed on November 5th, 2021, <https://ukcop26.org/wp-content/uploads/2021/07/COP26-Explained.pdf>.

methane emissions by 2030.¹¹⁷ In addition, Biden also announced a proposal that will support the Global Methane Pledge, by establishing “standards for old wells, impose more frequent and stringent leak monitoring, and require the capture of natural gas that is found alongside oil and is often released into the atmosphere.”¹¹⁸ Pro-climate laws are coming and it will only be a matter of time before they will be enforced; museums will be expected to follow suit.

From his first day in office, President Biden started to put forth sustainability mandates and set goals upon climate regulation for the United States. I anticipate that new laws at all levels will be created specifically targeting carbon emission rate and other environmental concerns. That means institutions must adapt to sustainable practices to comply with the new push to conserve energy. For example, California already has mandatory energy-efficiency codes and the International Green Construction Code (IgCC) since 2010, which give concrete guidelines for energy use to both commercial and residential buildings.¹¹⁹ These construction laws apply to all non-historical buildings in the state of California, regardless of the nature of construction (renovation, addition or new build).¹²⁰ Before guidelines and restrictions become more strict, why not get ahead? It is time to invest in the future, and museums are certainly not excluded.

In 2013, The American Alliance of Museums (AAM) held a summit on sustainability standards in museums. The core belief behind the discussion of sustainability at the summit was that “[Environmental] standards have enough of a presence in other fields that they have come to

¹¹⁷ Dino Grandoni and Steven Mufson, “Biden’s Team Unveils New Rules to Curb Methane,” *The Washington Post* (Washington D.C.), November 2nd, 2021.

¹¹⁸ *Ibid*

¹¹⁹ *Ibid*, 4.

¹²⁰ “2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings for the 2019 Building Efficiency Standards,” *California Energy Commission*, accessed November 29th, 2021, <https://www.energy.ca.gov/publications/2008/2019-building-energy-efficiency-standards-residential-and-nonresidential>.

affect the museum world.”¹²¹ In the opinions of many, this is a very rational position. It is an issue that simply cannot be ignored anymore. Why should businesses, offices, public spaces and heavy industries be working towards green solutions, but not museums? Among the numerous issues surrounding climate change, organizers of the summit sought to gain a stronger understanding of building and operational design, industry metrics and standards and informed choices on what standards to use for each unique type of museum.¹²²

One of the attendee’s largest concerns were finances, because energy efficient changes have a stereotype of being extremely costly.¹²³ The speakers explained that while some changes can be extremely costly, this route may not be the right fit for your particular institution in the first place. For example, an aquarium’s need for energy differs greatly from an art gallery.¹²⁴ Rather, the “need for smarter operational practices is universal” and the sum of the entire museum field making the changes they are capable of making may be more important than one singular museum reaching net zero.¹²⁵ The various speakers discussed affordability of several small changes that can have huge impacts.

A key takeaway from the discussions is that flexibility is the key to developing widespread museum sustainability standards and standards cannot be set without shared values.¹²⁶ To conclude the summit, the organizers gave museums a list of options, practices, guides, programs and technologies, with pros and cons for each, to help guide the leaders of each

¹²¹ “Museums, Environmental Sustainability and Our Future: A Call to Action from the Summit on Sustainability Standards in Museums 2013,” *American Alliance of Museums and the PIC Green Professional Network*, accessed September 17th, 2021, <http://ww2.aam-us.org/docs/default-source/professional-networks/picgreenwhitepaperfinal.pdf>, 1.

¹²² *Ibid*, 5.

¹²³ *Ibid*, 7.

¹²⁴ *Ibid*, 10.

¹²⁵ *Ibid*, 8.

¹²⁶ *Ibid*, 14.

individual institution on their sustainability journey. Among these included the adoption of an existing standards system, such as LEED, Green Globes, Living Building Challenge and SITES, all of which are current systems put in place that offer certification for environmentally conscious structures.¹²⁷ Another option gave museums the choice to use guidelines from numerous existing systems listed above in order to fit their institution.¹²⁸ For those museums not satisfied with the first two options, the organizers suggested to create their own unique standard, or to develop a standard specific for museums that can be shared with other similar institutions.¹²⁹

Lastly, the summit recognized several museums that had already gone above and beyond the expectation of the AAM. The Cooper-Hewitt Museum in New York City was recognized for its use of recycled construction materials throughout the structure, including 100% of the building's wood, 80% of the building's carpeting and 75% of the objects' protective cases.¹³⁰ Monticello, the home of Thomas Jefferson, was commended for the installation of a closed-loop geothermal system, reducing both energy and water usage, and earning the building Gold certification.¹³¹ This is especially impressive when you consider that Monticello is a centuries old historical building. Lastly, the Natural History Museum of Utah received praise for the education presented to their guests, coupled with the green standards they follow. A kiosk "shows in real time how much energy the rooftop solar panels are generating relative to the energy the building is using."¹³² This is a great usage of exhibit space to educate guests on the

¹²⁷ Ibid, 15.

¹²⁸ Ibid, 16.

¹²⁹ Ibid, 19.

¹³⁰ Ibid, 41.

¹³¹ Ibid, 46.

¹³² Ibid, 48.

sustainable efforts the museum is taking. It exemplifies what a museum should strive to do: provide inspiration to its visitors and attempt to create change through their actions.

The American Alliance of Museums (AAM) President and CEO, Laura Lott, signed the Climate Heritage Network Memorandum of Understanding (MOU) on October 23rd, 2020. This urges museums and other cultural institutions to reduce their carbon footprint and operate more sustainably.

“The signatories to this MOU (hereinafter referred to as “the Parties”) commit to strengthening their efforts to address climate change and support communities in achieving the decarbonization goals and other ambitions of the *Paris Agreement*, emphasizing (i) that arts, culture and heritage are both impacted by climate change and an asset for climate action; and (ii) that arts, culture and heritage (including sites and landscapes, institutions and collections as well as creativity, intangible heritage, traditional ways of knowing and practices) constitute an invaluable resource to help communities reduce GhG emissions and strengthen adaptive capacity, even while the risks to those resources from climate impacts must also be addressed.”¹³³

Furthermore, the Climate Heritage Network (CHN) wants to help people in the field of cultural heritage develop climate policies and greenhouse gas reduction goals through methods that work, while discussing previous failures as well. Institutions should consult with local, regional and national authorities and governments. Another step is putting metrics in place to hold these institutions accountable and to help them track their progress.¹³⁴ The CHN hopes to raise awareness to the issue of climate change through highlighting the connection between

¹³³“Memorandum of Understanding (MOU),” *Climate Heritage Network*, accessed June 26th, 2021, <https://www.aam-us.org/wp-content/uploads/2017/11/AAM-2020-Climate-Heritage-Network-MOU-Final-.pdf>, 2.

¹³⁴ Ibid

ecological and social values.¹³⁵ Lastly, they hope to provide opportunities to attract visitors, and involve the community in healing the environment.

The AAM successfully bolstered their position and guidance on the issues of environmental sustainability through the 2013 Summit. Coupled with their release of the MOU, the AAM is giving inspiration, guidance, and even in certain cases pressure when needed upon museums looking to begin their sustainability action plan. Museums should strongly consider their actions regarding operational change or lack thereof. They should make the conscious choice to implement the sustainability recommendations set forth by the AAM and CHN. As enough museums begin making changes, others may find themselves far behind in the future. The 2013 Summit and other programs along with the MOU, encourage museums to go green now.

Going Green: A Cost Effective Solution

The final argument for museums to embrace the green movement are the benefits of cost-effective solutions. Many who oppose green mandates make the argument that sustainable technologies are too costly for what their institution can afford. Outlined in *The Green Museum* are energy efficient methods and day-to-day operational changes will cut the price of bills and save the institution money long term. Preservation is always a top priority for museums. By incorporating sustainable practices, institutions can save money that can be spent on “carrying out the core responsibilities and [keeping] the environment clean and safe for your objects, building, staff, and visitors.”¹³⁶ According to one study, “green buildings cost roughly 2% more

¹³⁵ Ibid

¹³⁶ Ibid

to build than conventional buildings.”¹³⁷ Green buildings, however, will give the institution a return on their investment. A term that best explains this is life cycle cost, which is “All of the costs associated with a product or service over its life span, including sourcing, producing, purchasing, running, and disposing of it.”¹³⁸ It is estimated that “green buildings reduce energy use by an average of 33%, resulting in significant cost savings.”¹³⁹ Green initiatives should be included in any museum board’s strategic planning process for this reason. When reviewing sustainable ideas, discussions should be focused on long term cost savings, immediate cost reductions and long-term benefits of any changes.

In some cases, it can cost less to retrofit an existing building and implement sustainable practices than to build a new structure. Renovating a structure removes or reduces the need for excavation, structural steel, concrete foundations, craning and underground utilities, all of which are necessary but costly components of a new structure. *The Green Museum* makes an excellent argument for renovating an existing space, stating that “not building is even greener since it conserves the embodied energy in your existing building (the energy expended to produce, transport, and use the construction materials). You avoid the waste generated by demolishing the old and constructing the new.”¹⁴⁰ The Preservation Green Lab at the National Trust for Historic Preservation published a study titled, “The Greenest Building: Quantifying the Environmental Value of Building Reuse”, confirming that reusing or renovating existing buildings has a significantly less carbon footprint than new construction. The study found that it takes “10 to 80 years for a new building that is 30 percent more efficient than an average-performing existing

¹³⁷ Greg Kats, *Greening Our Built World: Costs, Benefits and Strategies*, (Island Press, 2009).

¹³⁸ Brophy and Wylie, *The Green Museum*, 281.

¹³⁹ Ibid

¹⁴⁰ Ibid, 99.

building to overcome, through efficient operations, the negative climate change impacts related to the construction process.”¹⁴¹

On the contrary, it may be difficult for historic buildings to implement green methods. Per the 2020 Existing Building Code of New York State, modifications of any structure that alter the historical significance of the building shall undergo review and require a written report of the changes made and how they affect the structure.¹⁴² Exceptions to this rule can be hard to come by, making sustainable changes much more difficult for museum personnel in historic buildings, than those residing in a modern building. However, there are historical structures that are LEED certified, such as the previously mentioned Monticello. With the New York State restrictions, historical buildings must be particularly creative in order to become more sustainable.

If an institution is neither looking to renovate or build a new structure, they can begin their sustainability journey by swapping out operational tasks and habits with green alternatives. Museums can implement sustainable practices such as “upgrading and monitoring your systems, reducing waste, recycling more, and sourcing green products and services.”. These can all have a large impact on an institution’s sustainability.¹⁴³ These upgrades can include wholesale replacements of systems, or upgrades in more efficient equipment, such as additions of Variable Frequency Drives, which decrease energy costs greatly over time. Conducting an energy audit

¹⁴¹ “The Greenest Building: Quantifying the Environmental Value of Building Reuse,” *National Trust For Historic Preservation*, accessed December 13th, 2021, <https://forum.savingplaces.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=5119e24d-ae4c-3402-7c8e-38a11a4fca12&forceDialog=0>.

¹⁴² “2020 Existing Building Code of New York State,” *International Code Council INC and New York State Department of State*, accessed November 29th, 2021, <https://dos.ny.gov/system/files/documents/2020/09/2020-ebcnys-november-2019.pdf>. 59.

¹⁴³ *Ibid*, 3.

proves to be the most beneficial practice to determine areas of energy waste.¹⁴⁴ It is simple, fast, and museums can see a return on their investments through energy savings.

The staff and board have control over how green they want to be, as well as how much money they are willing to invest. The *Green Museum* emphasizes that there are various shades of green and “green is a continual path toward greater improvement.”¹⁴⁵ Small changes over time make a big difference. Once a museum has set up its green initiative, it can inspire others to join the cause which may even result in financial donation from an impressed donor. Museums have the opportunity to “show funders the direct connection between green strategies that save money in operations and how that money can be used instead on critical mission objectives.”¹⁴⁶ It can provide a new perspective to existing funders and may even intrigue first-time funders.

International Museums Lead by Example

The United Nations have delivered several creative solutions that have been in place for years. As for museums, the United Kingdom and European Union governments fund almost all of their cultural institutions. In order to keep endowment, the museums are required to publish “annual energy scorecards.”¹⁴⁷ As long as these institutions comply with the country’s sustainable standards, no funds can be taken from them. This accountability ensures that museums remain sustainable indefinitely. As stated by Sutton, “Museums everywhere would do well to follow the European model for requiring action while providing funds and technical support for achieving results that benefit institutional missions and global emissions.”¹⁴⁸ The

¹⁴⁴ Ibid.

¹⁴⁵ Ibid, 4.

¹⁴⁶ Ibid, 217.

¹⁴⁷ Sarah Sutton, “The Evolving Responsibility of Museum Work in the Time of Climate Change, *Museum Management and Curatorship*,” (Routledge: Taylor & Francis Group, 2020), Vol. 35, No.6, 622.

¹⁴⁸ Ibid

United Kingdom and European Union are not alone in their regulations upon institutions. In fact, this is happening all across the world.

International museums have put their sustainable development goals into action. When attending the “Looking Ahead: Embracing Sustainability and Resiliency for a Better Tomorrow” conference presented by AAM and Parque Explore on September 22, 2021, I saw this to be true. The conference’s host Andrés Roldán from Columbia introduced the audience to three museum professionals who would speak on their institution’s sustainable efforts, Frances Morris from the Tate Modern Museum (U.K., London), Leonardo Menezes from the Museum of Tomorrow (Rio de Janeiro, Brazil), and Massimo Bergamini (Ontario, Canada).

Founded in 2000, the Tate Modern is an art gallery filled with modern and contemporary. Seven years after the initial construction, they added an addition with a unique design that allows natural air circulation, and the construction materials are designed to store heat in cooler weather. This combination has made a tremendous impact on reducing their energy consumption. The Tate Modern also sits on a major power station, and the new building was designed to absorb the heat emitted from the transmitters of the power station and use it for heating the air and water.¹⁴⁹ This new space utilizes 54% less energy and generates 44% less carbon than current building.¹⁵⁰ By 2023, the Tate’s goal is to use 50% less carbon than its current rate.¹⁵¹ By 2030, they hope to reach net zero.¹⁵² Frances Morris, the director at Tate Modern, offered a very simple piece of advice. She states that institutions must recognize when they should no longer grow, but instead

¹⁴⁹ “New Futures,” *Tate*, accessed October 14th, 2021, <https://www.tate.org.uk/visit/tate-modern/new-tate-modern/future>.

¹⁵⁰ Joyce Lee, Frances Morris, Leonardo Menezes, and Andrés Roldán, *American Alliance of Museums*, “Looking Ahead: Embracing Sustainability and Resiliency for a Better Tomorrow,” September 22nd, 2021, <https://www.aam-us.org/2021/10/21/looking-ahead-embracing-sustainability-and-resiliency-for-a-better-tomorrow/>.

¹⁵¹ Ibid

¹⁵² Ibid

change what they already possess.¹⁵³ This can be applied to anything from physical structures to collection practices. Morris tells others that it is not possible to take everything into the future, so make decisions wisely now, because those decisions will impact our collective future.¹⁵⁴ In 2019, the museum staff was approached by a group of artists to re-examine the Tate's values and incorporate sustainability in all senses of the word. Now they include climate and social justice at the core of the institution's values.¹⁵⁵ In pursuit of these newly found values, the curators chose to collaborate with artists and the public to bring attention to issues in climate change.¹⁵⁶ Frances describes people as the vehicle of change, and to start that change is to get involved in prominent institutions such as museums.¹⁵⁷

The Museum of Tomorrow is “an Applied Sciences museum which explores the opportunities and challenges that humanity will be forced to tackle in the coming decades from the perspective of sustainability and conviviality. It is an experimental museum, where the content is presented through a narrative that combines the accuracy of science with the expressiveness of art, using technology as a support in interactive environments, and audiovisual and gaming facilities created from scientific studies conducted by experts and data released all over the world.”¹⁵⁸ This museum was founded in 2015. Right from conception, the museum's entire focus was on environmental sustainability and inspiring its audience to find creative solutions to achieve a greener tomorrow.

¹⁵³ Ibid

¹⁵⁴ Ibid

¹⁵⁵ Ibid

¹⁵⁶ Ibid

¹⁵⁷ Ibid

¹⁵⁸ “About the Museum,” *Museu do Amanha*, accessed October 14th, 2021, <https://museudoamanha.org.br/en/about-the-museum>.

Exhibitions Manager, Leonardo Menezes, discussed how the museum is constantly focused on climate change and environmental sustainability. He proudly expressed that the museum has been carbon neutral (also known as net-zero) since its opening day.¹⁵⁹ They utilize solar panels and local water for power. The institution has a waste disposal and recycling system. Menezes states that every single exhibition within this museum has always addressed the topic of climate change.¹⁶⁰ They developed a group called scientific knowledge communities that are made up of students, farmers, teachers, indigenous groups, and scientists that can be called upon for numerous collaborations.¹⁶¹ The host of the conference, Andrés Roldán, commented on the effectiveness of the collaboration, stating “it’s not enough to educate them [visitors/public], but to get them emotionally connected. Even if you are a science museum.”¹⁶² Roldán further discussed with Menezes that in order to get the visitor emotionally connected to social issues like climate change, museums need to shift their focus away from collecting objects and start telling more stories.¹⁶³ He expressed his point even further by comparing museums to a hub of tools, connections, and resources for people to bring their stories together to share.¹⁶⁴

Last but certainly not least, Massimo Beramini, an Executive Director and CEO in the Finance and Operations Branch of the Canadian Museum Association entered the discussion. Previously Beramini had a 30 year career in policy, strategic planning, communications,

¹⁵⁹ Joyce Lee, Frances Morris, Leonardo Menezes, and Andrés Roldán, *American Alliance of Museums*, “Looking Ahead: Embracing Sustainability and Resiliency for a Better Tomorrow,” September 22nd, 2021, <https://www.aam-us.org/2021/10/21/looking-ahead-embracing-sustainability-and-resiliency-for-a-better-tomorrow/>.

¹⁶⁰ Ibid

¹⁶¹ Ibid

¹⁶² Ibid

¹⁶³ Ibid

¹⁶⁴ Ibid

association management, government, and politics.¹⁶⁵ His focus is on decolonization museums throughout the country of Canada.¹⁶⁶ His passion is to evolve museums to institutions of inclusiveness in order to remain relevant with its audiences.¹⁶⁷ Another social issue that is dear to him is climate change. He expressed his view on the subject that climate change is a polarizing issue. Beramini believes that museums can facilitate change by defining common solutions and opening doors to all communities.¹⁶⁸ Both Beramini and Menezes agreed that it is critical for museums to include social aspects into their mission statement, because the mission statement holds the core values of that institution.¹⁶⁹ Nature and culture, just like humans and the environment, will not survive without the other.¹⁷⁰

How Can Museums Go Green?

It may seem like a daunting task for museums to embrace environmental sustainability to its full extent. What is important to realize is that going green is not necessarily all or nothing. Any small change, that can be implemented within an institution is better than no change at all. There are various shades of green because not all museums are at the same point in their journey. Going green needs to be a lifelong commitment for museum staff and board as they strive to make improvements in every aspect of sustainability.

¹⁶⁵ “About Massimo Bergamini,” *Massimo Bergamini: Policy, Strategies, and Ideas*, accessed October 16th, 2021, <http://bergaminipolicy.ca/about-massimo-bergamini/>.

¹⁶⁶ Ibid

¹⁶⁷ Ibid

¹⁶⁸ Ibid

¹⁶⁹ Ibid

¹⁷⁰ Ibid

Mission Statement

Whenever it comes to implementing new values within an institution, whether a business or a museum, it is always a great place to start the implementation process with written policies and statements. By including sustainability in the mission, it creates a sense of permanence and dedication. These documents support the more tangible, instantaneous actions that museums can implement.

A mission statement is especially critical for museums because it explains the purpose of the institution and the goals it seeks to achieve. It is the essence of the museum and what they intend to be known for. Mission statements clearly reflect the organization's values. Environmental sustainability should be “a mission based decision; implementation should come from mission-driven decisions on a daily basis.”¹⁷¹ A great example of a museum that incorporates sustainability into their mission statement is the Phipps Conservatory and Botanical Gardens. Their mission statement is as followed: “To inspire and educate all with the beauty and importance of plants; to advance sustainability and promote human and environmental well-being through action and research; and to celebrate its historic glasshouse.”¹⁷² When asked about their sustainability driven mission, Richard V. Piacentini replied, “We really need to take a much stronger leadership role in inspiring the public to make changes in the way they live and operate.”¹⁷³ A more simple mission statement from the Natural History Museums of Los Angeles County (NHMLAC), reads, “to be good stewards of our natural and cultural worlds. That means becoming aware of what we can do as individuals—and as a museum community—to foster a

¹⁷¹ Brophy and Wylie, *The Green Museum*, 245.

¹⁷² “About,” *Phipps Conservatory and Botanical Gardens*, accessed December 12th, 2021, <https://www.phipps.conservatory.org/about>.

¹⁷³ Brophy and Wylie, *The Green Museum*, 245-246.

more sustainable environment.”¹⁷⁴ Additionally, many museums added core values in addition to the mission statement, to provide support for the inclusion of sustainability in their mission.

These core values are a great opportunity to express clear and concise goals for how they plan to address sustainability, among other extremely important museum values. For example, Boston’s Museum of Fine Arts has a fantastic sustainability statement that is visible on their website. It reads:

“The Museum of Fine Arts, Boston, recognizes the magnitude of human impact on the environment and is committed to the preservation of our planet for future generations. This commitment supports our mission to care for and share the artistic and cultural works of humankind in perpetuity and is our civic responsibility as an institution of Boston. At the MFA, we strive to incorporate sustainability into our planning and decision-making with the aim to reduce the environmental impact of our facilities and operations and to increase our resiliency and ability to adapt to our changing world. In line with these operational imperatives and our institutional values of shared accountability, inclusion, and care, we seek to use our unique platform as a forum for creativity and community to promote sustainability. Our commitment to the environment is driven and supported by staff at all levels across the organization, who have implemented a variety of green initiatives and are eager to extend our efforts. We take pride in being a founding institution of the Green Ribbon Commission, a group of business, institutional, and civic leaders in Boston working to develop shared strategies for fighting climate change in coordination with the city’s Climate Action Plan. In addition to complying with city regulations for the annual disclosure of energy use, we continue to employ new strategies to decrease energy consumption and greenhouse gas emissions. In response to the urgency of climate change, we

¹⁷⁴ “About Us,” *Natural History Museums of Los Angeles County*, accessed December 12th, 2021, <https://nhmlac.org/statement-sustainability>.

have formed a museum-wide sustainability team to assess, improve, and expand our efforts, with a goal of being a leader in our field. To this end, we will: develop a comprehensive climate action plan for the institution, participate in local and national collaborations, and facilitate programs that educate the public about sustainability and resiliency.”¹⁷⁵ The Museum of Fine Arts, Phipps Conservatory, and the Natural History Museums of Los Angeles County all have great mission statements in place, which is a great reference for aspiring museums to investigate.

Institutional Governance

The beauty of going green is that everyone can start anywhere at any time. To start, make minor day-to-day operational changes such as switching to LED light bulbs or recycling. These are easy changes that can be implemented with relatively little funds and efforts. For a more profound change, institutions should start by creating a sustainability statement, and corresponding policies.¹⁷⁶ Together this will help create a strategic sustainability plan to implement permanent change and have a lasting effect.

A sustainability statement incorporates sustainability into a museum’s values, community engagement, and operations. *The Green Museum* provides generalized examples of a sustainability statement that can be used as a reference for other institutions. It reads, “We will actively choose environmentally sustainable practices that create the healthy, productive environment our employees and visitors expect and deserve.”¹⁷⁷ Another example is, “Environmentally sustainable practices in programs and operations demonstrate our commitment

¹⁷⁵ “Sustainability Statement,” *Museum of Fine Arts, Boston*, November 7th, 2019, <https://www.mfa.org/about/sustainability-statement>.

¹⁷⁶ Brophy and Wylie, *The Green Museum*, 241.

¹⁷⁷ *Ibid*, 242.

to our community not just through programs, but by institutional behavior.”¹⁷⁸ These statements and documents will take time to manifest, and several decisions will need to be made before they can implement. It should be agreed upon by all members of the staff and board and expanded upon in their museum values.

Principles put the written words of statements into action. “Principles help guide thoughtful decision making to conserve resources, increase impact, manage risk, inform others, and create the best sustainable solutions for each situation.”¹⁷⁹ Hiring a sustainability consultant is the best resource to help set up these principles and ensure action. A great thing to implement is a Green Team within the museum staff. A Green Team can be formed when an institution agrees to assign sustainability tasks to staff and board members.¹⁸⁰ These tasks can be anything from implementing green programs, fostering educational opportunities, introducing a more rigorous standard, budgeting for green practices that have up-front costs, integrating green responsibilities and including these in annual performance reviews, encouraging participation from all levels of the staff and communicating green principals and actions internally and externally.¹⁸¹ There are Green Teams that have designated sustainability officers, or full time positions that oversee the team and sustainability action within the institution.¹⁸² Members within the team, generally have an understanding of environmental sustainability or a skill that they can contribute to the effort. It is easier to stay motivated and to achieve more with accountability partners, and the biggest reason why Green Teams could be beneficial.

¹⁷⁸ Ibid

¹⁷⁹ Ibid, 243.

¹⁸⁰ Ibid, 99.

¹⁸¹ Ibid, 101.

¹⁸² Ibid, 102.

After arriving at clear principles for the institution, the next step is to implement these principles into the museum policy. As explained in *The Green Museum*, “Policy institutionalizes behavior by providing visioning frameworks, defining process, identifying goals and evaluations methods, and delegating authority.”¹⁸³ Policy is the outline of your guiding principle, explanation of authority, oversight, and goals, supporting documents, baseline information, explanation of goals, metrics, timelines and budgets.¹⁸⁴ It is critical for success and helps sustain actions for the future.¹⁸⁵ Once your institution develops the policy, it is best to revisit it in “six months to finalize it, then yearly to update it.”¹⁸⁶ “Policy development and implementation require full participation by the board and staff leadership, with understanding of all staff ramifications. Make clear who has decision-making authority, who is responsible for oversight, and what the mechanisms are for ongoing training for staff and volunteers.”¹⁸⁷

Supporting documents provide information that can influence a decision on how to approach the situation. For example, supporting documents can be “energy-audit information, historical data for consumption of energy and water, and materials on the history of buildings and systems.”¹⁸⁸ Sustainability evaluations and budget are important to include as a supporting document. Evaluations like a “monthly, quarterly, or annual comparison to goals will let you know your degrees of success.”¹⁸⁹ Evaluations can help determine the budget. “The budget is necessary to calculate the return on investment or what is projected for energy-price fluctuation

¹⁸³ Ibid, 32.

¹⁸⁴ Ibid, 245.

¹⁸⁵ Ibid, 32.

¹⁸⁶ Ibid, 245.

¹⁸⁷ Ibid, 246.

¹⁸⁸ Ibid

¹⁸⁹ Ibid, 53.

or for inflation to prices.”¹⁹⁰ These documents will continually be supplemented with new data as the years progress and can be adjusted accordingly.

Physical Structure and Operations

If your institution wants to take immediate action to tackle its newfound passion for environmental sustainability, the following section will offer several suggestions that pertain to the physical structure and the daily operations. Accompanying each suggestion will be an explanation of the benefits. Implementing sustainable practices to your physical structure and day-to-day operations can be a challenge, but these challenges can be overcome with the right tools and information. To see fast results, reduce your energy consumption that is wasted, for example, lights that are left on for extended periods of time when they can be off instead. There are four categories that will be discussed: energy, water, paper and other physical materials, and space.¹⁹¹

Energy

Performing an audit is another good idea for museums in the early stages in a museum’s sustainability plan. An energy audit is an analysis of energy flow and distribution within a building. It can identify areas where energy can be conserved in order to decrease expenses and emissions. ASHRAE 90.1 was created by the American Society of Heating, Refrigerating and Air Condition Engineers, whose “program establishes the minimum standards for saving energy and is the basis for many state and local code.”¹⁹² They encourage everyone to regularly check

¹⁹⁰ Ibid, 247.

¹⁹¹ Ibid, 5.

¹⁹² Ibid, 65.

utility bills and measure them, in case of consumption spikes or increases.¹⁹³ “Audits are important whether the building is new or old, and you do not stop doing them just because you had the building commissioned. Nothing tells you about how you use the building better than an audit. ...One of the best, first activity of your green team may be a room-by-room audit of what you have, what you use, and what you do.”¹⁹⁴ For those that want to take the next step, Smart Grid technology allows users to view their energy consumption in real-time and where it is the highest through the use of “digital technology, embedded in the electrical grid, homemakers, and buildings.”¹⁹⁵ Energy Star is a widely recognized program for energy application. It is a joint program between the U.S. Environmental Protection Agency and U.S. Department of Energy focusing on conserving funds for consumers and protecting the environment with green products and practices.¹⁹⁶ Not only are their products highly recommended but the company also provides strategies, resources, and tools to track your data and provide custom solutions to save energy. Any program chosen will be a great resource to refer to when assessing energy usage.

Conscious lighting is a great way to curb energy waste. There are automatic lighting systems such as occupancy sensors that turn off if there is no movement detected.¹⁹⁷ This limits energy consumption by turning off lights when there are no occupants in the area. Another technology called Watt-Stopppers have “dual-technology sensors that sense motion but also occupy, through changes in space temperature from body heat,”¹⁹⁸ Some programmable systems allow staff to control light exposure through lightning circuits, dimmers, and time clocks.¹⁹⁹

¹⁹³ Ibid, 66.

¹⁹⁴ Ibid, 66-67.

¹⁹⁵ Ibid, 249.

¹⁹⁶ Ibid, 67-68.

¹⁹⁷ Ibid, 129.

¹⁹⁸ Ibid, 132.

¹⁹⁹ Ibid, 131.

There are automatic late-night shut offs for exterior lights to reduce light pollution.²⁰⁰ Did you know that exhibit lighting can produce heat that triggers the air conditioning units? The most popular alternative is using compact fluorescents (CFLs), LED's or metal halides where you can.²⁰¹ Heat emitted from these lights is reduced, and the air conditioning use can reduce as well. Many curators and collection managers have addressed their concerns about the use of LED lights in exhibition for fear it could permanently damage artifacts due to strong exposure. However, the LEDs, do not emit UV light that can damage artifacts long-term, and artifacts are displayed true to color.²⁰² Pairing LED's with one of the light sensor technologies, can significantly reduce light damage to objects displayed in exhibitions. Another simple, but effective way to reduce energy is to unplug any electronics that are unused.²⁰³ Leaving them plugged in often cause "phantom" or "vampire loads" because it is still drawing electricity even when it is turned off.²⁰⁴ Utilize as much natural lighting as possible.²⁰⁵ By incorporating the use of natural light, there is a decrease in energy consumption which will reduce the electricity bill. Furthermore, these measures all contribute to the reduction of your energy consumption and can be implemented rapidly.

Another way to save on energy use is through a proper HVAC system. The HVAC system can either benefit or destroy sustainability mission, so it is important to do the research to find a system that fits your institution's specific needs. When deciding on what HVAC system to buy, it is important to include curators, conservators, administration and educators in discussions with the HVAC specialist. Every department has their own specific needs, and it is important that all these needs be fulfilled. HVAC regulates temperature in all areas of the museum, and it

²⁰⁰ Ibid, 129.

²⁰¹ Ibid, 130.

²⁰² Ibid, 130 -131.

²⁰³ Ibid, 134.

²⁰⁴ Ibid

²⁰⁵ Ibid, 5.

needs to perform at peak efficiency for both the collection and the people. A replacement for the HVAC system is not always needed, but many systems can benefit from regular maintenance and upgrades. A system that some museums benefit from include the use of variable-frequency drives (VFDs) and adjustable-frequency drives. VFD's adjust fan speed by lowering electricity supply to the equipment, allowing the equipment to condition the temperatures or lighting intensities for the amount of people within the space at a given time.²⁰⁶ Heat Recovery Ventilators are another component that can be added to an HVAC system. Heat Recovery Ventilators "capture heat from air expelled from the building and put it back into fresh incoming air."²⁰⁷

Another exceptional energy saving system are geothermal systems, which tap "into the subterranean temperature conditions of the earth to reduce the amount of energy we need to heat and cool the interior of our buildings. This kind of geothermal system uses the constant 50-55 degree temperature of the earth, conditions cooler than the outside air in summer, and warmer than the outside air in winter to raise or lower the temperature of the air supplied to the buildings for heating and cooling, water heating or general use. There are three parts to the system: the tubes that reach into the earth, the exchanger that transfers the temperature from one medium to the next, and the heating and cooling distribution system throughout the building."²⁰⁸ Additional benefits for geothermal energy is that it is a quiet system, there are no unsightly structures to look at because it is concealed underground, and it can work for new and old construction (including historic preservation buildings). Another alternative energy source is solar power. This process captures the sun's light and heat through Photovoltaic (PV) Panels; that transform it

²⁰⁶ Ibid, 136.

²⁰⁷ Ibid, 137.

²⁰⁸ Ibid, 138-139.

into electrical or thermal energy.²⁰⁹ These panels can be placed on the ground, on the roof, an even on roofing tile. The panels serve as a renewable source of energy, while also reducing the building's electric bill.

Two advancements in energy creation are fuel cells and biomass generation. Fuel cells create energy by converting electricity into natural gas.²¹⁰ It is said to be “two to three times more efficient in energy use than combustion (burning fuel), meaning more of the fuel is absorbed directly into energy, rather than going to waste – and there are no emissions of nitrous oxide or sulfur oxide as with combustion.”²¹¹ Biomass on the other hand, converts materials created by plants and animals into energy, such as corn husk and manure.²¹² Zoos benefit greatly from biomass generation. Instead of hauling their organic matter away, they use it for energy to power buildings. All of these systems can be expensive but are a worthwhile investment and the reduction in energy costs will be noticeable.

Stepping away from interior methods of saving energy, there are several solutions that can be explored on the exterior of the museum. Ever heard of cool or green roofs? Cool roofs are often coated with a material or paint that will reflect heat instead of traditional roofing materials that tend to absorb heat.²¹³ A green or living roof is essentially a plant covering. Plants in general are great for absorbing heat and moisture and on top of a roof, they also provide natural insulation, and purification of the air by converting carbon dioxide into oxygen.²¹⁴ Plants that thrive on a living roof are grasses, sedums, shrubs, flowers and even trees. Opening up the roof to visitors can allow the museum to introduce more programs, cultivation events, and facility

²⁰⁹ Ibid, 145.

²¹⁰ Ibid

²¹¹ Ibid

²¹² Ibid, 146.

²¹³ Ibid, 151-152.

²¹⁴ Ibid, 152.

rentals such as wedding venues. Be aware that a green roof could require the maintenance levels of a park. Sometimes these roofs can qualify for park-designated funds for construction and maintenance.²¹⁵ This type of roof works great in conjunction with solar panels. Both green and cool roofs can last two to five times longer than a traditional roof because of the UV related damages. Vegetative roofs are better for storm-water management while cool roofs are better for heat reduction. These alternative roofs are becoming a trend among museums. For context, The Getty Center, The Rock and Roll Hall of Fame, The California Academy of Sciences, The Brooklyn Children’s Museum, and the visitor and administration center at the Queens Botanical Garden all possess alternative roofs.²¹⁶ Similar to a green roof there are green and living walls that not only provide those same benefits as the roofs but can be incorporated inside the museum for aesthetic purposes. An active living wall is made when the vegetation is a part of the building’s mechanical air and water system, creating its own small ecosystem “if the wall is connected to the buildings water systems, gray water from sinks travel down through the plant-attachment material, and the plant roots clean the water. If it is attached to the air system, the air filters through the plant-attachment material, and the plant roots clean the air. It could also be connected to a gray-water system to purify the water.”²¹⁷ A green wall on the exterior facade adds a rustic element to the atmosphere of the museum, while being an extremely sustainable option for the function of the museum.

²¹⁵ Ibid, 153.

²¹⁶ Ibid

²¹⁷ Ibid, 154.

Water

Although one of the most common resources, water can be the most misused. It can be extremely beneficial, especially for an institution of large scale, to use it responsibly. When assessing the efficiency of your museum's water system, the best place to start is with an audit. From there you can decide if you need a new water pump, switch to a tankless heater, or even recycle rain/grey water. A tankless water heater is a demand-only technology that can be up to 70 percent more efficient than traditional heaters.²¹⁸ An added benefit is that "The tank itself will take up far less space in your building, while reducing harmful emissions."²¹⁹ Another simple change to save water is to use less of it. Consider adding aerators, which mix air into the water flow, to the museum's faucets.²²⁰ Aerators allow the user to "keep the water running for the usual time they need to wash their hands, but less water comes out of the faucet during that time, and none sprays outside the hand-washing radius and goes unused."²²¹ Low flow and dual-flush toilets will help reduce water consumption, giving institutions another option to save water.²²²

A simple switch to keep wastewater cleaner, is to switch to biodegradable or natural soaps and remove any harsh chemicals in purchased cleaning supplies with other natural alternatives on the market. Another option is to recycle and reuse water by harvesting rainwater. Collected water, whether it is from rain barrels or runoff, can be used in landscape maintenance that is often associated with a museum's exterior.²²³ Another option is to clean and repurpose rainwater into a water feature or display within a museum.²²⁴ These interior water displays

²¹⁸ Ibid, 142.

²¹⁹ Ibid

²²⁰ Ibid

²²¹ Ibid, 142-143.

²²² Ibid, 143.

²²³ Ibid, 147.

²²⁴ Ibid, 149.

should be investigated thoroughly before constructing as they too can use unnecessary energy and may increase the humidity within the building, and therefore the air conditioning usage. Grey water can also be used for toilets.²²⁵ Stormwater is slightly more complicated because it contains pollution and dirt and collect quickly in heavy amounts. Stormwater falls from the sky, lands on roofs, roads, or parking lots, and in the process, it collects pollutants from the atmosphere, roofing materials or other surfaces.²²⁶ Also, the heavy force erodes storm drains quickly. It is important to have proper stormwater management, which “cleans water through biological filters, slowing the flow by encouraging absorption, and slowing the rate of flow to prevent erosion.”²²⁷ Sustainably designed buildings rescue water runoff by including bioswales, rain gardens, green roofs, permeable pavers and porous pavement parking lots.²²⁸ Bioswales remove silt and pollution before releasing stormwater into the drain, while permeable pavers and parking lots allow for water collection through drainage systems underneath hard exterior surfaces.²²⁹

Physical Materials

When it comes to assessing the physical waste consumption, it is easiest to again start with an audit. An audit allows the museum to “review of the amount and type of waste generated during a representative period.”²³⁰ It is suggested to hold onto a weeks’ worth of waste, weigh it and sort it out. Then the museum will be able to see where their institution generates the most

²²⁵ Ibid

²²⁶ Ibid

²²⁷ Ibid

²²⁸ Ibid

²²⁹ Ibid, 278

²³⁰ Ibid, 104.

amount of waste. The EPA has a waste checklist online called “Waste Wise.”²³¹ From there they can begin reducing what comes into the institution by “selecting items that come in less packaging (more items in one box, bulk and concentrated materials), and by choosing to provide or use less.”²³² When it comes to physical materials, museums should always think to reduce, reuse, recycle and remain as chemical free as possible. Seeking out materials and technologies that utilize renewable resources and are low impact can also be more sustainable options. Think if it a purchased item is recyclable or biodegradable. Can it reused or repurposed, if not? For example, in office spaces it would be wise to invest in double sided printers that use soy-based ink on recycled paper to reduce paper consumption. Encourage staff to print less. If the document can be sent via email, that is sufficient. The other entities a museum might have such as a café or gift shop can be improved as well. Reduce or eliminate the use of single use plastic by using recycled paper products or compostable materials instead of plastic. Encourage visitors to go green by creating a rewards program for members that bring their own reusable bags and eliminate the sale of plastic water bottles while offering water fountains instead. Cafés are notorious for creating food waste. Placing a compost bin next to the trash and recycle bins allows diners to discard their organic waste in a responsible way. Another option is to donate the scraps to a local compost site or, as some museums have started, add the waste to worm bins for the recycling of food waste and production of usable compost.

Exhibition materials tend to generate excess waste, especially temporary and traveling exhibits. Exhibition designers and curators should be looking for materials that can be recycled, reused, or repurposed. There are some resources that offer unique solutions, such as “CultureNut Xchange, a U.S.-based organization for reselling museum materials. “The Island of Misfit

²³¹ Ibid

²³² Ibid, 103.

Crates' is an exchange idea suggested by staff at Atelier 4 to repurpose vacant city-owned buildings as locations for shared crate storage by area museums."²³³ If a designer must buy new materials, they can invest in well-built pieces that can be used for several exhibitions in the years to come. A general checklist when creating an exhibition to keep in mind: reduce new material, use local resources, reduce waste, reduce energy consumption, reduce toxic emissions, and think with innovation.²³⁴ This is another area where implementation of museum policies could be easily put in place by museum leadership to limit wasteful exhibitions.

Space

Space is precious, especially inside of a museum. It is common within the museum world to hear about fundraising projects or grants for expansion projects that have state of the art technology and modern designs. Construction of a new structure comes with an expansive price tag. It is also harmful to the environment to construct a new building as the construction processes causes an increase of CO2 emissions and wasted energy from machinery, transportation of materials, and depletion of resources used in making construction materials. Renovating existing buildings can be particularly useful if its viable and safe to do so, as this can greatly limit waste created by the demolition of an entire building and construction of a new foundation and structural frame. The Children's Museum of Pittsburgh is an excellent example for their repurposing of two old structures using "construction materials [that] were bought from local salvage companies or nonprofit that resells construction components like stained glass

²³³ Sarah Sutton, "The Evolving Responsibility of Museum Work in the Time of Climate Change, Museum Management and Curatorship," (Routledge: Taylor & Francis Group, 2020) Vol. 35, No.6, 627.

²³⁴ "Museums, Environmental Sustainability and Our Future: A Call to Action from the Summit on Sustainability Standards in Museums 2013," *American Alliance of Museums and the PIC Green Professional Network*, accessed September 17th, 2021, <http://ww2.aam-us.org/docs/default-source/professional-networks/picgreenwhitepaperfinal.pdf>, 34.

windows, floorboards, wall panels, light fixtures, cabinetry and carpet.”²³⁵ Another purpose for renovating or repurposing a structure is to preserve the story of the site and its effect on the local community. “There is a social value in the history of the site, and in the feel of its materials, its appearance, and the landscape it inhabits.”²³⁶ Consider all of the impacts of new construction before investing the time, energy, resources, and environmental impact.

Contrary to many standard buildings, there are several laws and regulation that protect historical structures (National Historic Landmark). Nothing can be changed or added for the sake of preservation and originality. This can make large scale changes difficult. However, simple upgrades to internal practices such as recycling and reducing unnecessary energy usage are still attainable and should be implemented.

Sustainable Metrics and Programs

There are several sustainability metrics programs such as U.S. Green Council, Living Buildings, Sustainable Sites, Green Globes, Renewable Energy Certificate and the Environmental Protection Agency’s Energy Star program and several more. Several museums have worked with these programs if LEED certification was not attainable or if not the correct fit for their individual institution. These programs have comparable guidelines to LEED; however, I choose to focus on LEED as it is the most popular, sought after, and widely recognized program among varying types of institutions.

If a new site is needed, consider a green design obtain LEED certification for the structure. The U.S Green Building Council’s Leadership (USGBC) in Energy and Environmental Design (LEED) is a nationally recognized ranking system that examines how sustainable a

²³⁵ Ibid, 159.

²³⁶ Ibid, 158.

structure is through its design, construction, and operation.²³⁷ It is important to know that the USGBC is a council that is “membership based and consensus driven and now includes over 10,000 member companies and organizations and a network of more than seventy local chapters, affiliates, and organizing groups.”²³⁸ Its greatest advantage is that it has a category for museums, unlike the other benchmarking programs.²³⁹ Points are awarded in five key areas of human and environmental health: Sustainable Sites (SS), Water Efficiency (WE), Energy & Atmosphere (EA), Materials & Resources (MR), and Environmental Quality (EQ).²⁴⁰ After assessment the structure will be designated a rating of Certified Silver, Gold, or Platinum if their operations and design meet the certification standards.²⁴¹ By 2030, this program will require that new buildings be carbon neutral in order to achieve LEED status.²⁴² Green Design and LEED guidelines change as sustainable technology and construction become the norm.

The USGBC website is a resource of publications, data, and tools for sustainable designs and practices. Museums are encouraged to strive for LEED certification because it will keep the museum’s function at a high standard over time, as well as the possibility of intriguing funders and collecting grants. Museums should aspire to be LEED certified for other reasons and well, such as the American Alliance of Museums joining the CHN’s mission to go green. It would be wise for museums to actively start implementing environmental practices and technologies into the structure and daily operations to stay relevant with current practices. A review of the U.S. Green Building Council’s website allows museum professionals to access several LEED designs

²³⁷ Ibid, 27.

²³⁸ Brophy and Wylie, *The Green Museum*, 285.

²³⁹ Sarah Sutton, “The Evolving Responsibility of Museum Work in the Time of Climate Change, *Museum Management and Curatorship*,” (Routledge: Taylor & Francis Group, 2020) Vol. 35, No.6, 620.

²⁴⁰ “Green Building,” *Burchfield Penney Art Center*, accessed October 26th, 2021, <https://www.burchfieldpenney.org/visit/the-building/green-building/>.

²⁴¹ Ibid

²⁴² Ibid

codes, educational articles and examples of positive changes. Additionally, it offers construction company or engineering firm suggestions with experience designing and constructing LEED certified buildings.

The first LEED Silver certified art gallery in New York State is The Burchfield Penney Art Center at SUNY Buffalo State.²⁴³ The Burchfield Penney's new construction was completed in November 22, 2008. The decision makers involved were able to design the building artistically, but sustainably. The building's "wood products that went into the construction of the Burchfield Penney were certified by the Forest Stewardship Council, an independent, non-governmental, not for profit organization established to promote responsible management of the world's forests."²⁴⁴ It was designed with large glass windows to utilize daylight in select exhibit spaces and offices. The structure held brand new heating and cooling systems containing no Ozone depleting chemicals.²⁴⁵ There are three reserved parking spaces for alternative fuel vehicles. Due to the proximity to the Albright-Knox Art Gallery, the Olmsted Parks, and the Richardson Complex it is accessible by walkways and public transportation.²⁴⁶ The surrounding landscape is composed of indigenous plants that thrive in Buffalo's climate, however, the most important step the Burchfield Penney took was to include sustainability within their institutional values, stating, "We will energize the WNY [Western New York] community and SUNY Buffalo State through meaningful, educational, and engaging experiences and will sustain and enhance our culture and environment through our decisions and actions."²⁴⁷ LEED certification does help elevate the museum as a responsible institution.

²⁴³ Ibid

²⁴⁴ Ibid

²⁴⁵ Ibid

²⁴⁶ Ibid

²⁴⁷ "Our Mission & Vision," *Burchfield Penney Art Center*, accessed October 27th, 2021, <https://www.burchfieldpenney.org/the-museum/our-mission-and-vision/>.

Landscape and Maintenance Practices

As previously mentioned, the incorporation of plants provides endless sustainability benefits. If a museum sits on any amount green space, utilizing plants indigenous both inside and outside can be helpful. Plants that are native to an area, thrive the best in their own climate which means they needs less additional water, fewer chemicals, and little to no maintenance.²⁴⁸ This saves money that can be put towards other necessities. As mentioned previously, collecting rainwater, graywater, or even stormwater can be used to water plants. Another way to efficiently water an outdoor garden is to use drip irrigation as opposed to hand watering. Drip irrigation provides “a steady, gentle water supply at a rate the soil can absorb with very limited evaporation.”²⁴⁹ By watering at the base of the plants, these systems use pump less, while conserving water and energy. The elimination of chemical fertilizers and pesticides prevent harm to the ecosystem. Pest-management practices can be used instead. Another simple, yet effective method is collecting fallen leaves all at once, placing them into compost bins that eventually can be used as mulch for a garden. Native plants provide habitats for wildlife as well. These indigenous plants are sure to create a beautiful and inviting scene for visitors, while also being environmentally friendly.

Discussion

Sustainability is not a new concept, but it is still not utilized as much as it could be. This chapter explained how to put green practices to use with the help of modern technology. Simple

²⁴⁸ Brophy and Wylie, *The Green Museum*, 155.

²⁴⁹ *Ibid*, 143.

adjustments and considerations such as “catching water in rain barrels and cisterns, using reading and work lamps instead of overhead lights, canalizing on natural terrain and solar orientation for siting buildings, getting by with less, reusing what we can, and recycling everything else.”, can improve one’s institution²⁵⁰ The advancement of technology and science to utilize the earth’s resources in a more responsible way like geothermal energy, is a great option to consider in the future. Sustainability is evolving at a tremendous pace but people, and museums need to put these practices into action soon, otherwise it may be too late to make an impact. “If we all share our knowledge and experience, we all can make progress. We have to; this may be one of the most important to-dos lists in the museum field.”²⁵¹ Every green decision a museum implements, is a great opportunity for interpretive labels. By explaining the technology or process, it will pique the curiosity of the visitors by providing an educational opportunity to learn about environmental sustainability.²⁵² As citizens of the Earth, we continue to witness the severity of climate change all over the world and the demand for a solution is potent. Museums have public influence and lead the public into action, and because of that, museums cannot be neutral.

While there is a need for a universal standard for sustainable operational practices in museums, it should not discourage museums from taking steps to become more sustainable by themselves. It is important to never become complacent. After small changes have been put in place, the hope is that in the coming years, museums will continue to revise and improve their sustainable decisions. Although the initial costs may be expensive, the investment will have long term savings in both costs and emissions. By enacting these changes, they are setting their institutions up for future success, raised integrity, and lower operational costs. While there are

²⁵⁰ Ibid, 159.

²⁵¹ Ibid, 251.

²⁵² Ibid, 159.

several museums that have made great strides in sustainability and should be applauded, there are still plenty with goals left to strive for. Widespread changes, both big and small, from all museums could impact our society in a profound way.

Chapter Three

Case Studies: Buffalo Museums and their Sustainable Efforts

Sustainability is not a one and done solution, but a journey. The development of new practices and technologies consistently improves upon the old. Museums adapt and change in order to fulfill their duties of environmental sustainability. Still, one wonders the answer to the question: are museums doing enough? I decided to determine the answer to that question on a local scale by interviewing three staff members of museums in Buffalo, New York: Buffalo and Erie County Botanical Gardens, Buffalo Zoo, and Buffalo Museum of Science. I choose these three distinctly different museums because their missions, collections, and physical structures vary greatly from one another. I wondered if their sustainable practices would vary as well. Is it more obtainable to be sustainable for botanical gardens than science museums? Regardless, I hope to highlight that sustainability is important no matter the institution. I was curious out to discover what each institution's current sustainable practices are and if there are any plans in the future. After each interview, I critique each of the museums on their sustainable efforts, offering some suggestions based on my research. My findings varied greatly across the three institutions.

The Buffalo and Erie County Botanical Gardens

The Buffalo & Erie County Botanical Gardens is a 501(c)(3) non-profit organization that is a historic site, education center, and a popular tourist destination.²⁵³ The Buffalo & Erie County Botanical Gardens is located on South Park Avenue between Lackawanna and South Buffalo. It was designed and orchestrated by David F. Day, Frederick Law Olmsted, John F. Cowell, Frederick A. Lord and William A. Burnham. David F. Day was the city attorney and judge that brought a botanical collection to Buffalo in 1860s. Frederick Law Olmsted was a famous landscape architect responsible for New York City's Central Park and six park systems

²⁵³“About Us,” *Buffalo and Erie County Botanical Gardens*, accessed November 2nd, 2021, <https://buffalogardens.com/pages/about-us>.

in the Buffalo area (Delaware Park, Front Park, Martin Luther King Jr. Park, Cazenovia Park, Riverside Park and South Park). Olmsted designed the park's layout whereas Lord & Burnham were the architectural designers. John F. Cowell was appointed as the first Director of the conservatory in 1894.²⁵⁴ He oversaw the landscape in South Park and the glass structure because of his background as an accomplished botanist and horticulturist. The Botanical Gardens is encased in a beautiful Victorian glass house with unique designs based upon the famous Crystal Palace in England".²⁵⁵ The conservatory and botanical gardens opened its doors in 1900. The total cost of construction was \$130,000. This spectacular structure was the "third largest public greenhouse in the United States and was ranked the ninth largest in the world."²⁵⁶

The botanical gardens' popularity boomed from the famous Pan-American Exposition in 1901.²⁵⁷ The institution offered trolley rides from downtown Buffalo to South Park for visitors to experience their diverse collection of plants and flowers, as well as admiring the glass house. As the gardens continued to flourish, six additional greenhouses were built in 1907.²⁵⁸ However, the museum was in danger of demolition in 1929 after years of poor management, low attendance, and structural disrepair.²⁵⁹ The gardens survived with the help of federal funding for repairs and renovations on the architectural gem.²⁶⁰ The building was badly damaged by the Blizzard of '77 and repaired by volunteers in 1979.²⁶¹ Erie County purchased the conservatory and the park from

²⁵⁴ "Our History," *Buffalo and Erie County Botanical Gardens*, accessed November 2nd, 2021, <https://buffalogardens.com/pages/about-us>.

²⁵⁵ "About Us," *Buffalo and Erie County Botanical Gardens*, accessed November 2nd, 2021, <https://buffalogardens.com/pages/about-us>.

²⁵⁶ Ibid

²⁵⁷ Ibid

²⁵⁸ Ibid

²⁵⁹ Ibid

²⁶⁰ Ibid

²⁶¹ Ibid

the City of Buffalo for one dollar in 1981.²⁶² The following year, the museum made the National Register of Historic Places and the New York State Register of Historic Places. In 1986, the gardens joined the Museum Education Consortium of Buffalo.²⁶³ From the 1900s to the 2000s, the gardens were the recipients of major restorations, and eventually installed a high-tech boiler system. In 2005 and beyond, the gardens underwent renovations to several greenhouses, the main palm dome, expanded restrooms and walkway entrances. They even upgraded their misting systems to be controlled thermostatically.²⁶⁴ Additionally the museum began charging an admission fee and added a gift shop to increase revenue.

The museum's mission focuses on inspiring curiosity and connecting people to the natural world.²⁶⁵ Their vision statement states that "the historic Buffalo Botanical Gardens is a premier cultural destination that engages visitors through a distinct and unique plant collection."²⁶⁶ According to their website, over 140,000 people visit the site annually.²⁶⁷ This museum is supported by the Botanical Gardens Society, Inc. (private), public funds from the Erie County, New York State Office of Parks, Recreation and Historic Preservation, and through memberships and visitation. Because of this support, the museum has enough funding to keep up with the daily maintenance of collections, exhibitions, and their various public programs. The Botanical Gardens also produced an organic vegetable garden on premises, and in 2019, they donated 700 pounds of fresh produce to Gerard's Place Community Kitchen.²⁶⁸

²⁶² Ibid

²⁶³ Ibid

²⁶⁴ Ibid

²⁶⁵ Buffalo and Erie County Botanical Gardens, "About Us."

²⁶⁶ Ibid

²⁶⁷ Ibid

²⁶⁸ "Buffalo Botanical Gardens donates record amount fresh produce to a community in need," *Niagara Frontier Publications*, December 9th, 2021, <https://www.wnypapers.com/news/article/current/2021/12/09/148960/buffalo-botanical-gardens-donates-record-amount-fresh-produce-to-a-community-in-need>.

Interview

I was able to secure an interview with the Botanical Garden's President and CEO, David J. Swarts. Swarts was Erie County Clerk from 1986 to 2006 when he became New York State's Commissioner of Motor Vehicles. He held that position until 2011, when he became the President and CEO of the Botanical Gardens. This interview was conducted over the phone on October 4th, 2021. It was a brief, yet informative discussion of how the gardens are instituting sustainability into their physical structure and daily operations.

At the beginning of the interview, Swarts went into detail about the museum's biggest restriction as it pertains to incorporating sustainability into the physical structure. The beautiful Victorian glass structure is recognized by the National Register of Historic Places and the New York State Register of Historic Places. Because of the rules of preservation for the existing structure, they are not allowed to make the necessary changes, without approval, to participate in the LEED program. It was conveyed that the gardens cannot obtain LEED status as a historical site. However, the glass components of the structure are coated with a protective liquid shade to help control the temperatures inside the conservatory for both the plants and the visitors.²⁶⁹ This technology is beneficial because it reduces the load placed on the boiler systems. Swarts reiterates that the gardens are owned by Erie County, meaning the building is leased to the occupants. Again, no modifications can be made without the county's approval. Additionally, their funding and financial decisions are at the county's discretion.

Outside of the legal restrictions, the unique composition and material of the glass makes repairs to the structure incredibly difficult, let alone modifications to make it more sustainable.

²⁶⁹ Ibid

Therefore, the museum's sustainability efforts are focused on daily operations, which limits the scope of their sustainability. I asked the question, "What does environmental sustainability mean to your institution?" Swarts' responded that the Botanical Gardens naturally imply sustainability in their mission statement. Their mission is "to inspire curiosity and connect people to the natural world through its historic living museum."²⁷⁰ He continued, stating that their purpose is to educate the public about the relationship between humans and plants and how we rely on plants to survive. Through programs and exhibitions, they encourage visitors to step into their role as stewards of the Earth.

Their daily operations rely on the use of electronics to help limit the use of physical materials. For example, sending out a bi-weekly newsletter via email rather than distributing paper copies. Text messages, laptop usage, e-mail and other technological means have minimized their paper usage. Any documents that are printed on paper are printed on both sides of the sheet. They recycle 100% of all used materials and use entirely LED lighting throughout the structure to reduce their footprint further. The education department incorporates sustainability into their programs, explaining how sustainability is important in horticulture.

When I asked if the gardens have a sustainability plan, it was revealed to me that there is an expansion project currently in the works. The gardens will be building a 33,000 square foot addition next to their existing complex. A competition was held among nine national architects who had to create a building plan for the new addition: the competition was won by Tatashe Moray. The new addition will have geothermal heating and cooling and an air/heat transfer system. They are exploring solar panels options for the rear roof of the addition and are considering ETFE roofing material that essentially appears as glass but is easier to replace than

²⁷⁰ Buffalo and Erie County Botanical Gardens, "Our History."

the glass on the existing structure. The proposed structure, is designed to be in the LEED Silver or Gold category. The proposed building's structure is a different style of architecture than the historical structure of the current building, but it is intended to be complimentary. Plans for the new structure will not be released until 70% of their funding goal is reached.

Lastly, I asked, "In what ways do you think your institution can improve with their current building and operations?" The two components Swarts considers when making improvements are the plants and the visitor experience. Currently, each of the twelve houses contains its own dedicated boiler set for the needs of each room's contents. In the future, they are looking to add a permeable parking lot to the grounds, to allow water to collect underneath. They are also considering the incorporation of a water run-off system to capture rainwater and use it for plants within the structure.

Critique

It appears that the botanical gardens' sustainable actions are minimal. There seems to be less interest in improving or slightly modifying the original structure as opposed to focusing on their new addition that has not yet come to fruition. Even their daily operations could improve. The museum staff would greatly benefit from the creation of a green team that has knowledge in environmental science and sustainability. Their mission statement does not present a clear message of sustainability, which could also be incorporated.

Swarts frequently referred to the limitations of historical structures that hinder several sustainable ideas. However, Monticello, the home of Thomas Jefferson, was awarded LEED Gold certification for their functional improvements and daily operations.²⁷¹ This historical

²⁷¹ Ibid, 46.

structure installed a closed-loop geothermal system that reduced energy and water usage.

Geothermal systems offer minimal alterations to the physical structure of the building. Another historical structure in the U.S. granted LEED Gold Certification is the Fay House, the first permanent home of Radcliffe College in Cambridge, Massachusetts, built in 1807.²⁷² They also installed a geothermal system, which they found benefitted the appearance of the structure with no visible outdoor HVAC equipment and it provided a very efficient cooling system.²⁷³ The Grand Canal, the Venetian Gothic palazzo Sede Centrale Ca' Foscari is the oldest LEED-certified building in the world, built in 1453.²⁷⁴ There are structures much older than the Buffalo and Erie County Botanical Gardens that have strived for LEED certification and have succeeded. Although it can be more difficult, sustainability can still be achieved within historic structures.

Swarts stated that the new structure will include geothermal heating and cooling. If the Buffalo and Erie County Botanical Gardens intend to use geothermal heating for the new construction, why not for the original structure as well? There seems to be money and space already dedicated to a geothermal system as evidenced by their desire to include one in an addition.

There are several creative ways to address sustainability within the existing space without changing the physical structure. I learned that the gardens currently do not participate in a composting program. What do they do with all of the annuals after their specialty exhibits end? Do they transplant the flowers and plants or just throw them out? Composting makes sense for a

²⁷² Martha McDonald, "Preservation and LEED See Eye to Eye," *Traditional Building*, updated February 5th, 2020, <https://www.traditionalbuilding.com/product-report/preservation-and-lead>.

²⁷³ Ibid

²⁷⁴ "Preserving Historic Buildings Through LEED Green Building Strategies," National Trust for Historic Preservation, August 25th, 2021, <https://forum.savingplaces.org/blogs/special-contributor/2021/08/25/preserving-historic-buildings-through-lead#:~:text=Sede%20Centrale%20Ca'%20Foscari%2C%201453%20%28Venice%2C%20Italy%29%20Overlooking,which%20the%20structure%20serves%20for%20a%20modern%20university>.

botanical garden to pursue, as the organic waste created by dead plant life can be reused in the soil. Not only is it beneficial to the museum to create a composting program, it is also a great educational experience for visitors. Compost collected from the staff will prevent organic waste from ending up in a landfill. This would be a wonderful opportunity to start a composting program to use for an organic vegetable garden. Collecting rainwater for the plants in and around the structure would significantly reduce water energy and expense. The gardens should present Earth Day activities for the community such as planting trees, hosting fundraising events specifically for sustainable technology to be used at the gardens, and more.

Phipps Conservatory and Botanical Gardens in Schenley Park, Pittsburgh, is a highly praised museum in *The Green Museum*. I discovered that Lord & Burnham Company also designed Phipps Conservatory in 1892-1893 prior to Buffalo's botanical garden.²⁷⁵ The Phipps' original glass structure has been on the National Register of Historic Places since 1967.²⁷⁶ Originally the structure was heated by steam purchased from the Bellefield Steam Plant.²⁷⁷ In 2012, the greenhouses would become the first in the world to achieve LEED Platinum for Existing Buildings: Operations and Maintenance. The greenhouse "temperature, light levels and humidity are all computer-controlled, allowing the production staff to maintain 16 different climate-controlled environments within eight ranges and enabling Phipps to grow a wider variety of plants than was ever possible before."²⁷⁸ Now, the use of thermal blankets and roof vents

²⁷⁵ Ibid

²⁷⁶ "The End of an Era (1971-1993)" *Phipps Conservatory and Botanical Gardens*, accessed November 23rd, 2021, <https://www.phipps conservatory.org/visit-and-explore/explore/explore-our-history/the-story-of-hipps/the-end-of-an-era-1971-1993>.

²⁷⁷ Ibid

²⁷⁸ "A New Beginning (1993-Present) *Phipps Conservatory and Botanical Gardens*, accessed November 29th, 2021, <https://www.phipps conservatory.org/visit-and-explore/explore/explore-our-history/the-story-of-hipps/a-new-beginning-1993-present>

regulate temperatures to decrease fan ventilation.²⁷⁹ This space uses 40 percent less energy than traditional glasshouses. The Phipps utilizes 14 geothermal wells for heating and cooling, solar and wind power, a lagoon system to manage rainwater, constructed wetlands to treat sanitary water, harvests rainwater, incorporated permeable paving, and more.²⁸⁰ They built a new visitor center (LEED Silver) and conservatory (LEED Platinum), and their cafe offers organic, healthy, usually locally grown from Phipps' own rooftop garden, and their food is served with recyclable and compostable products.²⁸¹

The Phipps Conservatory and Botanical Gardens and the Buffalo and Erie County Botanical Gardens are similar in that they both have ornate glass constructions and comparable function. However, the Phipps have and continue to make incredible advancements towards sustainability. The Phipps made sustainability a major component of every decision through their exhibitions, programs and daily operations. They even have a dedicated tab of information on their website labeled "Green Innovations". The Buffalo and Erie County Botanical Gardens can take inspiration from the Phipps for their own path towards sustainability.

Buffalo Zoo

²⁷⁹ Ibid

²⁸⁰ Ibid

²⁸¹ Brophy and Wylie, *The Green Museum*, 260.

The Buffalo Zoo sits on 23.5 inside Delaware Park. It is the third oldest zoo in the United States, established in 1875.²⁸² The Buffalo Zoo's history begins in 1870 when noted furrier, Jacob E. Bergtold, gifted the City of Buffalo a pair of whitetail deer. Within five years, the first permanent structure was erected, as the zoo grew to hold a flock of sheep, two bison and eight elk, along with the two deer. By 1890, a bear exhibit had been constructed and the animal house expanded. Due to public interest, donations of exotic animals grew rapidly, and Frank J. Thompson was appointed as the Zoo's first curator.²⁸³

Upon the completion of the Elephant House, coupled with an already thriving collection of animals, the zoo estimated attendance peaked at twenty to thirty thousand visitors per day in 1912.²⁸⁴ Many years passed in the zoo's history with little improvements made and a lack of public interest. Until in 1938, a redevelopment was put into action by the Works Progress Administration with a budget of \$1.5 million. In 1942, the zoo opened its reptile house with over four hundred specimens, furthering their already expansive collection.²⁸⁵

The following twenty years brought another period of financial hardship for the zoo, which limited growth. The city attempted to combat this situation with the addition of a train ride and concession stands to generate additional revenue. \$300,000 was spent by the city to repair the sewer system, renovate the elephant house, and reconstruct the small mammal house. This caused the zoo to shut its doors for five months. By 1965, the zoo transitioned into a zoo catering

²⁸² "Our Animals," *The Buffalo Zoo*, accessed November 12th, 2021, <https://buffalozoo.org/our-animals/>.

²⁸³ "About The Buffalo Zoo," *The Buffalo Zoo*, accessed November 12th, 2021, <https://buffalozoo.org/about/>.

²⁸⁴ *Ibid*

²⁸⁵ *Ibid*

towards children. The yearly attendance increased to over one million visitors due to this change.²⁸⁶

Operation of the zoo was turned over to the Zoological Society in January of 1973. The city of Buffalo, and for the first time, Erie County, provided the Zoo with a \$350,000 annual budget.²⁸⁷ During the 1980's and 1990's, the quantity of animals throughout the park was reduced, and the zoo shifted its focus to the breeding of rare and endangered species. Although many animals were removed from the zoo, several new exhibits were introduced at this time.²⁸⁸

The year 1981 brought one of the zoo's biggest attractions, the Gorilla House. The Lion and Tiger habitats were completed in 1988. Since 2000, the zoo has added several new exhibits including Vanishing Animals and The Bone Zone (2002), Ecostation (2003), Otter Creek (2004), Rainforest Falls (2008), and Arctic Edge (2015).

In current times, "the philosophy of the Buffalo Zoo is to exhibit animals and plants in ecological habitats and geographical arrangements that represent the biomes of the world. Current programs focus on providing visitors with a better understanding of the natural world, how animals relate to each other, to their environment and to humankind. No longer are animals housed at the Buffalo Zoo solely for the amusement and entertainment of visitors, but rather, are presented to increase awareness for the importance of conservation for the benefit of both the animal kingdom and the human race."²⁸⁹

²⁸⁶ Ibid

²⁸⁷ Ibid

²⁸⁸ Ibid

²⁸⁹ Ibid

Interview

I had the pleasure of meeting with Norah Fletchall, the President and CEO at the Buffalo Zoo. We met over a zoom video conference on November 16th, 2021, to discuss the zoo's sustainability efforts. It was an insightful and encouraging conversation.

I asked Fletchall about her work experience prior to her position at the zoo. She began her career in 1984 as a zookeeper. For the next twenty-two years she worked at the John Ball Zoo in Grand Rapids, Michigan and nine more years as the head of Conservation, Interpretation and Research at the Indianapolis Zoo in Indiana. She has been the President and CEO at the Buffalo Zoo for four and a half years. As President, she oversees all operations within the zoo, including their sustainability. In her previous experiences at the John Ball Zoo, they explored the idea of conserving water and instituting biomass gasification, a process that converts waste from plants and animals into fuel.²⁹⁰ At the Indianapolis Zoo, they instituted a program to convert oil waste into fuel for vehicles used on the grounds. The zoo also pushed the My Carbon Pledge to get visitors to make a commitment to raising or lowering the temperature of their thermostat by one degree. She states that both she and the Buffalo Zoo are very involved in the subject of sustainability.

The next question I asked Fletchall was "Is there was a sustainability plan?" She responded that their strategic plan incorporates several elements of sustainability. She admits that it is a bit outdated. She spoke of an organization called the Association of Zoos and Aquariums (AZA) which stand for the "advancement of zoos and aquariums in the areas of conservation, education, science, and recreation."²⁹¹ Zoos must incorporate a level of sustainable practices in

²⁹⁰ Ibid, 146.

²⁹¹ "About Us," *Association of Zoos & Aquariums*, accessed November 19th, 2021, <https://www.aza.org/about-us>.

order to achieve accreditation, Fletchall explained. If a zoo is accredited by the AZA, they are allowed to house desirable animals that need special attention. The Buffalo Zoo is proud to be accredited by the AZA.

Their mission statement is short and simple, “The Buffalo Zoo: Building Community, Creating Connections, and Saving Wildlife.” Fletchall explains that creating connection between wildlife and humans cannot happen without a healthy environment. The zoo is part of conservation efforts such as the Species Survival Plan to protect endangered species. It is important to illustrate how several ecosystems and habitats are affected by global warming, which threatens the survival of several species, including the animals that live within the Buffalo Zoo. Fletchall’s goal for the zoo is to influence people to live sustainably to create a healthier environment for themselves and for the animals with which we share the planet. There are two ways the zoo can fulfill this goal; continuing and improving upon their sustainable operations through educational opportunities within their exhibitions. Fletchall mentioned that the zoo is part of the Western New York Sustainable Business Round Table that provides equipment and services to optimize the "use of energy and materials, reduce waste and pollution, and enhance community investment.”²⁹²

I asked about how the zoo implements sustainable practices. The zoo created a version of a green team called the Green Smart Squad, which helps to spread their green ideas to the entire staff and keeps decision makers accountable. They have an internal recycling program among the staff. They also provide recycling bins for guests. However, the zoo does not currently provide a compost bin for food waste, but it is their next initiative to implement in the near future. The zoo composts their animal manure, however. They repurpose the manure by donating it to a

²⁹² “About Us,” *Western New York Sustainable Business Roundtable*, accessed November 19th, 2021, <https://www.wnysustainablebusiness.org/about-us#mission>.

composting facility located in the city. It is estimated that they donate the manure about three to four times a week. This zoo does not participate in a biomass gasification system at this time but has thought about incorporating one in the future. The staff has been diligent about eliminating paper waste, by sending emails instead of printing. If they do need to print any documents, they use recycled paper. For their guests, they offer digital maps of the zoo grounds, in lieu of paper maps. Lastly, Fletchall states that the concession stands within the zoo no longer provide straws or lids to cut down on plastic consumption.

The zoo was not originally designed with sustainability in mind, like many buildings of its time. Additionally, the zoo is owned by the city of Buffalo. Often, improvements with large costs must receive approval from the city prior to starting construction. One of the challenges for the zoo is that the needs of each individual animal must take precedence over advancements in sustainability, as their living collection is the essence of their existence. Therefore, none of their physical structures are LEED Certified, because it takes a large amount of energy to mimic specific climates. She listed the newly remodeled Komodo Dragon enclosure as needing to be 85 degrees Fahrenheit in order for the animals to survive. Reptiles are cold blooded animals that absorb heat from their environment. It is impractical to save energy on the heating of this space. In contrast to the Reptile House, they were able to make environmentally conscious changes in other areas. Fletchall mentioned a new filtration system for the pools inside the Polar Bear exhibit. This system saves incredible amounts of water as opposed to their previous dump and fill system. Additionally, the pumps throughout the system are operated by a Variable Frequency Drive (VFD) which lowers electricity usage when the pump's full capacity is not needed. VFD usage is common throughout the complex in various pieces of equipment in an effort to save electrical energy. Fletchall clarified that because the zoo has restrictions, it does not mean that

they are exempt from changing in areas within their control, such as operational changes. The switch to LED lighting is something that is largely completed throughout the zoo, with a few exceptions. They have incorporated more perennials and pollinator friendly gardens throughout the complex as an effort to conserve energy and water used by planting annuals each year. Lastly, the zoo installed electric vehicle charging stations in their parking lot to promote the use of electric vehicles.

I asked if there were funding sources specifically for instituting sustainability. There are many grants given out for exhibiting excellence in environmental sustainability. She believes strongly in being vigilant when applying for grants, as they can provide great financial relief. She shared her belief that grants earned for their sustainability should be reinvested into further sustainable efforts. Any money saved by reduced energy costs are also invested in furthering sustainability. This philosophy can be instrumental in any museum's effort to become more sustainable.

We concluded our discussion with how the zoo feels it can improve their sustainable efforts. Fletchall mentions the benefits of reusing and repurposing construction pieces from previous exhibitions and enclosures. She is actively looking for more efficient boiler systems and playing around with the idea of incorporating green roofs and grey water retention. Their upcoming initiative aims to reduce or remove plastic bottles for sale within the zoo. To support this effort the zoo plans to install water fountains and encourage guests to bring in their own refillable bottles. Fletchall states that starting programs and initiatives is tough to do. Unfortunately, COVID-19 has made the zoo cut staff and put several of these fantastic ideas and plans on hold.

Critique

After my interview concluded, Fletchall I found myself pleased and impressed by her significant understanding and experience with sustainability. Several avenues within the zoo reflected this. For example, the zoo's involvement with The Western New York Sustainable Business Round Table shows their dedication to the cause. I appreciate her honesty on the realities of sustainability within a zoo. It cannot be applicable everywhere and to everything. I believe that the zoo is operating sustainability to the best of their abilities under the circumstances.

I think moving forward, the zoo should consider taking the next step with their existing practices. For example, instead of hauling the animal waste to a composting site, invest in a biomass gasification system. *The Green Museum* praises the Denver Zoo's biomass gasification system because it not only utilizes animal waste but human generated trash, too. In fact, about 90% of it is used to power the zoo.²⁹³ It eliminates 750 tons of waste from landfills and saves about \$80,000 from transportation of the waste per year.²⁹⁴ The addition of this system can easily reduce their greenhouse gas emissions. This project is not a light task and there is so much more that goes into it. However, with Fletchall's prior experience with a biomass gasification system at the John Ball Zoo, I am confident that this can be implemented successfully. This project could come to fruition a few years from now, once adequate funding and support is raised.

I would suggest that the zoo should attempt a green roof with at least one building. Green roofs are great insulators, absorb heat and moisture, and purify the air. Whatever the building's temperature and humidity are set at, it will not strain the unit, taking less energy and time to heat or cool the space. The roof can last two to five times longer than a traditional roof because of UV

²⁹³ Brophy and Wylie, *The Green Museum*, 253.

²⁹⁴ Ibid

light and other weather-related damages. The maintenance would not increase significantly or in complexity. I think a green roof would be striking but not out of place at the zoo. The animal enclosures all have greenery that resemble natural habitats already. I think the zoo can tie a green roof back to their mission to connect humans with animals. This logic can also be applied to greywater retention. Greywater is the byproduct of sinks, showers, baths, washing machines, or dishwashers. It is important to keep in mind, that greywater may contain “traces of dirt, food, grease, hair, and certain household cleaning products.”²⁹⁵ However, greywater is a safe and even beneficial as irrigation water for plants in gardens.²⁹⁶ It acts as fertilizer to the plants. Greywater can be dangerous if it ends up in the septic and sewer systems or polluting nearby bodies of water. It cannot be used for the animals because it is toxic, even when treated. By recycling greywater as water irrigation for non-edible gardens, it protects that local bodies of water.

Another suggestion I have for the Buffalo Zoo is to communicate their sustainability efforts to visitors. By educating the public on the zoo’s sustainable practices, it can inspire change within their personal and professional lives. The zoo already utilizes several signs sprinkled throughout the campus to convey interesting and important information about the animals they keep, such as conservation efforts and which species are in danger of extinction. Creating signs that discuss the zoo’s sustainable practices, it will engage visitors and strengthen the relationship through transparency. For example, signs could be made that explain how the zoo recycles all of the animals’ manure to the local compost facility. They could entitle the sign “Zoo Poo” which can catch the attention of visitors and intrigue guests to read the label about the

²⁹⁵ “Greywater Reuse,” *Greywater Action For Sustainable Water Culture*, accessed December 11th, 2021, <https://greywateraction.org/greywater-reuse/>.

²⁹⁶ Ibid

benefits of composting. They could also bring attention to the switch to LED lighting throughout the campus and its environmental benefits and cost effectiveness as well.

Fletchall mentions that the zoo's physical structures would not even be considered for LEED certification because of the massive energy emissions produced in order to maintain an environment within the enclosures for the animals. However, I wonder if modifying other structures such as their gift shops, cafes and office spaces could allow them to become certified in the future.

Most of my suggestions for the zoo have already been taken into consideration. The zoo's leadership has a strong understanding of environmental sustainability, and it influences every decision they make. COVID-19 has limited the zoo's ability to install new sustainability programs. As we continue through this pandemic and its eventual passing, I hope the zoo continues to pursue the sustainable efforts discussed in the interview. On December 2nd, 2021, eleven cultural institutions throughout Buffalo received a surprise donation. The Ralph C. Wilson Jr. Foundation made a "\$100 million donation that will establish an endowment, funding in perpetuity to support many of the region's most well-known attractions."²⁹⁷ The zoo will receive \$200,000 annually in perpetuity with no restrictions on how the money is used. This generous gift creates a potential to support future sustainability plans.

The Buffalo Museum of Science

Buffalo's Young Men's Christian Association (YMCA) was in 1836 with the purpose of organizing cultural activities in the city. The YMCA obtained a collection of "numerous

²⁹⁷ Mark Sommer, "Wilson Foundation announces \$100 million to support arts and cultural organizations," December 2nd, 2021, https://buffalonews.com/news/local/wilson-foundation-announces-100-million-to-support-arts-and-cultural-organizations/article_a8009048-5126-11ec-a517-df7aa8615cdd.html.

specimens, minerals, fossils, shells, insects, pressed plants, sea weeds and various paintings and articles of historic value.”²⁹⁸ This collection laid the foundation for the Buffalo Museum of Science’s current collection. The YMCA decided to organize a Natural Science Society in 1861, which was spearheaded by fundraising efforts from President Millard Fillmore.²⁹⁹ Today, the Buffalo Society of Natural Sciences governs not only the Buffalo Museum of Science, but also the nearby Tiff Nature Preserve.³⁰⁰ After displaying their collection at several temporary locations, the society opened a newly constructed, state of the art facility on Best Street in 1929. The facility still stands today as the current location for the Buffalo Museum of Science. The building was originally designed by August Esenwein and James A. Johnson.³⁰¹ In 1990, the museum opened a new addition to the structure housing the Dr. Charles R. Drew Science Magnet Elementary School, making the Buffalo Museum of Science the first museum in the nation with an elementary school inside.³⁰² Since 2010, the museum has renovated all its permanent exhibits, turning them into highly interactive and immersive experiences. The exhibitions displayed currently are “Explore You,” “Lost Beauty II,” “Rethink Extinct,” “Artifacts,” “Buffalo in Space,” and even a 3D Cinema Theater.³⁰³ In addition to the interior renovations, the museum restored its rooftop observatory in 2018 for visitor experiences.

Most of the museum’s collections pertain to the Greater Niagara Region. With over 700,000 specimens, it is the largest and most complete collection of its kind.³⁰⁴ Their collection

²⁹⁸ “About Us,” *Buffalo Museum of Science*, accessed November 30th, 2021, <https://www.sciencebuff.org/about-us/>.

²⁹⁹ “What Does Three Museums, a Social Club, a Hospital, and a University Have in Common?” *Discovering Buffalo, One Street at a Time*, accessed November 30th, 2021, <https://buffalostreets.com/tag/buffalo-museum-of-science/>.

³⁰⁰ “About Us,” *Buffalo Museum of Science*

³⁰¹ Ibid

³⁰² Ibid

³⁰³ Ibid

³⁰⁴ Ibid

is divided into smaller collections of anthropology, vertebrate and invertebrate zoology, entomology, botany, herpetology, geology, and education.

Interview

As a science museum, I feel as if it is almost expected to operate with the highest sustainable practices because of the correlation between the environment and science. Science museums typically explore various sciences and technologies through interactive exhibits, and climate change exhibits are common. I met with Andy Powrie, Head of Buildings and Grounds over Google Meet on Friday December 3rd, 2021. The conversation I had with Powrie included the depths of the complexities that museums face when searching to improve their sustainable efforts.

I began the interview by asking about Powrie's credentials and work experience that contribute to his position at the Buffalo Museum of Science. Powrie graduated from Western Michigan with a double major in Environmental Studies and Public History, specializing in archival management. What initially drew him towards a degree in Environmental Studies was the appeal of working for the National Park Service. After graduating, he worked at the front desk of the Ann Arbor Hands-On Museum before transitioning to Exhibits and Facilities Technician. He then moved to Buffalo to start a job at the Explore and More Ralph C. Wilson, Jr. Children's Museum as a floor manager. After his time at Explore and More, Powrie was hired by the Olmsted Park Conservancy before entering his current role at the Buffalo Museum of Science.

I proceeded to ask what environmental sustainability means to the Buffalo Museum of Science. Powrie responded that the museum is primarily concerned about the collections. The

collections need to be stored at specific temperatures and humidity in order to prevent decay. Powrie noted that the HVAC system consumes an incredible amount of gas and runs constantly to ensure the stability of the collections. Powrie mentions that the director of the museum just released a new strategic plan for 2022 through 2026 and that some sustainable aspects have been inserted. However, there is no push to make sustainability a priority. Why? The answer is complex. He explained that the building was built in 1929. Since the construction of the site is almost one hundred years old, there are several areas where the physical structure is challenged. Understandably, the original building was not designed for today's museum standards. For example, the building has issues with flooding that potentially contains contaminants. Another reason why sustainability is harder to achieve is that the building is owned by the City of Buffalo. Anything that has to do with the physical structure of the museum has to be approved by the city council. Not to mention there is a tight budget that the museum is granted, so renovations are currently too expensive.

Powrie continued to state that the nature of a museum historically has been to generate a lot of waste through exhibition creation. Powrie discussed the chemical waste that the museum generates throughout the various departments: maintenance, collections, preservation, and exhibits for construction. Their sustainability efforts focus on properly disposing of the chemicals that are unsafe for the environment. Powrie talked about the biohazard waste generated by the taxidermy collection and how they had to seek assistance with disposal of a few deaccessioned artifacts.

The conversation transitioned to the museum's practices. Powrie mentioned that there are two solar panels on the museum's roof. The panels were installed in 1996 in a collaboration with The University of Buffalo. Solar panels were still considered a new technology at this time. He

explained that the solar panels are more for demonstration purposes for an exhibition on solar power. No one has done a study on the solar panels' efficiency, but he states panels do not generate enough power to impact the museum's electricity bill. He feels the return on the investment is minimal, and the heat generated by the panels causes the HVAC system on the fourth floor to work even harder. The lack of maintenance was another issue the museum faced with the solar panels. For these reasons, the museum is looking to remove the panels. I asked Powrie if the experience with the current solar panels will discourage the museum from investing in modernized on-site solar panels. Unfortunately, the answer is yes. The current solar panels are to be mounted directly to the roof. The existing panels are damaging the already aged and fragile roof. The museum is in the process of replacing the old roof in the upcoming years. Adding or replacing the existing solar panels would cost the museum approximately \$30,000 to install in addition to the cost of a new roof. Also, the roof space is too small, and there would not be enough room to fit as many solar panels as they would need to reduce their non-renewable electricity usage. Another thing that deters the museum from solar panels relates back to the elementary school. The school and the museum share resources such as gas and electricity. However, the museum must pay 40% percent of the school's monthly bills as part of their contract. Powrie explains that even if the museum were to reduce its electricity consumption to zero with the use of solar panels, they would still have to pay 40% of the school's energy bills. The school has shown no interest in joining the museum's efforts to reduce energy. Powrie said that if the museum did not have the school attached, the museum would be operating on renewable power, potentially buying energy from an electrical farm.

The museum has replaced about 90% of their light bulbs with LEDs, excluding exhibition spaces. Powrie mentioned that the staff have an internal recycling program. For exhibitions, the

staff tries to buy durable products to be reused and repurposed. He encourages the staff to be conscious of where they purchase their materials, and to buy from local companies whenever possible. In 2022 and 2023, Powrie will conduct a waste audit for the exhibition department and maintenance. He is interested in quantifying things such as paint consumption and usage of other finite resources. Powrie mentioned that for every exhibition the walls are painted with a new color and the curators purchase extra paint out of necessity. The extra paint typically rests in storage, untouched until it expires. He estimates that there about 75 gallons of different paint colors ranging from 2003 to 2021. He suggested to the curators and exhibit designers to use paint the museum already has.

The newest project the museum will tackle in the next few months is the renovation of the first floor. This renovation includes replacing the problematic elevator. This is crucial not only for making the structure more secure but to improve energy efficiency. This renovation led me to my next inquiry on LEED certification for the museum. Powrie says that LEED is always the goal for any museum. However, the reality is LEED is not achievable for this structure. Powrie reiterated that it is an old building in need of a complete renovation to satisfy all of LEED requirements. The windows, for example, are problematic. Many of the window do not close properly because of the aged construction. Renovating the entire museum would be a huge capital project. Unfortunately, the museum currently does not have the ability to pursue this project. There is more interest in LEED certification if the museum decided to build a new structure, that is if they can afford to do so. Then the museum would strive for LEED Platinum certification.

Powrie and I concluded our conversation with improvements that can be made to the museum's sustainable efforts. Powrie mentions renovating a few areas within the museum that

are crucial for improving energy efficiency. The example he provided is the need to replace the old leaky roof. However, they have to receive approval and money from the city in order to move forward with this process. Powrie says it will most likely be a three-to-ten-year project due to the circumstances. He hopes to replace windows and piping as well. Powrie reiterates the physical waste the museum generates is a concern. Is it worth making a temporary exhibit if it generates an enormous amount of waste? He plans to eliminate areas that generate excess materials and avoid chemicals whenever possible. Conducting energy and waste audits will be an important step in this quest. Lastly, Powrie wants to educate staff and board members on the newest sustainable practices and technology specifically for museums and their associated benefits. This could encourage everyone at the museum to think about the museum's environmental impact.

Critique

The Buffalo Museum of Science efforts to increase sustainability is often hindered by circumstances. The staff cannot make the necessary changes to improve their sustainable progress, without asking for permission from the city, which can be a long and involved process. The most necessary changes that need to be made, if only for general maintenance, are often delayed. The issues with the pipes, roof and windows are not unheard of with old historic structures. Basic repairs can be expensive for non-profit institutions, and if not addressed in a timely manner, the damage can worsen and become even more expensive. However, it is necessary to ensure safety for the occupants and its collections.

Dr. Charles R. Drew Science Magnet Elementary School was an attempt to revive the surrounding community and museum but ultimately became a burden for museum operations.

The energy sharing system with the school greatly disrupts the museum's ability to reduce their energy consumption. The museum is pushing for energy audits to figure out exactly how much energy the museum uses versus the school. The museum paying 40% of their shared energy bill to the school is a puzzling situation. If the museum does not consume that much energy during the month, they are still required to pay that amount. The museum cannot seek alternative energy sources that could save the museum money and increase their sustainability, because they still have to pay the school per their contract. Another reason for the energy audits is to show the school that the current systems are inefficient, and that the entire building should invest in better equipment. Powrie explained that the museum's boiler is near the end of its life. Once it becomes irreparable, there will be a big discussion on energy usage and a push to separate the museum from the school. The benefits to the shared energy system are minimal. It would take the school to close down and the city to resign ownership in order for the museum to have complete control over its finances, energy use, and decisions.

A great place to start improving the science museum's sustainable efforts is energy and waste audits. The audits should be done over several months, to get an accurate measurement of their water, gas, and electricity use in all areas throughout the museum. Once the source of energy waste has been identified, then the staff can begin looking for solutions such as installing a new, more efficient system. Next, I think it would be wise to invest in motion or thermal sensor lighting in the labs, offices, and potentially exhibition spaces. Sensors are a great tool to help the reduction of electrical energy, as they limit its use entirely.

When Powrie mentioned the waste generated from the creation of exhibitions, I remembered the *Green Museum* provided resources for renting or buying gently used museum materials from businesses like CultureNut Xchange and The Island of Misfit Crates. The

concerns over paint waste can be a simple fix by using the paint that is in their inventory before their expiration date. Also, measuring the space to see how much paint is needed to completely cover the walls with little to no paint leftover could reduce waste. Another suggestion I can offer is to look at alternative paints, such as low or no Volatile Organic Compounds (VOCs) paint. VOCs are “organic chemicals have a high vapor pressure and low water solubility.”³⁰⁵ These chemicals are released into the air as fumes when actively painting and to some degree when stored. The fumes from VOCs paint are so potent that they can cause short and long-term adverse health effects. According to the EPA, their “Total Exposure Assessment Methodology (TEAM) studies found levels of about a dozen common organic pollutants to be 2 to 5 times higher inside homes than outside, regardless of whether the homes were located in rural or highly industrial areas.”³⁰⁶ VOCs is also a ground water contaminate. Opting for low to no VOCs paint will help reduce the risk of pollution and health problems.

Prioritizing the replacement of the roof, windows, pipes, and fixing the storage room’s HVAC system would have immediate sustainable results. My major concern is the leaky roof. I think it would be wise to move the bulk of the collection to an off-site storage location with a proper HVAC system composed of the newest energy efficiency technology. Many museums have off-site storage facilities just because their vast collection demands it. This would be a preventive measure to ensure the artifacts safety. Now if the roof renovation continues to be postponed, at least the collection will not face any potential damage. Another benefit for the off-site storage facility, is that the roof and the storage rooms can be completely renovated. Again, if the museum has the capital to do so.

³⁰⁵ “What are volatile organic compounds (VOCs)?” *United States Environmental Protection Agency*, accessed December 12th, 2021, <https://www.epa.gov/indoor-air-quality-iaq/what-are-volatile-organic-compounds-vocs>.

³⁰⁶ *Ibid*

During my conversation with Powrie, I asked about a green roof or rooftop garden after the completion of the roof renovation. Powrie argues against it for this specific building for a couple of reasons. First and foremost, the building structure probably could not support the weight of a green roof. He states that a living roof would be too modern for the eloquent style of the building. Powrie is unsure of how a green roof would fit with the museum's current collection. I respectfully disagree with Powrie, a green roof would make a perfect addition to a science museum for several reasons. The science museum has a significant botany collection. Although it is smaller now, it could be great to revive the collection and to talk about climate change through hands-on experience. The roof is already considered another exhibition space because of the access to the observatory. This is a perfect opportunity for new public programs involving botany, environmental science, and sustainable living, all while the museum reaps the benefits of the extra insulation, water absorption, and protection from UV rays extending the life of the roof. Even if the museum cannot commit to a green roof, I think a small, raised vegetable garden would be a great alternative. Again, this could be another programming opportunity to explore health science, organic farming, and more. The produce can provide food for the museum's café or school's lunches. Powrie mentions that there was a plan to install a greenhouse on the roof of the science museum in the past that ultimately fell through.

I expected the Buffalo Museum of Science to be the most environmentally sustainable in its practices because of the nature of the museum. Science is about evolution, truths, and discovery and to share these valuable finds with the public. In order for the science museum to remain relevant regarding sustainability, the museum needs to address climate change through the incorporation of sustainable daily operations or the creation of exhibits. There needs to be a more conscious effort to upgrade the existing structure. In many cases it is more environmentally

friendly to repair the old. I understand that it is an old building and there is a lot that needs to be fixed, which requires a lot of capital. However, any action by the museum will relay a message to its community. Prioritizing the preservation of the historic structure which houses its unique collection shows visitors that they care about the environment, the history of the building, and what the museum represents to the community. This museum is a historical landmark that houses artifacts that tell us about science and its history. It is an influential place for learning through display and interaction, a forum to discuss science and ideas freely, but most of all it represents an important part of Buffalo's identity. Protect it and revive it through a sustainable lens. The science museum is also a recipient of the Ralph C. Wilson Jr. Foundation endowment of \$200,000 annually with no restrictions. With this generous gift, the museum can plan more effectively for necessary renovations touched upon previously throughout this critique.

Summary

I hope the questions I asked influenced these museum leaders to think more about their carbon footprint and waste they generate. Hopefully, our conversation inspired action and a new desire to operate more responsibly and sustainably. I found numerous similarities between the three institutions, as well as distinct differences. All of the museums acknowledged the fact that sustainability should be more prominent within their own institutions. Each expressed difficulties finding the money to implement these changes. Due to the fact that all three are historically protected structures, there are limitations for physical changes. All three expressed a difficulty with restrictions from their landlords, all of which are owned by government entities (The City of Buffalo and Erie County). One of the most obvious physical similarities among the three institutions is the replacement of conventional lightbulbs with LED's to varying degrees

throughout their complex. Additional similarities include an internal recycling plan and use of technology to reduce paper consumption, as well as limitations of waste from plastic use and garbage in some capacity.

On the other hand, there are noticeable difference between the three museums within this study. The first difference was the disparity in knowledge of environmental sustainability. The depth of awareness on the subject was not equal. Ranking these institutions, the Buffalo Zoo was the most sustainable, followed by the Botanical Gardens and lastly the Buffalo Museum of Science. I felt as though Norah Fletchall possessed a great wealth of knowledge and experience on the subject of sustainability, and it clearly reflects in the zoo's daily operations. Also, the Buffalo Zoo has done a great job bringing awareness to climate change through participation in the Species Survival Plan as well as educational exhibits.

Although the Botanical Gardens have little changes in place outside of LED usage and paper waste reduction. I commend this institution on their organic vegetable garden. At least the gardens' have a plan in place for an addition that meets LEED Silver or Gold qualifications that will include the latest sustainable technologies such as a geothermal heating system, installation of solar panels, and an energy efficient glass facade. They are looking into harvesting rainwater and recycling greywater. Another positive is that a couple of their exhibitions labels and programs explain the relationship between humans and plants, and how we are dependent on the environment for our survival. I think the botanical gardens would benefit greatly by the formation of a green team to encourage the gardens to advocate for more sustainable alternatives and practices.

Andy Powrie possesses a degree in environmental sustainability, and his expertise will be extremely useful when the museum is ready to delve more deeply into sustainable practices. The

science museum has an opportunity to plan exhibitions and educational programming dedicated to climate change and environmental sustainability, and to do so while using sustainable practices. Their commitment to sustainability through daily operations can improve, as can exploration of energy efficient practices.

From this study, I learned that my expectations for these prominent institutions were higher than what their current sustainable efforts actually are. This shows that not all museums have prioritized sustainability for a variety of reasons, and this is clearly an area that needs to be improved upon within the city of Buffalo. My hope is that these museums come together to advance a commitment to improving their sustainability. As an emerging museum professional, my goal is to assist museums in this cause. It is inevitable that in the near future these goals will become more urgent. Museums must do a better job of prioritizing sustainability. If they do not do so, museums may find themselves very far behind the other institutions in our society.

Admittedly, there are areas within this research I would like to improve upon to make a stronger argument for increasing sustainability within museums. Originally, my intent was to include the Albright-Knox Art Gallery as part of my case study. I felt it would have made a great addition as they are currently undergoing construction on a new building adjacent to its original structure. It would be interesting to uncover how the gallery will counteract the environmental damages that are associated with construction. New construction tends to have a negative environmental impact. Unfortunately, due to the museums temporary closure, I found them hard to reach and was unable to establish contact to conduct an interview. Upon completion of the construction and the re-opening of the museum in 2022, I think it would be beneficial to conduct an additional interview and compare and contrast my findings with the three museums listed above. Additionally, I wish that I had interviewed more museums in the area to provide a more

complete and comprehensive case study. Museums of particular interest include the Darwin Martin House, Explore and More Children's Museum, The Buffalo History Museum, The Burchfield-Penney Art Center, and the Buffalo Niagara Heritage Village in Amherst, just to name a few. Any additional information provided by these museums could create a clearer picture of sustainability within museums in the Western New York area. Another exercise that could improve this case study is an interview with the AAM to gauge their expectations of sustainability for museums and its value for accreditation purposes.

Overall, this experience was noteworthy. One tends to believe if one museum is implementing a sustainable practice that the others will follow suit. Instead, there are various obstacles that make it difficult for any type of museum to function at the highest level of sustainability. There is a lot of work that needs to be done with these three museums in Buffalo to elevate their sustainable contributions. I hope that this research is informative to the Western New York Community and local institutions, but also to the general public and institutions across the country. Sustainability will increasingly become more prominent not only in museums, but in all aspects of society throughout the coming years.

Conclusion

Climate change and environmental sustainability has been a prominent topic for the last several years. Environmental sustainability should be encouraged and promoted as a solution for both the private and public sectors. This is especially true for educational and cultural institutions that are highly regarded within their community, such as museums. It is time for museums to be active leaders in this global issue by incorporating the latest sustainable practices and technologies. As change makers, museums can influence change through actions and exhibitions.

Chapter Two discussed the numerous physical changes that help reduce energy. While each option may not be the correct fit for every institution, there are numerous ways for each individual museum to make a change in their energy consumption. Many of these are extremely affordable, and the expensive options may end up saving money over time while also helping structures limit their consumption of natural resources. These long-term cost savings can be stockpiled and used for future alterations to the structure. Additionally, there are several programs available to guide museums along their green journey and keep up with the latest technology. Museums are encouraged to create internal green programs for employees to remain educated on green practices and decrease environmental impact. This can be taken a step further in the museum realm by creating educational opportunities for the community through exhibits and external programs, as well as physical opportunities such a recycling waste through compost bins while visiting.

Government and other entities are committing to the decrease of humanities carbon footprint and other environmental problems. Although the push for widespread sustainability is ongoing, the acknowledgement from these government entities is encouraging. Museums will have proper guidance on their green journey through several legislations that are already put in

place, as well as inevitable future laws and regulations yet to be instituted. The argument for stricter guidelines has validity, as several sectors of industry are still emitting at alarmingly high rates with no attempt to operate sustainably. Thankfully, these governmental guidelines have not been completely ignored as several companies have made public their commitment to sustainability, including numerous museums across America. From Monticello to the Phipps Conservatory, the list of museums making commendable changes to their energy usage is ever-growing. Because of these institutions, I became inspired to investigate my community in search of sustainable practices in local institutions. The expectation was that the most prominent museums in my community would have many of the same practices of the aforementioned museums that deserve celebration.

While the desire was to find out that the interviewed institutions had all been practicing sustainability to the best of their abilities, I left the exercise feeling underwhelmed by their efforts. While they had all taken small steps, none had taken the major steps that I assumed institutions of this magnitude would already have in place. It seems that none of the museums operate with sustainability at the forefront of their decision making, nor do they have an overall culture that promotes sustainability. I found this to be of the utmost surprise, as their domains are all critically reliant on environmental sustainability. While there are numerous things each institution could do to further their efforts, I suggest that all the museums in western New York work together to improve upon their needs and desires to attain greater levels of environmental sustainability. Hosting a local summit on sustainability would be beneficial to all cultural institutions in the area. Each organization can share their experiences on how they incorporated sustainable practices, while discussing failures along with the successes. Inviting experts in sustainability as it pertains to museums, contractors with experience in green technology, and

environmental scientists to speak and host workshops would be beneficial. The local cultural organizations would gain knowledge on sustainability and find appropriate solutions to their institution's challenges. Three of the most prominent institutions in the area are lacking in sustainable practices and need more support from the city of Buffalo and Erie County. For example, the city could allocate more annual funds specifically for environmentally sustainable renovations, as well as the addition of specific guidelines and regulations to businesses within the area. I recognize that non-profits with limited funds are unable to spend large chunks of their budget, and often funds have to go to areas outside of sustainability out of necessity. While their claims of lack of funding from their owners (City of Buffalo and Erie County) may have validity, efforts can always be improved upon. Many simple tactics that require little to no money have yet to be made at all three organizations, and their internal sustainability plans could all improve. As referenced in Chapter Two, there are other cultural institutions in Buffalo that are excelling in their sustainable efforts such as the Burchfield Penney Art Center. This art gallery has been LEED Silver certified, as of 2009. If a summit were to be held, the Burchfield Penney's presence may be beneficial to other institutions in the area.

As a society, we still have much work to do to reduce our carbon emissions. If we hope to lessen the already troubling effects of Global Warming, then participation in sustainable practices needs to be consistent among all businesses, institutions, and homes across the world. As evidenced in Chapter Two, there are several businesses already going above and beyond when it comes to reducing carbon footprint, however, Chapter Three revealed that some businesses are greatly lacking in their efforts. Other cultural organizations may be even more challenged regarding their sustainable contributions. If we want to change our planet's future, this gap in sustainable effort cannot continue, and further government is necessary to ensure this

is not the case in the future. I hope this project highlights the importance of investigating museums on their current state or sustainability. I encourage others in the museum field to take a critical look at their own nearby institutions regarding their sustainability efforts. Museums cannot avoid this issue any longer and must rise to the challenge by actively seeking out a variety of options to protect the future of our world.

Bibliography

- “About.” *Phipps Conservatory and Botanical Gardens*. Accessed December 12th, 2021. <https://www.phipps.conservatory.org/about>.
- “About Massimo Bergamini.” *Massimo Bergamini: Policy, Strategies, and Ideas*. Accessed October 16th, 2021. <http://bergaminipolicy.ca/about-massimo-bergamini/>.
- “About The Buffalo Zoo.” *The Buffalo Zoo*. Accessed November 12th, 2021. <https://buffalozoo.org/about/>.
- “About the Farmer Pirates.” *Farmer Pirates*. Accessed October 7th, 2021. <http://www.farmerpirates.com>.
- “About Us.” *Association of Zoos & Aquariums*. Accessed November 19th, 2021. <https://www.aza.org/about-us>.
- “About Us.” *Buffalo and Erie County Botanical Gardens*. Accessed March 23rd, 2021. <https://buffalogardens.com/pages/about-us>.
- “About Us,” *Buffalo Museum of Science*. Accessed November 30th, 2021. <https://www.sciencebuff.org/about-us/>.
- “About Us.” *Natural History Museums of Los Angeles County*. Accessed December 12th, 2021. <https://nhmlac.org/statement-sustainability>.
- “About Us.” *Western New York Sustainable Business Roundtable*. Accessed November 19th, 2021. <https://www.wnysustainablebusiness.org/about-us#mission>.
- “Barack Obama transfers \$500 million to the Green Fund in attempt to protect the Paris Deal.” *The Guardian*. January 17th, 2017. <https://www.theguardian.com/us-news/2017/jan/18/barack-obama-transfers-500m-to-green-climate-fund-in-attempt-to-protect-paris-deal>.
- Brophy, Sarah S., and Elizabeth Wylie. *The Green Museum: A Primer on Environmental Practice*. Maryland: Rowman & Littlefield Publishers, 2013.
- “Buffalo Botanical Gardens donates record amount fresh produce to a community in need.” *Niagara Frontier Publications*. December 9th, 2021. <https://www.wnypapers.com/news/article/current/2021/12/09/148960/buffalo-botanical-gardens-donates-record-amount-fresh-produce-to-a-community-in-need>.
- Carson, Rachel. *Silent Spring*. Boston: Houghton Mifflin Company, 1962.
- “A Century of Environmental Sustainability.” *U.S. Sustainability Alliance*. August 20, 2021. <https://thesustainabilityalliance.us/a-century-of-american-sustainability/>.

- “Climate Action.” *United Nations*. Accessed July 19th, 2021. <https://www.un.org/en/climatechange/paris-agreement>.
- “Climate Change: How Do We Know?” *National Aeronautics and Space Administration*. Accessed October 6th, 2021. <https://climate.nasa.gov/evidence/>.
- “Climate Change Indicators: Weather and Climate.” *Environmental Protection Agency*. Accessed October 9th, 2021. <https://www.epa.gov/climate-indicators/weather-climate>.
- “COP26 Explained.” *United Nations Climate Change Conference UK 2021 in Partnership with Italy*. Accessed November 5th, 2021. <https://ukcop26.org/wp-content/uploads/2021/07/COP26-Explained.pdf>.
- Denchak, Melissa. “Consequences and Effects of Global Warming.” *National Resources Defense Council*. March 15th, 2016. <https://www.nrdc.org/stories/are-effects-global-warming-really-bad>.
- “The Earth Charter.” *Earth Charter International Council*. Accessed August 30th, 2021. https://earthcharter.org/wp-content/uploads/2020/03/earthcharter_english.pdf?x79755.
- “The End of an Era (1971-1993)” *Phipps Conservatory and Botanical Gardens*. Accessed November 23rd, 2021. <https://www.phipps conservatory.org/visit-and-explore/explore/explore-our-history/the-story-of-hipps/the-end-of-an-era-1971-1993>.
- “Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis.” *The White House*. January 20th, 2021. <https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/20/executive-order-protecting-public-health-and-environment-and-restoring-science-to-tackle-climate-crisis/>.
- “FACT SHEET: United States Support for Global Efforts to Combat Carbon Pollution and Build Resilience.” *The White House*. November 15th, 2014. <https://obamawhitehouse.archives.gov/the-press-office/2014/11/15/fact-sheet-united-states-support-global-efforts-combat-carbon-pollution>.
- “FACT SHEET: President Obama’s Climate Action Plan.” *The White House*. June 25th, 2013. <https://obamawhitehouse.archives.gov/the-press-office/2013/06/25/fact-sheet-president-obama-s-climate-action-plan>.
- “Global Greenhouse Gas Emissions Data.” *Environmental Protection Agency*. Accessed October 6th, 2021. <https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data>.
- “Global Warming.” *National Aeronautics and Space Administration*. Accessed October 6th, 2021. <https://earthobservatory.nasa.gov/features/GlobalWarming>.

- “The Greenest Building: Quantifying the Environmental Value of Building Reuse.” *National Trust For Historic Preservation*. Accessed December 13th, 2021. <https://forum.savingplaces.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=5119e24d-ae4c-3402-7c8e-38a11a4fca12&forceDialog=0>.
- “Greywater Reuse.” *Greywater Action For Sustainable Water Culture*. Accessed December 11th, 2021. <https://greywateraction.org/greywater-reuse/>.
- Kats, Greg. *Greening Our Built World: Costs, Benefits and Strategies*. Washington DC: Island Press, 2009.
- Lee, Joyce, Frances Morris, Leonardo Menezes, Andrés Roldán. *American Alliance of Museums*. “Looking Ahead: Embracing Sustainability and Resiliency for a Better Tomorrow.” September 22nd, 2021. <https://www.aam-us.org/2021/10/21/looking-ahead-embracing-sustainability-and-resiliency-for-a-better-tomorrow/>.
- McDonald, Martha. “Preservation and LEED See Eye to Eye.” *Traditional Building*. February 5th, 2020. <https://www.traditionalbuilding.com/product-report/preservation-and-leed>.
- “Memorandum of Understanding (MOU).” *Climate Heritage Network*. Accessed June 26th, 2021. <https://www.aam-us.org/wp-content/uploads/2017/11/AAM-2020-Climate-Heritage-Network-MOU-Final-.pdf>.
- Murawski, Mike. *Museums as Agents of Change: A Guide to Becoming a Changemaker*. Maryland: Rowman & Littlefield Publishers, 2021.
- “Museums, Environmental Sustainability and Our Future: A Call to Action from the Summit on Sustainability Standards in Museums 2013.” *American Alliance of Museums and the PIC Green Professional Network*. Accessed September 17th, 2021. <http://ww2.aam-us.org/docs/default-source/professional-networks/picgreenwhitepaperfinal.pdf>.
- “Net Zero Resources.” *United States Environmental Protection Agency*. Accessed December 12th, 2021. <https://www.epa.gov/water-research/net-zero-resources>.
- “New Futures.” *Tate*. Accessed October 14th, 2021. <https://www.tate.org.uk/visit/tate-modern/new-tate-modern/future>.
- “Our Animals.” *The Buffalo Zoo*. Accessed November 12th, 2021. <https://buffalozoo.org/our-animals/>.
- “Our History.” *Buffalo and Erie County Botanical Gardens*. Accessed November 2nd, 2021. <https://buffalogardens.com/pages/about-us>.
- “Our Mission and What We Do.” *National Environmental Agency*. Accessed September 20th, 2021. <https://www.epa.gov/aboutepa/our-mission-and-what-we-do>.

- “Paris Agreement.” *United Nations*. Accessed July 19th, 2021. https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf.
- “The Paris Agreement.” *United Nations Framework Convention on Climate Change*. Accessed September 21st, 2021. <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>.
- “Paris climate deal: Trump announces US will withdraw.” *British Broadcasting Corporation News*. June 1, 2017. <https://www.bbc.com/news/world-us-canada-40127326>.
- “Preserving Historic Buildings Through LEED Green Building Strategies.” *National Trust for Historic Preservation*. August 25th, 2021. <https://forum.savingplaces.org>.
- Princeton University. “A more potent greenhouse gas than carbon dioxide, methane emissions will leap as Earth warms.” *ScienceDaily*. Accessed October 7, 2021. www.sciencedaily.com/releases/2014/03/140327111724.htm.
- “A Quick History of the National Park Service.” *The National Park Service*. May 14th, 2018. <https://www.nps.gov/articles/quick-nps-history.htm>.
- Sommer, Mark. “Wilson Foundation announces \$100 million to support arts and cultural organizations.” December 2nd, 2021. https://buffalonews.com/news/local/wilson-foundation-announces-100-million-to-support-arts-and-cultural-organizations/article_a8009048-5126-11ec-a517-df7aa8615cdd.html.
- “Sustainability Statement.” *Museum of Fine Arts, Boston*. November 7th, 2019. <https://www.mfa.org/about/sustainability-statement>.
- “Summary of the Resource Conservation and Recovery Act.” *National Environmental Agency*. Accessed September 20th, 2021. <https://www.epa.gov/laws-regulations/summary-resource-conservation-and-recovery-act>.
- “Sustainability and the ROE.” *United States Environmental Protection Agency*. Accessed September 14th, 2021. <https://www.epa.gov/report-environment/sustainability-and-roe>.
- Sutton, Sarah. “The Evolving Responsibility of Museum Work in the Time of Climate Change, Museum Management and Curatorship.” Routledge: Taylor & Francis Group, 2020. Vol. 35 No.6, 618-635.
- “This Interactive Chart Shows Changes in the World's Top 10 Emitters.” *World Resources Institute*. December 10th, 2020. <https://www.wri.org/insights/interactive-chart-shows-changes-worlds-top-10-emitters>.
- Throne, Audrey. “The Environmental Benefits of Gardening.” *US Green Technology*. December 7th, 2020. <https://usgreentechnology.com/environmental-benefits-gardening/>.

- “What are volatile organic compounds (VOCs)?” *United States Environmental Protection Agency*. Accessed December 12th, 2021. <https://www.epa.gov/indoor-air-quality-iaq/what-are-volatile-organic-compounds-vocs>.
- “What Does Three Museums, a Social Club, a Hospital, and a University Have in Common?” *Discovering Buffalo, One Street at a Time*. Accessed November 30th, 2021. <https://buffalostreets.com/tag/buffalo-museum-of-science/>.
- “What is Climate Change?” *National Aeronautics and Space Administration*. May 14th, 2014. <https://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-climate-change-k4.html>.
- “What is Environmental Sustainability?” *Sphera*. May 19th, 2020. <https://sphera.com/glossary/what-is-environmental-sustainability/>.
- “Welcome.” *National Environmental Policy Act*. Accessed September 15th, 2021. <https://ceq.doe.gov>.
- “2019 Building Energy Efficiency Standards for Residential and Nonresidential Buildings for the 2019 Building Efficiency Standards.” *California Energy Commission*. Accessed November 29th, 2021. <https://www.energy.ca.gov/publications/2008/2019-building-energy-efficiency-standards-residential-and-nonresidential>.
- “2020 Existing building Code of New York State.” *International Code Council INC and New York State Department of State*. Accessed November 29th, 2021. <https://dos.ny.gov/system/files/documents/2020/09/2020-ebcnys-november-2019.pdf>.