

**RAISED OR RAZED: THE CHALLENGE OF CLIMATE ADAPTATION AND SOCIAL EQUITY  
IN HISTORIC COASTAL COMMUNITIES**

Rachel B. Isacoff

A THESIS

in

Historic Preservation

Presented to the Faculties of the University of Pennsylvania in  
Partial Fulfillment of the Requirements of the Degree of

MASTER OF SCIENCE IN HISTORIC PRESERVATION

2014

---

Advisor

Michael C. Henry, PE, AIA

Adjunct Professor of Architecture

---

Program Chair

Randall F. Mason

Associate Professor

To my parents,  
who have waved a magic wand over my life  
and encourage me to realize my dreams.

## ACKNOWLEDGMENTS

I would like to thank my advisor, Michael Henry, for believing from the start that this topic could make a timely and meaningful contribution to the field of cultural heritage. This thesis would not be possible without his guidance and expertise on coastal systems and genuine interest in intangible values and social sustainability. I am deeply grateful for his time and support.

I would also like to thank the following people for suggesting many of the resources that became integral to my research: Erica Avrami, Research and Education Director, World Monuments Fund; Ira Feldman, President and Senior Counsel, Greentrack Strategies; Randall Mason, Chair and Associate Professor, Graduate Program in Historic Preservation, University of Pennsylvania; Daniel Saunders, Deputy State Historic Preservation Officer, New Jersey Department of Environmental Protection; and Heidi Stiller, Coastal Management Specialist, NOAA Gulf Coast Services Center.

To all of my friends and family, thank you for being sources of beauty in my life. I appreciate all of your encouragement and positive energy. Thanks especially to Reina Chano for her wealth of ArcGIS knowledge, and to my parents and sister for their humor and unconditional love.

## TABLE OF CONTENTS

<b>ACKNOWLEDGEMENTS</b>	<b>iii</b>
<b>LIST OF FIGURES</b>	<b>vii</b>
<b>CHAPTER 1   INTRODUCTION</b>	<b>1</b>
CLIMATE CHANGE THREATS TO COASTAL HERITAGE	2
WHY ADAPTATION?	4
POLICY CONSTRAINTS FOR ADAPTATION IN HISTORIC COASTAL COMMUNITIES	7
SOCIAL COMPONENTS TO ADAPTATION IN HISTORIC COASTAL COMMUNITIES	11
METHODOLOGY	13
<b>CHAPTER 2   EXISTING LITERATURE AND GUIDANCE</b>	<b>17</b>
LITERATURE AND POLICIES ON CLIMATE CHANGE AND PRESERVATION	17
LITERATURE ON THE LIMITS OF ADAPTATION	20
MODELS OF ADAPTIVE STRATEGY ANALYSIS	24
CONCLUSION	30
<b>CHAPTER 3   PROTECTION: THE IMPLICATIONS OF FLOOD BARRIERS</b>	<b>32</b>
OPTIONS FOR “SOFT” AND “HARD” ENGINEERING	32
HISTORIC PRECEDENTS OF LEVEES AND DIKES	34
POLICY CONSTRAINTS	36
CONSIDERATIONS FOR HISTORIC COMMUNITIES	39
<i>Impact on the Cultural Landscape and Traditional Ways of Living</i>	39
<i>False Sense of Security</i>	41
<i>Adverse Effects of Constructing New Levees or Dikes</i>	43
CONCLUSION	45

<b>CHAPTER 4   ACCOMMODATION: THE IMPLICATIONS OF ELEVATING</b>	<b>47</b>
<b>HISTORIC PROPERTIES</b>	
OPTIONS FOR FLOOD-PROOFING	47
HISTORIC PRECEDENTS FOR ELEVATING HISTORIC BUILDINGS	48
POLICY CONSTRAINTS	51
CONSIDERATION FOR HISTORIC COMMUNITIES	57
<i>Impact on Spatial Relationships</i>	57
<i>Factors for Public Infrastructure</i>	61
<i>Reassess the Criteria for Evaluation</i>	64
CONCLUSION	64
<b>CHAPTER 5   RETREAT: THE IMPLICATIONS OF RELOCATION</b>	<b>65</b>
OPTIONS FOR REMOVING HUMAN SETTLEMENTS FROM VULNERABLE AREAS	65
HISTORIC PRECEDENTS FOR RELOCATION	66
POLICY CONSTRAINTS	67
CONSIDERATIONS FOR HISTORIC COMMUNITIES	70
<i>Impacts on Sense of Place and to Cultures</i>	70
<i>Justice Concerns</i>	71
CONCLUSION	73
<b>CHAPTER 6   CONCLUSION</b>	<b>74</b>
REVIEW OF ADAPTATION OPTIONS AND IMPACTS	75
VALUES AND THRESHOLDS FOR CHANGE	76
<i>At the Community Level</i>	76
<i>For Policy-Makers</i>	77
<i>Within the National Park Service</i>	78
LOCAL AND PLACE-BASED DECISION-MAKING	80

<i>Community-Based Adaptation</i>	81
<i>Traditional Ecological Knowledge</i>	82
CONCLUSION	83
<b>BIBLIOGRAPHY</b>	<b>85</b>
<b>INDEX</b>	<b>97</b>

## LIST OF FIGURES

<b>Figure 1.</b> Barriers and Limits to Adaptation Across Scales	8
<b>Figure 2.</b> Map of Vulnerable National Register Historic Districts	14
<b>Figure 3.</b> Influence of Climate Change on Adaptation Strategies	16
<b>Figure 4.</b> Decision Tree of Approaches for Assessing Costs and Benefits	28
<b>Figure 5.</b> Dike in Walcheren (Netherlands)	35
<b>Figure 6.</b> Illustration of Levee Failures	42
<b>Figure 7.</b> Galveston Elevations	50
<b>Figure 8.</b> Flood Insurance Rate Map Zones	52
<b>Figure 9.</b> Landscaping as Disguise for Elevations	59
<b>Figure 10.</b> Darlington Interior Floodwall	59
<b>Figure 11.</b> Sheepshead Bay Court Elevations	63

## CHAPTER 1 | INTRODUCTION

The Hippocratic Oath states, “first, do no harm.” But applying that maxim to the ideals of cultural heritage preservation in a period of rapid climate change presents a heart-wrenching dilemma: preservation professionals must choose which precious resource not to harm – the natural environment, the built environment, or the cultures of longstanding communities. Climate change’s deleterious impacts on cultural heritage will include direct physical effects on buildings and landscapes and intangible social and economic consequences that jeopardize “many traditional practices – indeed, entire cultures – that have evolved in concert with their natural surroundings.”<sup>1</sup>

Climate change is a “threat multiplier. It magnifies and exacerbates existing social, economic, political, and environmental trends, problems, issues, tensions, and challenges.”<sup>2</sup> Framed by geopolitics, the outcomes of climate change encompass “people and power, ethics and morals, environmental costs and justice, and cultural and spiritual survival.”<sup>3</sup> The predicted impacts of sea-level rise and extreme weather due to climate change have forced policy makers and practitioners in both the environmental and historic preservation arenas to begin to acknowledge the grim reality that tough choices need to be made among competing interests and values. This thesis explores the necessity of a triage-like approach, the legitimacy of which the preservation community is only recently beginning to acknowledge. Ultimately, social justice and the intangible costs to cultures must be balanced with other desirable agendas.

---

<sup>1</sup> Anthony Veerkamp, “The Impacts of Climate Change on the Chesapeake Bay” (statement presented at the U.S. House of Representatives Committee on Natural Resources’ Subcommittee on National Parks, Forests and Public Lands and the Subcommittee on Insular Affairs, Oceans and Wildlife, July 2, 2009), <http://www.preservationnation.org/information-center/sustainable-communities/additional-resources/NTHP-Chesapeake-Bay-Climate-Change.pdf>.

<sup>2</sup> Susan A. Crate and Mark Nuttall, ed., *Anthropology and Climate Change: From Encounters to Actions* (Walnut Creek, CA: Left Coast Press, Inc., 2009), 11.

<sup>3</sup> Ibid., 11.



## Climate Change Threats to Coastal Heritage

Advances in research, data collection and analysis have enabled scientists to project future climate change and its specific effects with an increasing degree of certainty. Though the planet will be altered by many climate change manifestations, one of the most readily apparent and irrefutable changes is the loss of coastal land to rising sea levels. Sea levels did not change considerably for nearly two-thousand years but in the late nineteenth century, as the Earth started to warm due to greenhouse gas emissions, sea levels began to rise from thermal expansion and the melting of ice on land.<sup>4</sup> By the end of the twenty-first century, sea levels are predicted to rise between two and seven feet. In more dire circumstances, if the Greenland ice sheet melts completely, sea levels would rise 25 feet within the next four to five centuries; if all the ice on land melts, sea levels would rise 216 feet.<sup>5</sup> Rising seas will submerge low-lying coastal lands and exacerbate flooding and coastal erosion. These changes are not without a human face – this impact poses a direct and immediate threat to the irreplaceable heritage of historic coastal communities.

This threat to the survival of coastal historic places is especially worrisome in the mid-Atlantic region of the United States, which is particularly vulnerable due to low-lying topography, land subsidence and high storm frequency.<sup>6</sup> At present, many surviving European settlements on the coastal edges of the mid-Atlantic that did not evolve into metropolises already have limited financial resources and professional help. Numerous historic maritime, fishing and resort communities, which continue the legacy of water-dependent economies, are at risk. In addition to damaged historic properties, reductions in

---

<sup>4</sup> Tim Folger, "Rising Seas," *National Geographic*, September 2013, 40.

<sup>5</sup> Folger, 41; and Baden Copeland, Josh Keller and Bill Marsh, "What Could Disappear," *New York Times*, November 24, 2012, [http://www.nytimes.com/interactive/2012/11/24/opinion/sunday/what-could-disappear.html?\\_r=1&#g-footnote-anchor](http://www.nytimes.com/interactive/2012/11/24/opinion/sunday/what-could-disappear.html?_r=1&#g-footnote-anchor).

<sup>6</sup> National Oceanic and Atmospheric Administration (NOAA), *Adapting to Climate Change: A Planning Guide for State Coastal Managers*, (Silver Spring, MD: NOAA Office of Ocean and Coastal Resource Management, 2010), 119.

the availability of recreational and cultural opportunities may affect tourism levels and local business revenues, leading to decreased services and a lost sense of community.

The Chesapeake Bay, the largest estuary in North America, has drawn human activity to its shorelines and islands over thousands of years – leaving a rich historical and cultural legacy.<sup>7</sup> According to the Maryland state climatologist, the Chesapeake Bay region is experiencing sea-level rise at two to three times the global pace.<sup>8</sup> This accreted rate is due to the combination of land subsidence of .05 inches on average each year for the past one- to two-thousand years and rising water. Sea levels in this region rose more than one foot during the twentieth century; land subsidence accounts for about half of this sea-level rise – making the total sea-level rise in this region six inches more than the global average.<sup>9</sup> Since higher sea levels accelerate erosion and submerge barrier islands, more than thirteen islands in the bay have been submerged disappeared. The 2013 report from the University of Maryland’s Center for Environmental Science recommends that the State should plan for a rise in sea level as little as 0.9 feet, and as much as 2.1 feet, by 2050, and likely, 3.7 feet by 2100.<sup>10</sup> Maryland alone has over 3000 miles of tidal shoreline and low-lying land that will be impacted, which includes more than two hundred individual sites on the National Register of Historic Places.<sup>11</sup>

The preservation of these sites exemplifies how climate and culture are inextricably linked, affecting the emotional bonds between people and places. Maintaining tangible contact with the past strengthens a community’s stability and continuity and provides a

---

<sup>7</sup> Veerkamp, “The Impacts of Climate Change on the Chesapeake Bay.”

<sup>8</sup> Brandon Goldner, “Rising seas, sinking land put Maryland’s waterfront communities at risk,” *Sea Level Rise in Maryland*, 2013, <http://cnsmaryland.org/sealevelrise/?p=62>.

<sup>9</sup> Maia David and Amanda Campbell, *Summary of Potential Climate Change Impacts, Vulnerabilities, and Adaptation Strategies in the Metropolitan Washington Region* (Washington, DC: Metropolitan Washington Council of Governments, 2013), 6.

<sup>10</sup> University of Maryland Center for Environmental Science, “Sea level along Maryland’s shorelines,” *Phys.org*, June 26, 2013, <http://phys.org/news/2013-06-sea-maryland-shorelines-feet.html>.

<sup>11</sup> Megan Kowalski, “Rising seas threaten national landmarks on the Chesapeake Bay,” *Sea Level Rise in Maryland*, 2013, <http://cnsmaryland.org/sealevelrise/?p=131>.

basis for future generations to be inspired by their legacy. Acknowledging that cultures adapt to external conditions and societies are rarely static, some heritage conservators have begun to recognize their position as managers of change. However, societies' need to adapt to climate change may challenge existing notions of culture in new ways and pressure communities into changing livelihoods and lifestyles.<sup>12</sup>

### **Why Adaptation?**

Eager to reduce the anthropogenic causes of climate change, such as emissions of greenhouse gases (GHGs), international stakeholders have focused on the reduction of these factors. Although these efforts are necessary to reduce long-term impacts, such mitigation efforts cannot suspend or avoid all impacts of climate change. "The overwhelming focus on GHG mitigation overshadows the adaptation half of the climate change equation."<sup>13</sup> In order to "avoid the unmanageable and manage the unavoidable,"<sup>14</sup> adapting to anthropogenic and natural climate change is an essential complement to reducing emissions.

The Intergovernmental Panel on Climate Change defines adaptation as "an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities."<sup>15</sup> This explanation can be pared down to: reduce vulnerability and enhance resiliency. The resilience of social-ecological systems focuses on "adaptive capacity, transformability, learning, and

---

<sup>12</sup> Jonathan Ensor and Rachel Berger, "Community-based adaptation and culture in theory and practice," in *Adapting to Climate Change: Thresholds, Values and Governance*, ed. W. Neil Adger, Irene Lorenzoni, and Karen L. O'Brien (Cambridge: Cambridge University Press, 2009), 228.

<sup>13</sup> Ira R. Feldman and Joshua H. Kahan, "Preparing for the Day After Tomorrow: Frameworks for Climate Change Adaptation," *Sustainable Development Law & Policy* 8:1 (Fall 2007): 61.

<sup>14</sup> Scientific Expert Group on Climate Change (SEG), *Confronting Climate Change: Avoiding the Unmanageable and Managing the Unavoidable* (Washington, DC: Sigma Xi and the United Nations Foundation, 2007), ix.

<sup>15</sup> M. L. Parry et. al., ed., *Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge: Cambridge University Press, 2007), 869.

innovation.”<sup>16</sup> Since an important part of making places resilient lies in a dynamic understanding of heritage and enhancing a community’s existing character,<sup>17</sup> preservation professionals have a role in anticipating and improving the way a place functions to make it sustainable and protect the interests of future generations.

Preservation practitioners’ focus in climate change issues has been in reducing the impacts of the built environment on the climate. Some preservation professionals have incorporated climate change mitigation and environmental sustainability measures in their efforts to preserve the existing stock of historic buildings– promoting the benefits of reuse, capturing embodied energy and integrating energy efficiency standards. Yet, however laudable, these goals are not adequate for long-term preservation of built and intangible heritage; adaptive action is also required to respond to the threats of climate change. The preservation field in the United States has been slow to enter the conversation about the full effects of climate change on built heritage and to take a holistic view towards the trade-offs and compromises associated with adaptation. For societies at large, “particularly in developed nations, climate change and its impacts, although generating concern, are also generally believed to be removed in space (‘not here’) and time (‘not yet’).”<sup>18</sup> Those who aim to preserve tangible history must actively address how best to protect it for the future, and adaptation must be part of that preservation strategy.

Adaptation measures implemented by communities and agencies are often tied to prioritized values. Distinctive values indicate various approaches to adaptation. Traditional worldviews prioritize strategies aligned with group identity – appreciating local knowledge and supporting established livelihoods; modern worldviews give precedence to rational,

---

<sup>16</sup> Intergovernmental Panel on Climate Change (IPCC), *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (New York: Cambridge University Press, 2012), 34.

<sup>17</sup> Samuel Jones and Melissa Mean, *Resilient Places: Character and Community in Everyday Heritage* (London: Demos, 2010), 65.

<sup>18</sup> W. Niel Adger et al., “Are there social limits to adaptation to climate change?,” *Climatic Change* 93 (2009): 346, doi: 10.1007/s10584-008-9520-z.

financial analyses; and postmodern worldviews seek communal well-being, equity and justice, stressing the impact on the poor and on future generations. As core elements of a culture, values serve as standards and guide action (or inaction), choice and rationalization.<sup>19</sup> Values provide the framework for how societies and institutions manage risk and change and allocate scarce financial resources.

For some, adaptation involves maintaining the status quo while for others it is about progress.<sup>20</sup> “Risk reduction is only meaningful and prioritized by local government authorities if it is perceived to be relevant in the context of other more pressing day-to-day issues.”<sup>21</sup> If there is a conflict among subjective priorities, whose values count? “The values that are pursued and those that are ignored can easily become enmeshed in the politics of climate change adaptation.”<sup>22</sup> For these reasons, the peril of the involuntary loss of places, identities, and perceived individual rights, coupled with the urgency for financially cost-effective solutions, may act as deep-seated barriers to adaptation. If preservation professionals are not active participants in values negotiations, precedence may be given to other public policy objectives.<sup>23</sup>

Adaptation is a “multi-scalar process of multi-level governance, concerned with the interaction of individual and collective behaviors acting from the bottom-up and the top-down in response to changing circumstances.”<sup>24</sup> There are, in addition to governmental responses, divisions among preservation theorists and practitioners and historic property owners, producing conflicts over what the acceptable reactions are to climate change

---

<sup>19</sup> Karen L. O’Brien, “Do values subjectively define the limits to climate change adaptation?” in *Adapting to Climate Change: Thresholds, Values and Governance*, ed. W. Neil Adger, Irene Lorenzoni, and Karen L. O’Brien (Cambridge: Cambridge University Press, 2009), 166, 170.

<sup>20</sup> Adger et al., 337-338, 341.

<sup>21</sup> IPCC, 75-76.

<sup>22</sup> W. Neil Adger, Irene Lorenzoni, and Karen L. O’Brien, *Adapting to Climate Change: Thresholds, Values and Governance* (Cambridge: Cambridge University Press, 2009), 5.

<sup>23</sup> O’Brien, 164, 171; Adger et al., 339, 342.

<sup>24</sup> Adger, Lorenzoni and O’Brien, 10.

threats. Though some adaptation may result through variations in market and individual behavior, markets are shaped by regulations and government. Implementation of policy responses to climate change will be most effective when it is linked to an agency's existing agenda, leveraging resources for maximum benefits.<sup>25</sup> However, agency and department red tape can encumber adaptation efforts. The time and cultural shift necessary to make changes in federal, state and local policies can delay responses to external change.<sup>26</sup> Differing values of government agencies and local communities, contingent on "ethics, knowledge, attitudes to risk and cultural constraints on action," may limit the options for adaptation.<sup>27</sup> This clash of positions imposes a critical impediment to fostering solutions for cultural heritage preservation in coastal areas.

### **Policy Constraints for Adaptation in Historic Coastal Communities**

One crucial concern for the preservation community is found in the President's Executive Order, "Preparing the United States for the Impacts of Climate Change." Complete with several directives to enhance the nation's "climate preparedness and resilience," the Executive Order charges federal agencies to promote information-sharing and to increase climate-resilient investment, and it establishes an interagency council and a state, local and tribal task force on resiliency planning. It also directs federal agencies to recognize the "many benefits" provided by the "natural infrastructure" of the nation's ecosystems.<sup>28</sup> Yet, the Executive Order has no single mention of considerations for cultural heritage resources.

---

<sup>25</sup> Feldman and Kahan, 68; and James Ford et al., "Reducing Vulnerability to Climate Change in the Arctic: The Case of Nunavut, Canada," *Arctic Institute of North America* 60-2 (2007): 152-153, <http://dx.doi.org/10.14430/arctic240>.

<sup>26</sup> James G. Titus, *Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region*, (Washington, DC: U.S. Climate Change Science Program and the Subcommittee on Global Change Research, 2009), 6.

<sup>27</sup> Adger, Lorenzoni and O'Brien, 6.

<sup>28</sup> "Executive Order – Preparing the United States for the Impacts of Climate Change," The White House, November 1, 2013, <http://www.whitehouse.gov/the-press-office/2013/11/01/executive-order-preparing-united-states-impacts-climate-change#!>.

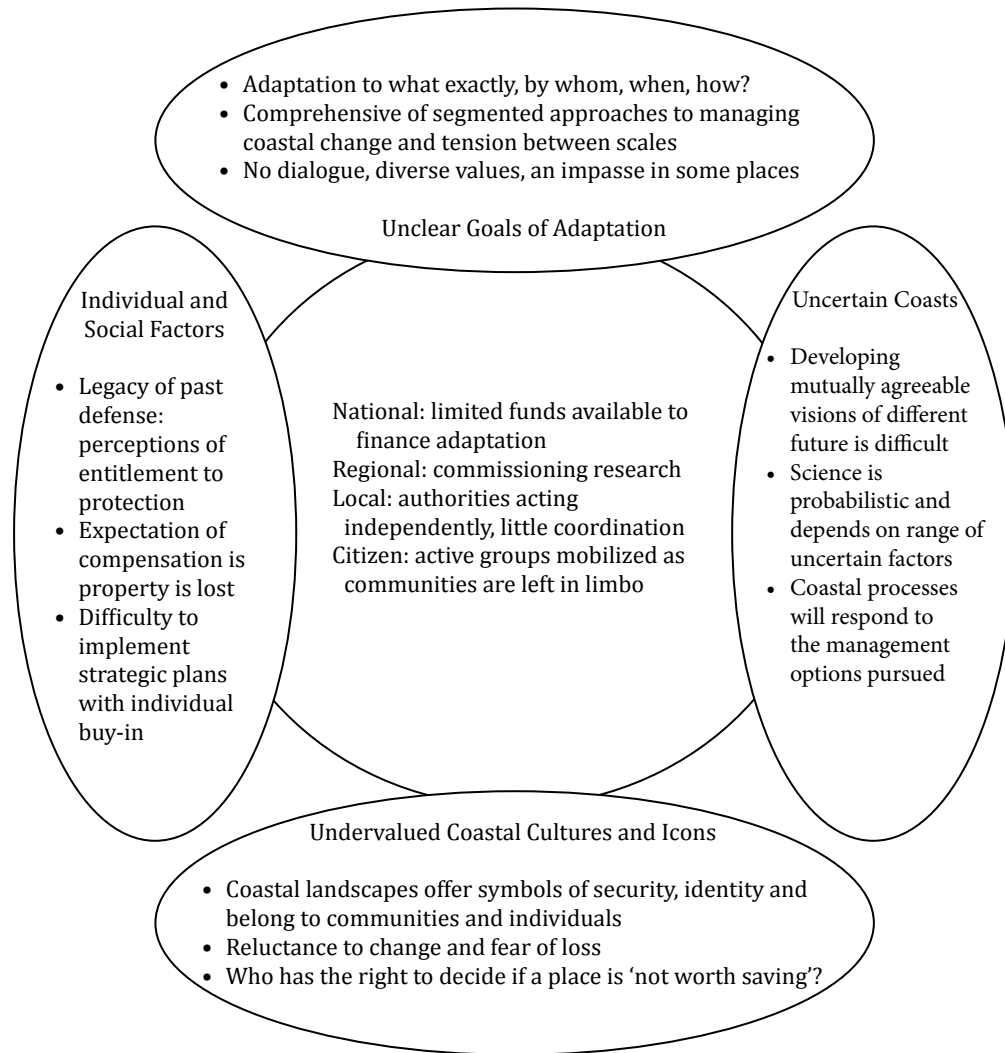


Figure 1. Barriers and Limits to Adaptation Across Scales.  
 Source | Adger, Lorenzoni, and O'Brien, 378.

Furthermore, the Department of the Interior's (DOI) implementation actions for the President's Climate Action Plan also are silent regarding recommendations for cultural heritage resources.<sup>30</sup> Considering the centrality of cultural resource stewardship to the mandate for the National Park Service (NPS) – a bureau of the DOI – this is a troubling omission.

The cornerstone for federal historic preservation legislation is the National Historic Preservation Act (NHPA) of 1966 – impacting fiscal and cultural resource management. Authorized under the NHPA and administered by the NPS, the National Register of Historic Places (National Register) is part of a national program to support public and private efforts to identify, evaluate and protect historic resources. This list includes districts, sites, buildings, structures and objects that meet the Criteria for Evaluation: they have *significance* in American history, associated with the life of a noteworthy person, embody the distinctive characteristics of a type, or yield information through archeological investigation; they possess *integrity* – the ability of a property to convey its significance through location, design, setting, materials, workmanship, feeling and association; and they are at least fifty years old. Properties on the National Register gain from federal preservation grants and federal investment tax credits, and those on or eligible for the National Register require review under Section 106 of the NHPA when there is a federal undertaking that affects the property to ensure that public funds are not used to damage or destroy places of national heritage without proper consideration.<sup>31</sup> The NHPA also authorized the creation of the Secretary of the Interior's Standards for the Treatment of Historic Properties (Standards), which are meant to be applied to all resource types on the

---

<sup>30</sup> Henry A. Waxman, Bobby L. Rush, and Earl Blumenauer, *Implementing the President's Climate Action Plan: U.S. Department of the Interior*, (Washington DC: United States Congress Bicameral Task Force on Climate Change, 2013), <http://www.whitehouse.senate.gov/download/?id=19dcfe67-2b3d-4fa6-95d5-500ddcf7c84c&download=1>.

<sup>31</sup> "National Register of Historic Places," National Park Service, <http://www.nps.gov/history/nr/>.



National Register. Accompanying *Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings* apply specifically to buildings. Though not prescriptive, the use of the Standards is required for all projects seeking any federal funding, including tax benefits or Historic Preservation Fund grants.<sup>32</sup>

The rigid application of the Criteria for Evaluation of the National Register and the Standards conflicts with the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program (NFIP) and competitive grants for state and local governments to retrofit flood-damaged properties and elevate structures. Created by Congress in 1968 – predating current notions of sea-level rise – the NFIP encourages states and municipalities to manage development in floodplains by offering subsidized flood insurance in areas that have adopted minimum requirements.<sup>33</sup> Without flood insurance, homeowners are not eligible to receive federally-backed mortgages.<sup>34</sup> Through mapping, setting insurance rates and developing floodplain regulations, these regulations can positively deter new construction in vulnerable areas; however, they do not adequately address the difficult question of adaptation of existing properties that are historic, as will be articulated throughout this thesis.

Additionally, since most risk-reduction and recovery policies are implemented in response to a disaster, it is difficult for historic property owners to obtain the funds necessary to preventively adapt. After a presidentially-declared disaster, FEMA offers a Hazard Mitigation Grant Program (HMGP) and Flood Mitigation Assistance, including the repetitive flood claims program, and the Department of Housing and Urban Development provides Community Development Block Grants (CDBG) to fund recovery efforts. In these

---

<sup>32</sup> “The Secretary of the Interior’s Standards,” National Park Service, <http://www.nps.gov/hps/tps/standguide/index.htm>.

<sup>33</sup> “The National Flood Insurance Program,” Federal Emergency Management Agency, <http://www.fema.gov/national-flood-insurance-program>.

<sup>34</sup> Anne Siders, *Managed Coastal Retreat: A Legal Handbook on Shifting Development Away from Vulnerable Areas*, (New York: Columbia Center for Climate Change Law, 2013), 86.

statutes, disasters do not include ongoing climate-induced changes, like sea-level rise and steady erosion. The only proactive financial assistance for planning and to implement projects that reduce property damage is FEMA's Pre-Disaster Mitigation Grant Program – though restricted to states, local governments and Indian tribes, this funding can reduce overall risks for communities and buildings.<sup>35</sup> While HMGP funds can be used for projects that will reduce future risks, those actions would still be reactive adaptation and may leave “remaining ultimate damages” because of irreversible outcomes.<sup>36</sup>

### **Social Components to Adaptation in Historic Coastal Communities**

While cities with larger populations are likely to receive substantial resources for shore protection, this aid is less probable for most of the smaller villages and towns along the mid-Atlantic coast. As indicated by the Intergovernmental Panel on Climate Change, climate change will disproportionately affect at-risk populations – with increasing evidence that under-resourced communities have a susceptibility to be adversely affected even within developed countries.<sup>37</sup> In Maryland, for example, a 2010 report for the U.S. Environmental Protection Agency found that sixty percent of the Eastern Shore, which has scattered rural, poor and less-populated areas, will not be protected from sea-level rise due to “economic difficulties that [the counties] and its residents are experiencing.”<sup>38</sup> The government's

---

<sup>35</sup> Siders, 111.

<sup>36</sup> Frank Lecocq and Zmarak Shalizi, *Balancing Expenditures on Mitigation of and Adaptation to Climate Change: An Exploration of Issues Relevant to Developing Countries*, Policy Research Working Paper 4299 (Washington, DC: The World Bank Development Research Group, August 2007), 7, [http://www-wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/2007/08/02/000158349\\_20070802095523/Rendered/PDF/wps4299.pdf](http://www-wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/2007/08/02/000158349_20070802095523/Rendered/PDF/wps4299.pdf).

<sup>37</sup> Parry et. al., *Contribution of Working Group II*, 791; and Robert E. Deyle and William H. Butler, “Resilience Planning in the Face of Uncertainty: Adapting to Climate Change Effects on Coastal Hazards,” in *Disaster Resiliency: Interdisciplinary Perspectives*, ed. Naim Kapucuc, Christopher V. Hawkins, and Fernando I. Rivera (New York: Routledge – Taylor & Francis Group, 2013), 180.

<sup>38</sup> William H. Nuckols, et al., “Maryland,” in *The Likelihood of Shore Protection along the Atlantic Coast of the United States, Volume 1: Mid-Atlantic*, ed. James G. Titues and Daniel Hudgens (Washington, DC: U.S. Environmental Protection Agency, 2010), 605.

current incapacity to prioritize these areas not only affects the lack of preparation available but also impacts the most vulnerable communities' ability to cope.

The capacity of a community for adaptation is shaped in part by an integrated economy, degree of urbanization, access to insurance, existing planning regulations at national and local levels, and attention to human rights.<sup>39</sup> Vulnerability is concomitant with the state of a place prior to a catastrophic event and with that place's ability to recover or potentially adapt after such an event– intersecting biophysical and social vulnerability.<sup>40</sup> Accordingly, “vulnerable groups are not only at risk because they are exposed to a hazard but as a result of marginality, of everyday patterns of social interaction and organization, and access to resources.”<sup>41</sup> Though sea-level rise functions as an objective condition, disaster-risk reduction is determined by social constraints – indicating that decisions can be directed to support social equity.<sup>42</sup>

Less resilient communities, whose vulnerabilities will be exposed by these external stressors, have limited opportunities for adaptation. The same qualities that create disadvantages, like living in low-lying areas and having water resource-based livelihoods, hinder the ability to avoid loss.<sup>43</sup> Some areas will be too vulnerable for physical defenses against sea-level rise and will require relocation. “The imperative lies not only in ensuring humankind's survival in the long term, but guaranteeing a certain degree of individual and social welfare in the present as well as the future.”<sup>44</sup> Socially-fragile populations with

---

<sup>39</sup> IPCC, 76.

<sup>40</sup> Feldman and Kahan, 62.

<sup>41</sup> IPCC, 71.

<sup>42</sup> Ibid., 36.

<sup>43</sup> Janet Swim, *Psychology & Global Climate Change: addressing a multifaceted phenomenon and set of challenges*, (Washington, DC: American Psychological Association Task Force on the Interface between Psychology and Global Climate Change, 2009), 47, <http://www.apa.org/science/about/publications/climate-change.aspx>.

<sup>44</sup> Adger, Lorenzoni and O'Brien, 11.

unique cultural characteristics will require more planning assistance. Public policy should include objectives to protect vulnerable populations by reducing their exposure to risk.<sup>45</sup>

## **Methodology**

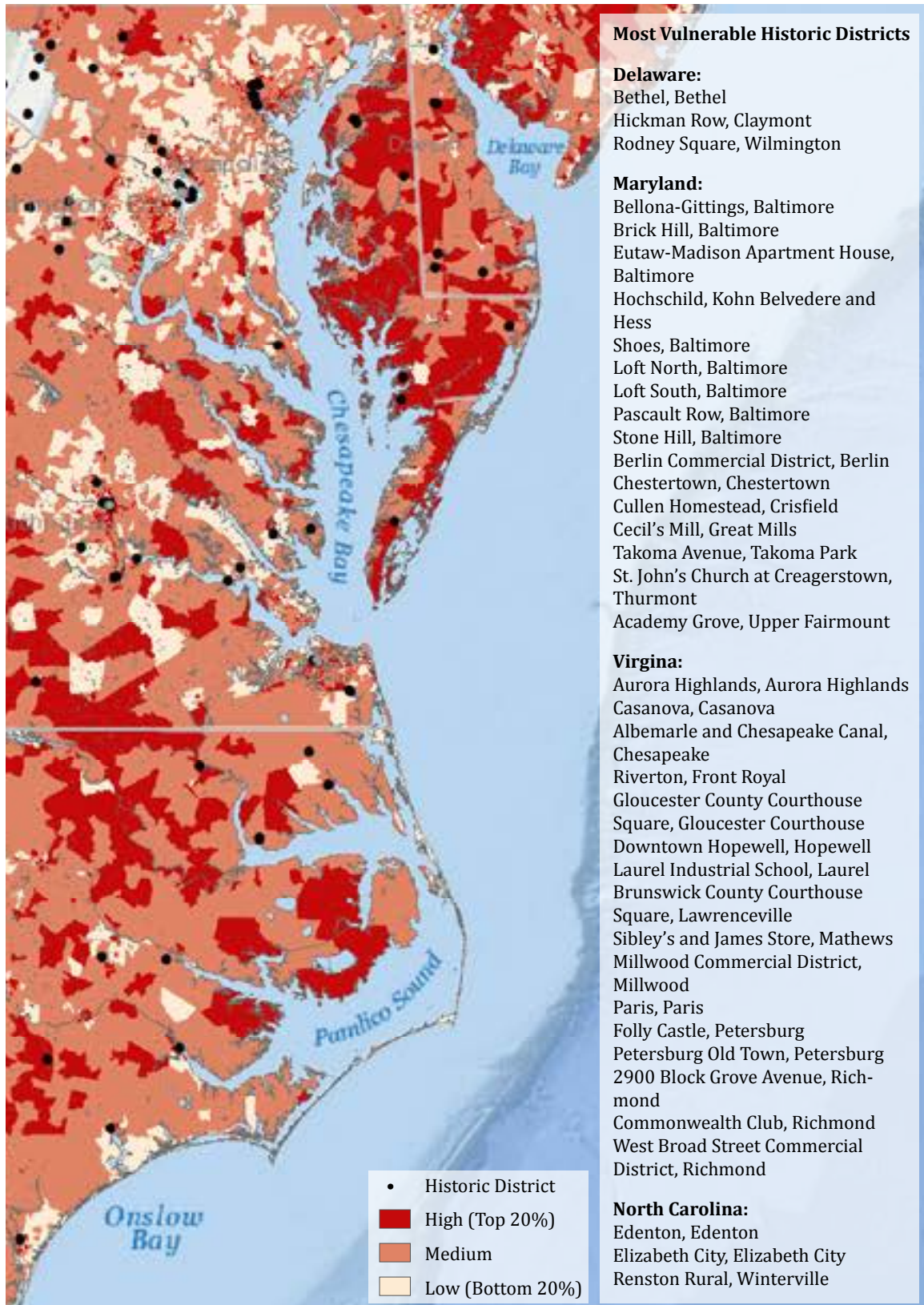
This thesis identifies issues posed by adapting to climate change for historic coastal communities by considering the vulnerability of National Register Historic Districts in the mid-Atlantic region. To determine which National Register Historic Districts are most vulnerable, the following graphic was created. Applying the National Oceanic and Atmospheric Administration (NOAA) Coastal Service Center's Social Vulnerability Index (SOVI) – which overlays social and economic data of United States counties on a map that illustrates sea-level rise – as a base and overlaying National Register Historic Districts, as provided by the NPS Cultural Resources GIS program, it is clear that many historic coastal communities need to adapt. The data applied reveals potential flooding and does not account for erosion, subsidence or future construction; the water levels denote the highest high tide for that area. The map below includes principal socioeconomic factors (such as age and poverty) from Census 2000 block groups that contribute to a community's ability to prepare for and cope with climate change. Dark red areas indicate counties with high human vulnerability to hazards, while lighter red zones convey increased resiliency.<sup>46</sup>

This planning tool is helpful for preservation professionals to establish which historic districts are most in need of recommendations and financial support. However, this map also reveals a lacuna in accessible information about such communities. For example, Cumberland County in New Jersey, labeled as a red zone, has two National Register Historic Districts: Bridgeton and Greenwich. Yet, neither of these districts appears within this

---

<sup>45</sup> Ibid., 9.

<sup>46</sup> "Sea Level Rise and Coastal Flooding Impacts," National Oceanic and Atmospheric Administration Coastal Service Center, <http://csc.noaa.gov/slr/viewer/>.



Sources | NOAA Coastal Service Center SOVI; and NPS Cultural Resources GIS Program.

available data set. This misinformation suggests that not all districts in the mid-Atlantic have been documented and errors exist in NPS geographic information system (GIS) resources. Because of incomplete mapping, this analysis is likely an underrepresentation of the vulnerability of historic districts to sea-level rise. The lack of a comprehensive historic inventory can be particularly challenging in obtaining funds for preventive planning and action and may lead to difficulties in calculating the total potential impact of climate change on historic resources.

To augment these findings, a review of existing literature and guidance on preservation and adaptation, limitations to adaptation, and decision-making frameworks for adaptation was conducted (Chapter 2). To examine conflicts with, and solutions to, adaptation to sea-level rise in historic coastal communities, this thesis then considers three recognized and common options: protection – actions that would keep rising water out of a specific area through “soft” or “hard” engineering structures (Chapter 3); accommodation – actions that allow continued use of an area but implement physical modifications to the built environment; this strategy can also include changes in behavior and regulating insurance policies (Chapter 4); and retreat – actions that plan for eventual removal of human settlements from areas subject to inundation (Chapter 5).<sup>47</sup> Burton et al. (1993) classify these strategies as, “to bear or share the loss, to modify extreme events or prevent their effects, or to change resource use or location,” revealing different objectives of adaptation.<sup>48</sup> Not all mechanisms are appropriate or feasible for all communities, and combinations of

---

<sup>47</sup> Martin Parry et al., *Assessing the Costs of Adaptation to Climate Change: A Review of the UNFCCC and Other Recent Estimates*, (London: International Institute for Environment and Development and Grantham Institute for Climate Change, 2009), 63; and Delaware Coastal Programs, *Preparing for Tomorrow's High Tide: Sea Level Rise Vulnerability Assessment for the State of Delaware*, (Dover, DE: Department of Natural Resources and Environmental Control, 2012), 151.

<sup>48</sup> Ian Burton, Robert W. Kates, and Gilbert F. White, *The Environment As Hazard*, 2<sup>nd</sup> edition (New York: The Guildford Press, 1993), 130; and Adger et al., 341.

these approaches are also possible. The conclusion stresses the need to incorporate community-based adaptation in all decision-making processes (Chapter 6).

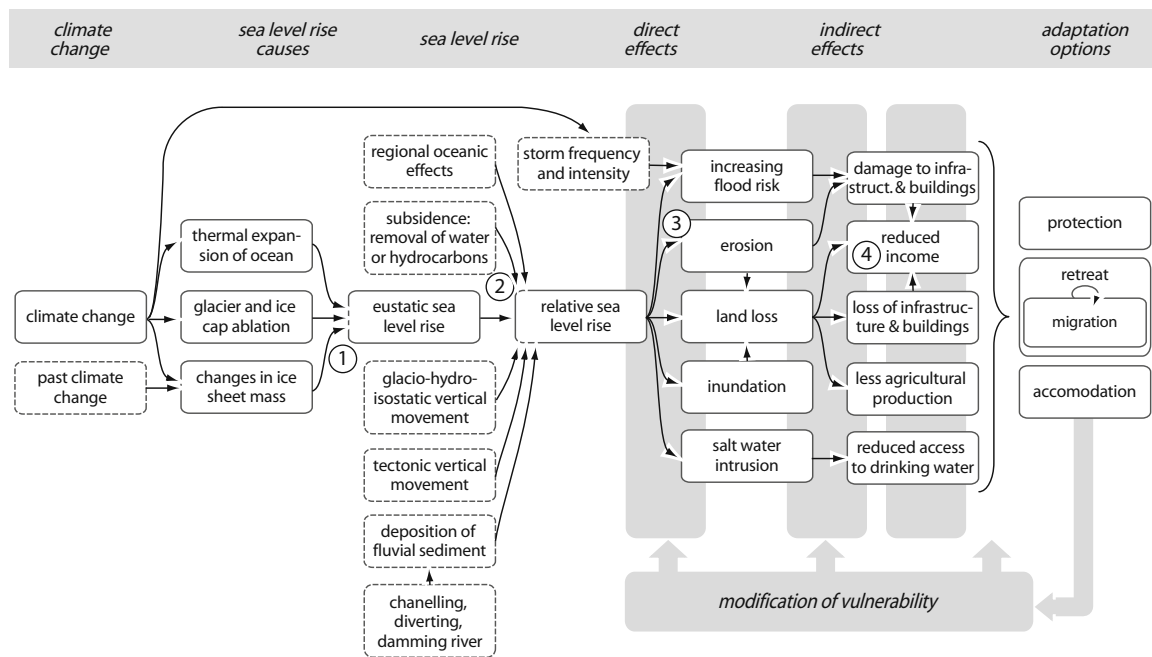


Figure 3. Influence of Climate Change on Adaptation Strategies.

Source | Sabine L. Perch-Nielsen, Michele B. Battig, and Dieter Imboden, "Exploring the link between climate change and migration," *Climatic Change* 91 (2008): 385, doi: 10.1007/s10584-008-9416-y.

## CHAPTER 2 | EXISTING LITERATURE AND GUIDANCE

While many communities have historically adapted their natural and built environments to defend against environmental challenges, the preservation field only recently has begun to examine the need for preventive planning for large-scale environmental change. The impact of Superstorm Sandy catalyzed an effort of cities and state governments to craft resiliency plans and federal agencies to review their standards and regulations in terms of the impacts of climate change. Because of the fledgling character of the paradigm of adaptation, the body of research pertaining to historic communities is inchoate. Though both academics and practitioners have scanned the issues germane to this topic, this chapter will reveal that none provide a comprehensive analysis of the interdisciplinary concerns that are integral to cultural heritage and climate adaptation.

### **Literature and Policies on Climate Change and Preservation**

In 2005, The Federal Emergency Management Agency (FEMA) created a state and local mitigation planning how-to guide, *Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning*. This manual focuses on identifying hazards and surveying community assets.<sup>50</sup> However, in determining which mitigation action should be implemented, it supports quality of life factors – such as the emotional value of landmarks – and provides a place to rank historic significance, but it concentrates mostly on the monetary value of the affected properties and does not consider social equity. Furthermore, it lacks information about more recent programs such as the 2012 Biggert-

---

<sup>50</sup> Federal Emergency Management Agency (FEMA), *Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning: State and Local Mitigation Planning How-to Guide*, FEMA 386-6, 2005, <http://www.fema.gov/media-library-data/20130726-1522-20490-2886/howto6.pdf>.



Waters Flood Insurance Reform Act, or the 2014 Homeowner Flood Insurance Affordability Act.

As part of its Climate Change Response Program, in 2010 the National Park Service (NPS) produced a strategy, including specific goals and objectives under four integrated pillars: science, adaptation, mitigation, and communication. The strategic approach contains plans for natural and cultural resources, though the publication includes only a short section about “preserving the nation’s heritage,” which lacks both goals and objectives.<sup>51</sup> To fill this gap, the NPS Climate Change Adaptation Coordinators for Cultural Resources have developed a preliminary approach for cultural resource adaptation (Rockman 2014).<sup>52</sup> Through this approach, the NPS suggests to first identify criteria for park superintendents to incorporate into decision making, including the impacts of climate change to the resource, the potential effects of action on the resource, the cost and feasibility of the action, and the significance of the resource and/or its function to the park. Prior to implementing any action, the NPS suggests a circular, iterative planning process of taking inventory of the resource, performing a vulnerability assessment, and evaluating and comparing alternatives. Utilizing this framework, the approaches, in no set order, include: (1) do nothing because of low vulnerability; (2) perform offsite action to enhance resiliency of the resource; (3) improve onsite resiliency/resistance; (4) relocate some of all of the resource and/or allow natural movement to occur; (5) document the resource because of inevitable loss; (5) record the resource in a less exhaustive manner and then let it go; and (7) interpret the change. At a “Preserving Coastal Heritage” conference in April 2014, these criteria and planning processes were evaluated by invited experts – their comments are being compiled

---

<sup>51</sup> National Park Service (NPS), *National Park Service Climate Change Response Strategy* (Fort Collins, CO: National Park Service Climate Change Program, 2010), 16-17.

<sup>52</sup> Marcy Rockman, “Cultural Resources and Climate Change Response” and “Revisiting the Seven Adaptation Options” (presented at the Preserving Coastal Heritage Workshop, New York, April 3-4, 2014).

to inform the language and approach of the NPS's forthcoming official recommendations. Although these planning processes will help direct specific-site and National-Park managers, the NPS has not provided guidance for sites and districts that are not owned by the NPS. (As described in Chapter 1, the National Register is administered by the NPS, but the listed properties and districts are not all federally owned.)

In order to evaluate how adaptation methods can protect National Register Historic Districts from the impacts of sea-level rise, Horowitz (2013) studied the vulnerability of three cities: St. Augustine, Florida; Elizabeth City, North Carolina; and Alexandria, Virginia; and deployment of preventive strategies in Galveston, Texas, and Norfolk, Virginia. This research concluded that while adaptation methods can protect historic properties, it may adversely impact their integrity, and that there is a need for local level decision-makers and stakeholders to be educated about sea-level rise and participate in adaptation planning. Horowitz references two United States guides: the 1000 Friends of Florida's *Disaster Mitigation for Historic Structures: Protection Strategies*, which identifies materials, systems, products and installation techniques available for the mitigation needs of individual buildings, and the Mississippi Development Authority's *Elevation Design Guidelines*, which provides information on adaptation to flooding and storm surge.<sup>53</sup>

In the United Kingdom, English Heritage has produced several reports about adaptation methods for historic buildings. Of note, in an English Heritage-funded publication, Cassar (2005) recommends that a "save all" approach to historic-environment needs should be re-evaluated.<sup>54</sup> By determining what to conserve based on value and significance, English Heritage and the United Kingdom National Trust are reassessing how to manage their

---

<sup>53</sup> Ann Horowitz, "The Effects of Sea Level Rise on Historic Districts and the Need for Adaptation" (MA thesis, Goucher College, 2013).

<sup>54</sup> May Cassar, *Climate Change and the Historic Environment* (London: The Centre for Sustainable Heritage, University College London, 2003), 2.

coastal heritage. In Europe, the Noah's Ark Project (2006) assessed that few studies exist on the impact of climate change on cultural heritage and published an article about the acceleration or intensification of building decay due to these global changes.<sup>55</sup>

The United Nations Educational, Scientific and Cultural Organization (UNESCO), as well, has created a publication of twenty-six case studies from natural and cultural World Heritage Sites to illustrate observable impacts of climate change and to review select adaptation measures. In the section on historic cities and settlements, Colette (2007) delineates the physical effects on buildings as well as the effects on social structures, including changes in or the migration of the societies which currently maintain these heritage sites.<sup>56</sup> Also, Marzeion and Levermann (2014) published a report about the impact of sea-level rise on World Heritage Sites; however, they use estimates for the next two thousand years, which is a missed opportunity to convey how these sites will be affected in the near future.<sup>57</sup>

### **Literature on the Limits of Adaptation**

Though Horowitz suggests performing a cost/benefit analysis – including social and environmental benefits – of preventive methods, she does not expand upon the various cultural issues associated with each strategy for historic communities. Since Horowitz's case studies are limited to a city-scale, smaller communities may not be able to apply her findings to their circumstances. She claims that the "last resort" of retreat is outside the

---

<sup>55</sup> C. Sabbioni et al., "Global Climate Change Impact on Built Heritage and Cultural Landscapes," in *Heritage, Weathering and Conservation*, ed. R. Fort et al., (London: Taylor & Francis/Balkema, 2006), 395-401, [http://noahsark.isac.cnr.it/publications/Publication\\_3.pdf](http://noahsark.isac.cnr.it/publications/Publication_3.pdf).

<sup>56</sup> Augustin Colette et al., *Case Studies on Climate Change and World Heritage* (Paris: UNESCO World Heritage Centre, 2007), 66-77, <http://whc.unesco.org/uploads/activities/documents/activity-473-1.pdf>.

<sup>57</sup> Ben Marzeion and Anders Levermann, "Loss of Cultural World Heritage and Currently Inhabited Places to Sea-level Rise," *IOP Science: Environmental Research Letters* 9 (March 2014), doi:10.1088/1748-9326/9/3/034001.

scope of the analysis since “it would abandon historic districts and accept their future destruction.”<sup>58</sup>

The current thesis suggests that a way that one may address what Horowitz characterizes as a “last resort” is by questioning unwavering preservation commissions and examining relocation as a necessary consideration. Furthermore, Horowitz does not include a critique of the divergence between the Secretary of the Interior’s Standards and FEMA’s mitigation strategies, nor the effects of the National Flood Insurance Program on historic communities, as explored in this thesis.

Though many articles in the popular press convey the public’s outrage with the rising flood insurance premiums, there is a dearth of published literature about its effects on historic properties. However, PlaNYC’s comprehensive resiliency plan (2013) specifically outlines an alternative approach to potentially reduce the cost of flood insurance other than elevating buildings.<sup>59</sup> Additional scholarly work should address the limitations of the National Flood Insurance Program and study potential substitutions to its current requirements that can reduce insurance premiums for historic property owners.

Although Horowitz mentions the needs to protect modest- or low-income historic districts, her paper does not fully analyze the need for social sustainability in climate adaptation. O’Brien and Leichenko (2009) explain that even in regions experiencing the same characteristics of climate change, the impacts will vary based on different social groups’ vulnerability – in part according to the political and economic conditions of a society.<sup>60</sup> Oliver-Smith (2009) explains that risks and outcomes are largely socially produced; social systems generate the conditions that place people with different

---

<sup>58</sup> Horowitz, 5.

<sup>59</sup> PlaNYC, *A Stronger, More Resilient, New York*, (New York: NYC Special Initiative for Rebuilding and Resiliency, 2013), 46, [http://nytelecom.vo.llnwd.net/o15/agencies/sirr/SIRR\\_spreads\\_Lo\\_Res.pdf](http://nytelecom.vo.llnwd.net/o15/agencies/sirr/SIRR_spreads_Lo_Res.pdf).

<sup>60</sup> Karen L. O’Brien and Robin M. Leichenko, “Double Exposure: Assessing the Impacts of Climate Change within the Context of Economic Globalization,” in *The Earthscan Reader on Adaptation to Climate Change*, ed. E. Lisa F. Schipper and Ian Burton (London: Earthscan, 2009), 327.

demographics at different levels of risk from the same hazard.<sup>61</sup> Bohle et al. (1994) propose that the most vulnerable are considered those who possess a limited coping capacity and who are least resilient to recovery.<sup>62</sup> Furthermore, Deyle and Butler (2013) have determined that the capacity to adapt is a function of human capital and is uneven across communities, even within developed countries. Because adaptive capacity in small and low-resource coastal communities limits planning and implementation, these populations are likely to have less capacity to manage coastal hazards.<sup>63</sup> To this end, in the Environmental Protection Agency's (EPA) Climate Change Adaptation Implementation Plan, vulnerable populations are defined in part by communities located in low-lying coastal areas.<sup>64</sup> Since change can severely affect less resilient groups, it limits their prospects for adaptation. For these reasons, it is important to consider low-income historic communities in preventive planning.

Adger et al. (2009) state that there are four propositions that limit adaptation. Grounded in insights from history, the sociology and psychology of risk, economics and political science, they establish that: adaptations depend on goals based on diverse values; adaptations should not be limited by uncertainty; action is restricted by social and individual factors; and the "systematic undervaluation of loss of places and culture disguises real, experienced but subjective limits to adaptation." However, societies have the power to alter these issues.<sup>65</sup> Moreover, Jones and Mean (2010) argue that the "resilience of place" should be used to gauge that state of towns and cities instead of the "quality" of place, since

---

<sup>61</sup> Anthony Oliver-Smith, "Climate Change and Population Displacement: Disasters and Diasporas in the Twenty-First Century," in *Anthropology and Climate Change: From Encounters to Actions*, ed. Susan A. Crate and Mark Nuttall (Walnut Creek, CA: Left Coast Press, Inc., 2009), 120.

<sup>62</sup> H. G. Bohle, T. E. Downing, M. J. Watts, ed., "Climate Change and Social Vulnerability," in *Global Environmental Change* 4-1 (1994): 37-48.

<sup>63</sup> Deyle and Butler, 180.

<sup>64</sup> Region III Climate Network Climate Adaptation Working Group, "Draft Climate Change Adaptation Implementation Plan," US Environmental Protection Agency: Mid-Atlantic Region III, 2013, <http://www.epa.gov/climatechange/Downloads/impacts-adaptation/region-3-plan.pdf>.

<sup>65</sup> Adger et al., 335-354.

this concept identifies “that places are not static, but instead are dynamic and change over time.” This recognition will help planners understand a place’s capacity for adaptation.<sup>66</sup>

Adger, Lorenzoni and O’Brien (2009) posit that decisions on how to respond to climate change inevitably rely on the identification of whose values count.<sup>67</sup> This recognition is exacerbated by dilemmas of governance concerning the ownership of power and influence within a society. The implementation of adaptation policy then is contested as the values and goals of different government agencies vary. Though an analysis of the conflicts between FEMA and the National Park Service is necessary, it is also important to create a platform for their alignments and collaboration. Additionally, as O’Brien (2009) points out, people’s values –such as what they care about and their relationship to places – change over time, which can influence the way that adaptation measures are viewed by future generations.<sup>68</sup> As such, it is important to consider the resiliency and sustainability of an adaptation strategy in its intergenerational perspective. It is also essential to examine how preventive measures implemented by one group may affect the values of others, and whose values matter.

As adaptation may pressure communities into changing livelihoods and behaviors, Ensor and Berger (2009) acknowledge that adaptation may challenge existing notions of culture and detail how community-based adaptation can promote shared concepts of well-being.<sup>69</sup> This process focuses on communities whose assets and capacities are most vulnerable to climate change, and requires the engagement of indigenous knowledge and practices. Likewise, Crate and Nuttall (2009) add anthropological factors to the complex understanding of the holistic nature of adaptation. They advocate that climate change

---

<sup>66</sup> Jones and Mean, 17.

<sup>67</sup> Adger, Lorenzoni and O’Brien, 5.

<sup>68</sup> O’Brien, 164-180.

<sup>69</sup> Ensor and Berger, 227-239.

brings different risks and opportunities to indigenous people around the world – threatening their cultural survival and undermining their human rights.<sup>70</sup> Through anthropological studies, it is clear that climate change has a direct interrelationship with human culture; nonetheless, further research about the worth of local knowledge of and impact to non-indigenous but still historic communities is needed.

In terms of migration and relocation, Oliver-Smith (2009) asserts that cultural identity is at risk in uprooted communities. “The loss and destruction on cultural sites...undermines the community’s sense of itself.”<sup>71</sup> However, he concedes that climate change will increasingly generate displacement. Therefore, it is important for the preservation field to investigate preservation’s role in this intersection of heritage and social equity.

### **Models of Adaptive Strategy Analysis**

Attempts have been made to analyze and rank various adaptation strategies. Horowitz differentiates hard, soft and non-structural adaptation methods and suggests reasons for preferred use based on scale, density, cost, and impact on historic integrity within her three case studies.<sup>72</sup> Though he attests that risk-reduction measures are often site-specific, Moench (2009) provides six warnings for the viability of a measure: strategies should maintain diversification of interventions within a system; strategies should not rely on technical assumptions but provide benefits for multiple scenarios; if approaches are framed based on what groups ‘should’ want, then the benefits are at risk if actual behavior differs; measures should avoid substantial time and capital investment, as future conditions are difficult to predict; interventions should not have major benefiter and losers, whether

---

<sup>70</sup> Crate and Nuttall.

<sup>71</sup> Oliver-Smith, 123.

<sup>72</sup> Horowitz, 187.

direct or due to a perception of equity, as conflicts can undermine objectives; and a clear source of funding over the long term should be fixed.<sup>73</sup>

Environmental planners have developed various multi-criteria analysis tools to assess preventive methods. While Deyle and Butler (2013) feel that cost-benefit analyses are widely used in public sector evaluations, this assessment type is too complex and data intensive for small local governments with limited staff and financial resources.<sup>74</sup> For a different approach, they turn to Hill (1968) for his goals achievement matrix (GAM) as a tool capable of applying multiple, non-commensurable evaluation criteria. Well-suited to the needs and capabilities of low-resource communities, all goals are weighted by a common, unit-less, ordinal scale – high (3), medium (2), and low (1).<sup>75</sup> Deyle and Butler demonstrate the GAM in assessing alternative strategies for mitigating storm surge flooding and wave damage from coastal storms, creating goals such as: minimize public sector capital and operating costs; maximize flexibility to adapt as conditions change and new knowledge is gained; and maximize political feasibility vis-à-vis property rights, etc.<sup>76</sup> This process creates a sum score for each alternative, simplifying their comparison.

Deyle and Butler also recognize several typologies for assessing different adaptive response strategies for sea-level rise. Titus et al. (2009) suggest using an empirical comparison based on existing and planned development intensity to prioritize alternatives for protection or retreat. They theorize that, as land use shifts from areas dedicated to conservation to those of high development, communities will opt for protection against sea-

---

<sup>73</sup> Marcus Moench, "Adapting to Climate Change and the Risks Associated with Other Natural Hazards: Methods for Moving from Concepts to Action," in *The Earthscan Reader on Adaptation to Climate Change*, ed. E. Lisa F. Schipper and Ian Burton, (London: Earthscan, 2009), 266.

<sup>74</sup> Deyle and Butler, 182.

<sup>75</sup> M. Hill, "A goals-achievement matrix for evaluating alternative plans," *Journal of the American Planning Association* 34-1 (1968): 19-29.

<sup>76</sup> Deyle and Butler, 187.



level rise.<sup>77</sup> Van Raalten et al. (2009) place adaptive strategies within a four-cell “Strategy Development Method” matrix based on the economic value and amount of existing development (high or low) and natural ecosystem dynamics (high/natural or low/altere).<sup>78</sup> Deyle and Butler then use these two approaches to inform the GAM and illustrate how goals can be defined in terms of coastal shoreline vulnerability, urban system values, and natural system values. In this way, they argue that cost-benefit analyses are not suited to account for the social and ecological goals of adaptation.

Adger et al. (2009) indicate that cost-benefit analyses fail to recognize how people interact with the world and that physical changes will have severe cultural impacts. “Specific losses of physical places involve loss of attendant cultural and social significance that is invisible to the prevailing calculus.” Indirect costs, including shifts in lifestyles and losses of identity, are often disregarded in such decision-making.<sup>79</sup> The Eastern Research Group, Inc., (2013) emphasize that fiscally and socially responsible decisions appraise short- and long-term costs and benefits, in addition to the cost of not taking action. They recommend that various stakeholders and residents should be included in the planning process to include all community interests and visions.<sup>80</sup>

The Nairobi work programme on impacts, vulnerability and adaptation to climate change, launched in 2005 by the United Nations Framework Convention on Climate Change (UNFCCC), developed an approach in 2011 to make an informed decision on allocating scarce resources. Its adaptation process includes assessing impacts and risks, planning,

---

<sup>77</sup> James G. Titus et al., “State and local governments plan for development of most land vulnerability to rising sea level along the US Atlantic coast,” in *Environmental Research Letters* 4 (2009): 1-7.

<sup>78</sup> D. Van Raalten et al., *San Francisco Bay: Preparing for the next level* (San Francisco: San Francisco Bay Conservation and Development Commission, 2009), [www.bcdc.ca.gov/planning/climate\\_change/SFBay\\_preparing\\_%20for\\_the\\_next\\_Level.pdf](http://www.bcdc.ca.gov/planning/climate_change/SFBay_preparing_%20for_the_next_Level.pdf).

<sup>79</sup> Adger et al., 347-348.

<sup>80</sup> Eastern Research Group, Inc., *What Will Adaptation Cost? An Economic Framework for Coastal Community Infrastructure*, (South Carolina: National Oceanic and Atmospheric Administration Coastal Services Center, 2013), 44.

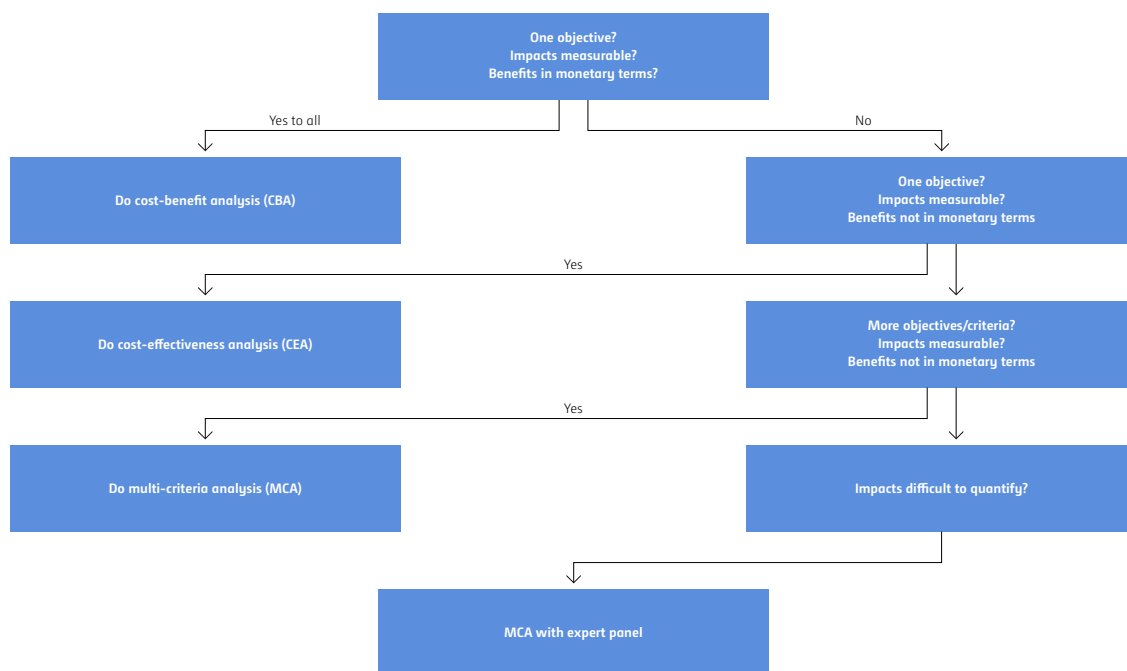
implementing measures, and monitoring and evaluating interventions. In the planning stage, the following core objectives must be assessed: “minimize or avoid all or only part of the expected or observed impacts; return levels of human well-being to pre-climate change levels; [or] maintain current levels of risk or as a minimum reduce them cost-effectively within agreed budgets or pre-defined acceptable levels.” Additionally, planners should identify criteria to assess alternatives against the objective. According to the programme, possible criteria include:

1. Efficiency – are the outputs achieved optimal relative to the resources allocated?
2. Effectiveness – will the option meet the objectives?
3. Equity – will the option benefit vulnerable groups and communities?
4. Urgency – how soon does the option need to be implemented?
5. Flexibility – is the option flexible, and will it allow for adjustments and incremental implementation and reiteration depending on the level and degree of climate change?
6. Robustness – is the option robust under a range of future climate projections?
7. Practicality – can the option be implemented on relevant timescales?
8. Legitimacy – is the option politically, culturally and socially acceptable?
9. Synergy/Coherence with other strategic objectives – does the option offer co-benefits (for example, improving agricultural land management practices could lead to reduced erosion/siltation and carbon sequestration).

Once the impacts and options have been considered, the actions can be implemented and then monitored through the feedback loop. The manual also reviews three decision-making tools – cost-benefit analysis, cost-effectiveness analysis, and multi-criteria analysis – and stress that residual damage that remains after the action is applied must be measured.<sup>81</sup>

---

<sup>81</sup> Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change, *Assessing the Costs and Benefits of Adaptation Options: An Overview of Approaches* (Bonn, Germany: United Nations Framework Convention on Climate Change, 2011), 5-7, 9-10.



Source: Adapted from BOYD R AND HUNT A. 2004. *Costing the Impacts of Climate Change in the UK: Overview Guidelines*. UK Climate Impacts Programme Technical Report.

Figure 4. Decision Tree of Possible Approaches for Assessing the Costs and Benefits of Adaptation Options.  
Source | Nairobi Work Programme, 11.

At the national level, as part of the *America's Climate Choices* study commissioned by Congress in 2008, a National Academics of Sciences (NAS) committee published a report recommending a national adaptation strategy (National Research Council 2010). Recognizing that the publication “would be shaped by the values that its members brought to the group process,” the panel chose to explicitly state those principles and offered them as a set of criteria to evaluate adaptation plans and policies: (1) impacts on the current and future generations; (2) account for the impacts on natural and social systems as well as on individuals, firms, government institutions, and infrastructure; (3) recognize the vulnerability of ecosystem structure and functioning; (4) evaluate solutions through the triple-bottom-line of sustainability so that social, economic, and environmental ramifications of proposed strategies and actions are explicitly recognized; (5) acknowledge equity and justice – “there is a need to prioritize helping those with a higher degree of vulnerability to become more resilient;” (6) identify impacts on all affected parties; (7) include a suite of technology and social-behavioral-economic options; (8) compare the risk of action and inaction; (9) and recognize the implications of U.S. adaptation and mitigation efforts and advocate for cooperative international efforts.<sup>83</sup>

In a planning guide for state coastal managers, the National Oceanic and Atmospheric Administration (NOAA - 2010) advises on six criteria that can help prioritize adaptation efforts: the importance or value of the asset, the magnitude of the impacts, the timing of the impacts, the persistence and reversibility of the impacts, the certainty of projected impacts, and threats from existing stressors. NOAA also evaluates proposed action through the STAPLEE method: social, technical, administrative, political, legal, economic, and

---

<sup>83</sup> Michael B. Gerrard, “Introduction and Overview,” in *The Law of Adaptation to Climate Change: U.S. and International Aspects*, ed. Michael B. Gerrard and Katrina Fischer Kuh (Chicago: American Bar Association, 2012), 9-10; and National Research Council, *Adapting to the Impacts of Climate Change* (Washington, DC: The National Academies Press, 2010), 23-24.

environmental opportunities and constraints are weighed to determine which method is best.<sup>84</sup>

The New York-Connecticut Sustainable Communities Consortium (2013) developed a guide to identify and evaluate potential strategies for coastal climate resilience on their urban waterfronts. In addition to illustrating the range of adaptive strategies, including a catalog of application at different scales and conditions, the Consortium identified the costs and benefits of each strategy and developed a framework for communities to evaluate the effectiveness and appropriateness of the approaches for each area over physical scales and time. Each strategy is detailed with its ability to address coastal hazards and applicability to building or geomorphology type.<sup>85</sup> Though this analysis is limited to New York coastal water defenses, it is a well-designed and clear assessment to reference.

Understanding that decision must reflect a jurisdiction's unique conditions, Grannis (2011) provides a framework for comparing different policies. The implementation of tools is organized based on the following factors: advantages and disadvantages, including economic, environmental, administrative, and legal criteria; the type of power used, such as planning, regulatory, spending, or tax and market-based; the community's goals, whether they are for protection, accommodation, or retreat; and the state of the place at risk, consisting of developed critical infrastructure and land.<sup>86</sup>

## Conclusion

Based on this review of resources, it is clear that values systems need to be considered when evaluating adaptation for historic coastal communities. Decision-making processes

---

<sup>84</sup> NOAA, 41, 52.

<sup>85</sup> New York-Connecticut Sustainable Communities Consortium, *Coastal Climate Resilience: Urban Waterfront Adaptive Strategies* (New York: HUD Sustainable Communities Regional Planning Grant and the City of New York, 2013), [http://www.nyc.gov/html/dcp/pdf/sustainable\\_communities/urban\\_waterfront.pdf](http://www.nyc.gov/html/dcp/pdf/sustainable_communities/urban_waterfront.pdf).

<sup>86</sup> Jessica Grannis, *Adaptation Tool Kit: Sea-Level Rise and Coastal Land Use: How Governments Can Use Land-Use Practices to Adapt to Sea-Level Rise*, (Washington, DC: Georgetown Climate Center, 2011).

need to be based on more than financial factors. By considering the impacts of various preventive methods on historic communities, along with current political structures and principles of social equity, the following chapters acknowledge the complexities of adaptation and analyze how it may affect the preservation field.

## CHAPTER 3 | PROTECTION: THE IMPLICATIONS OF FLOOD BARRIERS

For centuries, coastal communities facing flood risks, like those in the Netherlands or New Jersey as discussed later in this chapter, have built infrastructure to live successfully near the sea. Although many of these structures were intended to protect against floods, they also have the potential to protect against climate change impacts. However, as they age, these structures require substantial maintenance and can fail “due to extreme events that exceed the engineering design level.”<sup>87</sup> Existing structures will likely require upgrading or replacement and monitoring for proper performance with respect to climate change.<sup>88</sup> Sea-level rise threatens to exacerbate the increasing costs of defending coastal areas in an environment undergoing change.<sup>89</sup> “Business as usual’ shore protection is not likely sustainable.”<sup>90</sup> The sensitive economies and cultures of coastal towns may restrict their ability to protect their communities against predicted sea-level rise and to improve their infrastructure to meet the National Flood Insurance Program (NFIP) standards.

### Options for “Soft” and “Hard” Engineering

Engineered interventions may be employed to reduce the risks of climate change-related effects – including flooding, coastal erosion, or inundation of land and structures. These interventions, known as “shoreline protection,” are used to maintain or enhance the protective functionality of the shoreline or to prevent flooding when water levels are higher than the shoreline and adjacent land. Approaches for shoreline intervention include both

---

<sup>87</sup> IPCC, 305.

<sup>88</sup> NOAA, 78-79.

<sup>89</sup> Sophie Nicholson-Cole and Tim O’Riordan, “Adaptive governance for a changing coastline: science, policy and publics in search of a sustainable future,” in *Adapting to Climate Change: Thresholds, Values and Governance*, ed. W. Neil Adger, Irene Lorenzoni, and Karen L. O’Brien (Cambridge: Cambridge University Press, 2009), 370.

<sup>90</sup> Robert R.M. Verchick and Joel D. Scheraga, “Protecting the Coast,” in *The Law of Adaptation to Climate Change: U.S. and International Aspects*, ed. Michael B. Gerrard and Katrina Fischer Kuh (Chicago: American Bar Association, 2012), 236.

“soft” measures and “hard” measures. Soft measures use organic materials to develop living shorelines, through beach nourishment, dune replenishment, revegetation, and wetlands restoration.<sup>91</sup> Because they are composed of living materials, soft measures, though man-made, can “imitate natural systems, interact with the local ecosystem, and adapt to changes in the environment.”<sup>92</sup> Hard measures, including levees, dikes, embankments, seawalls, river channel modification, flood gates, and reservoirs, are designed to physically withstand storm waves and current action and prevent overflow during a storm to protect the area immediately inland of the shore. Each approach, or a combination of approaches, is typically applied depending on shore-protection costs, property values, the amount of land available for the intervention, and the feasibility of protecting the shores without harming the natural environment.<sup>93</sup> However, it is also important to consider an approach’s effect on the historic built environment.

This chapter focuses on levees and dikes. Sometimes used interchangeably with “levee,” a dike is an earthen structure used to retain or divert waters from a tidal storm. A levee is a man-made, raised embankment parallel to the water, designed to control the flow of water in times of high flow.<sup>94</sup> Dikes and levees guard an interior, low-lying area that is below the elevated water level of a flood event or storm surge. To allow water to drain from the land side to the water side, levees often include land-side drainage systems, including culverts, storm sewers, flood-gates, tide-gates, or pump stations.<sup>95</sup>

---

<sup>91</sup> Verchick and Scheraga, 238; and Grannis, 39.

<sup>92</sup> Siders, 64.

<sup>93</sup> Verchick and Scheraga, 238; and IPCC, 305

<sup>94</sup> Siders, 64; and “So You Live Behind a Levee!” American Society of Civil Engineers, 2010, 8-9, <http://content.asce.org/files/pdf/SoYouLiveBehindLevee.pdf>.

<sup>95</sup> “So You Live Behind a Levee!” 10.



## Historic Precedents of Levees and Dikes

In the Netherlands, twenty percent of the land is at least twelve feet below sea level, and building protection systems is a centuries-old tradition.<sup>96</sup> Since the Middle Ages, the Dutch have constructed drainage ditches, dikes, and windmills (which powered pumps) as part of their flood-control management to reclaim land for farming.<sup>97</sup> Dikes were also built for the purpose of empoldering – to create a boundary for an inundation area – and as military defense systems. The first dikes guarded these lands from salt water intrusion and floods and were expanded to form closed systems of water defenses. Built as steep embankments of tamped earth or clay, these systems were not the most suitable method for contending with tidal currents and tidal flooding. By the mid-seventeenth century, moderately sloping stone revetments were constructed, and masonry was used in the framework of sluice gates that would automatically close during a storm and facilitate drainage.<sup>98</sup> However, in the aftermath of a devastating storm surge in 1953, the existing systems were unable to protect the coast of the Netherlands, and nearly two-thousand people died in the resulting flood disaster.<sup>99</sup> In response, the Dutch constructed three storm-surge barriers along the North Sea coast as part of a national project called the Delta Works – engineered to protect the inlets and dikes from a one-in-ten-thousand-year storm, the strictest standard in the world.<sup>100</sup> However, even with this rigorous standard of design, today the Dutch government is reassessing their defenses to adapt to the threats of climate change and sea-level rise.

---

<sup>96</sup> Natural Lands Trust, Inc., *Downe Township, NJ: Helping a Delaware Bayshore community adjust to climate change* (Millville, NJ: U.S. Environmental Protection Agency and the William Penn Foundation, 2013), 52.

<sup>97</sup> Diane Barthel-Bouchier, *Cultural Heritage and the Challenge of Sustainability* (Walnut Creek, CA: Left Coast Press, Inc., 2013), 80.

<sup>98</sup> Audrey M. Lambert, *The Making of the Dutch Landscape: an historical geography of the Netherlands* (New York: Seminar Press LTD, 1971), 81, 239.

<sup>99</sup> Bryan Walsh, "Sand: What a Coastal U.S. Can Learn from Other Threatened Cities," *Time Magazine*, November 5, 2012, <http://science.time.com/2012/11/05/sandy-what-a-coastal-u-s-can-learn-from-other-threatened-cities/>.

<sup>100</sup> Russell Shorto, "Water Works," *New York Times Magazine*, April 13, 2014, 21; and Barthel-Bouchier, 91.



Figure 5. This dike in Walcheren (Netherlands) has projecting piles to break the force of the waves.  
*Source* | ©Aerofilms; Lambert, 247.

In the United States, until the twentieth century, dikes and drainage systems were used to convert tidal wetlands into farmland. The largest amount of marsh conversion to dry land took place along the Delaware Bay and lower Delaware River. Colonial and, later, state governments in New Jersey sought “meadow companies” to build dikes and manage the reclaimed lands. By 1866, twenty-thousand acres of New Jersey’s marshes had been transformed for agricultural uses, mostly in Salem and Cumberland counties. By 1885, ten thousand of fifteen thousand acres of marsh in New Castle County, Delaware, had been reclaimed, as well as eight thousand acres in Kent and Sussex counties. Because of the reduced market for their cultivated products, mainly salt hay, many farmers abandoned their dikes in the twentieth century. Sea levels since have risen above the drainage capabilities of many of the surviving dikes, and the land behind the dikes has returned to marsh. In some areas, longstanding agricultural dikes and levees now provide a nominal level of *de facto* protection from flooding; and public officials are faced with the prospect that structures and drainage systems, built for agricultural purposes, must be upgraded and maintained as flood-control devices.<sup>101</sup> Depending on a levee’s or dike’s condition, these alterations can be realized either through repairs to the original form or by elevating and extending the structure to prevent tidal inundation from sea-level rise.

### **Policy Constraints**

There is “no uniform safety standard for levees in the United States. Instead, the NFIP, a program designed to help people obtain private flood insurance, now unwittingly fills the void.”<sup>102</sup> Through the NFIP, the Federal Emergency Management Agency (FEMA) has designated the one-percent annual-chance event (the 100-year flood) as a special flood

---

<sup>101</sup> Titus, 88.

<sup>102</sup> Verchick and Scheraga, 245.

hazard area (SFHA) in which property owners with a federally-backed mortgage would be required to purchase flood insurance. (See Chapter 4 for more NFIP information on these requirements.) This base flood became the *de facto* levee standard because it allowed continued development in the areas protected by levees without requiring property owners to obtain flood insurance.<sup>103</sup>

The NFIP only recognizes levee systems that meet minimum design, operation, and maintenance standards that provide reasonable assurance that protection from the base flood exists, as established in its flood plain management criteria. For coastal levees, the design criteria include: a minimum freeboard – or the height of a levee between the crown and the waterline – of “one foot above the height of the one percent wave or the maximum wave runup (whichever is greater) associated with the 100-year stillwater surge elevation at the site;” closures designed in accordance with sound engineering practice; engineering analyses (from the Army Corps of Engineers or a registered professional engineer) demonstrating that no appreciable erosion of the levee embankment will occur during the base flood, that the foundation is stable, and that future levee settlement will not reduce the minimum standards of freeboard; and an analysis identifying the sources of potential flooding.<sup>104</sup> In the Delaware Bay area in New Jersey, of the seventy intact dikes none are accredited, leaving the structure behind the dikes ineligible to be insured unless the dikes or structures are elevated and demonstrate compliance with the NFIP standards.<sup>105</sup>

In July 2013, FEMA created a new approach for analyzing and mapping areas on the landward side of non-accredited levee systems that are shown on FEMA’s Flood Insurance

---

<sup>103</sup> Verchick and Scheraga, 245.

<sup>104</sup> National Flood Insurance Program Regulations (44CFR65.10), <http://www.gpo.gov/fdsys/pkg/CFR-2002-title44-vol1/pdf/CFR-2002-title44-vol1-sec65-10.pdf>.

<sup>105</sup> Amy Ellis Nutt, “Hurricane Sandy’s Impact on South Jersey: A Precarious Situation That’s Only Likely to Get Worse,” *NJ.com*, October 25, 2013, [http://blog.nj.com/ledgerupdates\\_impact/print.html?entry=/2013/10/hurricane\\_sandy\\_impact\\_on\\_south\\_jersey\\_a\\_precarious\\_situation\\_thats\\_only\\_likely\\_to\\_get\\_worse.html](http://blog.nj.com/ledgerupdates_impact/print.html?entry=/2013/10/hurricane_sandy_impact_on_south_jersey_a_precarious_situation_thats_only_likely_to_get_worse.html).

Rate Maps (FIRMs). Prior to this process, a non-accredited levee system was recorded as if it had no effect on the landward side of the levee during the base flood. The new process refines the approach to mapping flood hazards in order to move towards discontinuing the “without levee” approach. Communities with non-accredited levee systems can engage in the process to better reflect their unique circumstances and local flood hazards.<sup>106</sup> This modification will impact, potentially reducing, flood insurance rates for historic property owners who live behind a non-accredited levee.

Additional policy challenges appeared in the distribution of disaster recovery resources after Superstorm Sandy. Most of the focus on recovery in New Jersey has been along the Atlantic coast – which benefits from millions of dollars’ worth of maintenance and sand pumping to stabilize the shoreline.<sup>107</sup> Yet, many residents and business owners along the Delaware Bayshore are in need of government aid. The Department of Housing and Urban Development (HUD) determined that the nine most impacted counties from Superstorm Sandy were: Atlantic, Bergen, Cape May, Essex, Hudson, Middlesex, Monmouth, Ocean and Union. Cumberland County – “the so-called tenth county” – is ineligible for many of the recovery programs.<sup>108</sup> As the poorest county in New Jersey with the second highest poverty rate in the state, according to 2010 census data, disregarding the impact of Superstorm Sandy on Cumberland County is problematic. “When high poverty rates, an aging and shrinking population base, high percentage of vacant housing units, and environmental concerns coexist in a community, the will and financial resources are often not available to

---

<sup>106</sup> FEMA, *Analysis and Mapping Procedures for Non-Accredited Levee Systems – New Approach*, July 2013, i-iii, [http://www.fema.gov/media-library-data/20130726-1922-25045-4455/20130703\\_approachdocument\\_508.pdf](http://www.fema.gov/media-library-data/20130726-1922-25045-4455/20130703_approachdocument_508.pdf).

<sup>107</sup> Natural Lands Trust, Inc., 43.

<sup>108</sup> Scott Gurian, “How will State spend next batch of federal funding for Sandy recovery?,” *NJ Spotlight*, January 27, 2014, <http://www.njspotlight.com/stories/14/01/26/how-will-state-spend-next-batch-of-federal-funding-for-sandy-recovery/?p=all>.

fully address the environmental concerns.”<sup>109</sup> With less than ten percent of it developed, Cumberland County’s shoreline can naturally erode or accrete, but the flood protection structures that do exist along the Bayshore require financing for stabilization.

In addition to financial constraints, Rutgers University projects that sea-level rise will increase about three-to-four feet along the Atlantic coast by the end of the twenty-first century – and four-to-six feet along the Delaware Bay coast. These predictions further suggest that all of Cumberland County’s Downe Township shoreline communities will be permanently inundated within the next seven years, putting it at higher risk than every other township in New Jersey.<sup>110</sup> To address social justice concerns, government agencies that allocate pre- and post-disaster grants must include this vulnerable region.

### **Considerations for Historic Communities**

#### *:: Impact on the Cultural Landscape and Traditional Ways of Living*

The results of climate change, compounded by changes in the agricultural economy, endanger the intangible and tangible heritage associated with cultural landscapes – which cross “the customary divide between nature and culture.”<sup>111</sup> Just as the Dutch have recognized water management systems in the Netherlands as part of its heritage worth preserving, levees and dikes in the United States are also important in shaping coastal landscapes.<sup>112</sup> According to UNESCO, cultural landscapes can be categorized three ways: “(1) clearly defined landscapes designed or created intentionally by humans, such as gardens or parks; (2) organically evolved landscapes, which can be both relict (fossil) or continuing to evolve; and (3) associative landscapes valued for the powerful religious,

---

<sup>109</sup> Natural Lands Trust, Inc., 45.

<sup>110</sup> Nutt, “Hurricane Sandy’s Impact on South Jersey.”

<sup>111</sup> Barthel-Bouchier, 103.

<sup>112</sup> Ibid., 81.

artistic, or cultural associations with a natural element rather than material culture evidence.”<sup>113</sup> Many Category 2 landscapes are primarily in agricultural settings and recognize how the interaction of humans with nature produces the distinct character of a place.

Expanding the definition of heritage from specific sites, preservation professionals in the United States now also include the concept of cultural landscapes in their conservation efforts. Since 1990, the National Park Service has maintained a Cultural Landscapes Inventory and offers technical advice for protecting and managing cultural landscapes, which include historic sites, historic designed landscapes, historic vernacular landscapes, and ethnographic landscapes.<sup>114</sup> Further, traditional cultural properties are eligible for the National Register for their “association with cultural practices or beliefs of a living community that (1) are rooted in that community’s history and (2) are important in maintaining the continuing cultural identity of the community.”<sup>115</sup> However, this appreciation brings additional potentials for heritage loss, and “these impacts are systematically undervalued and do not enter into the decision making calculus for adaptation responses.”<sup>116</sup> The current mechanisms for measuring loss do not account for the cultural and symbolic values of landscapes.

As dynamic social constructions, landscapes are a result of the combination of cultural and ecological processes. Therefore, any alterations in the built environment, including elevating levees, will impact the societies that interact with the landscape. “The implications of a changing physical environment touch the core of how individuals and cultures may

---

<sup>113</sup> David W. Morgan, Nancy I. M. Morgan, and Brenda Barrett, “Finding a Place for the Commonplace: Hurricane Katrina, Communities, and Preservation Law,” *American Anthropologist* 108-4 (2006), 707.

<sup>114</sup> Charles A. Birnbaum, “Preservation Brief 6: Protecting Cultural Landscapes: Planning, Treatment and Management of Historic Landscapes,” *National Park Service Technical Preservation Services*, <http://www.nps.gov/tps/how-to-preserve/briefs/36-cultural-landscapes.htm>.

<sup>115</sup> Morgan, Morgan and Barrett, 710.

<sup>116</sup> Adger et al., 349.

define themselves and their interactions with the world around them.”<sup>117</sup> Beyond repairing the dikes, in the Delaware Bayshore the land will gradually be submerged because much of the region is barely above low tide. The increase in the salinity of the Delaware River due to sea-level rise could result in salt-water intrusion in the freshwater marshes, making them impractical for traditional agricultural practices.<sup>118</sup> The residents of these – and similarly impacted – areas, dependent on local ecosystem services such as fishing and farming systems, will need to adapt their livelihoods and production patterns.

*:: False Sense of Security*

Past performance of existing flood barriers may not always provide the desired protection against future coastal storms. In the field of “human adjustment to hazards,” decision makers are increasingly recognizing the limitations of protective solutions and have asserted that levees can provide a false sense of security.<sup>119</sup> Though levees reduce the risk of floods, no levee system can entirely eliminate flood risk. Most levees and dikes were designed for past storm events and sea levels and will not be effective if there is a significant acceleration rate in sea-level rise or change in storm intensities. As levees are designed to control a specific amount of floodwater, a levee’s long-term performance to protect against predicted sea-level rise is a function of time, and levees can fail in the case of a breach or water overflow.<sup>120</sup> Naysayers maintain using levees to protect developed areas is a maladaptation that can ultimately lead to increased risk.<sup>121</sup>

---

<sup>117</sup> Ibid., 348-349.

<sup>118</sup> Titus, 208.

<sup>119</sup> Siders, iii.

<sup>120</sup> “So You Live Behind a Levee!” 2.

<sup>121</sup> IPCC, 55.



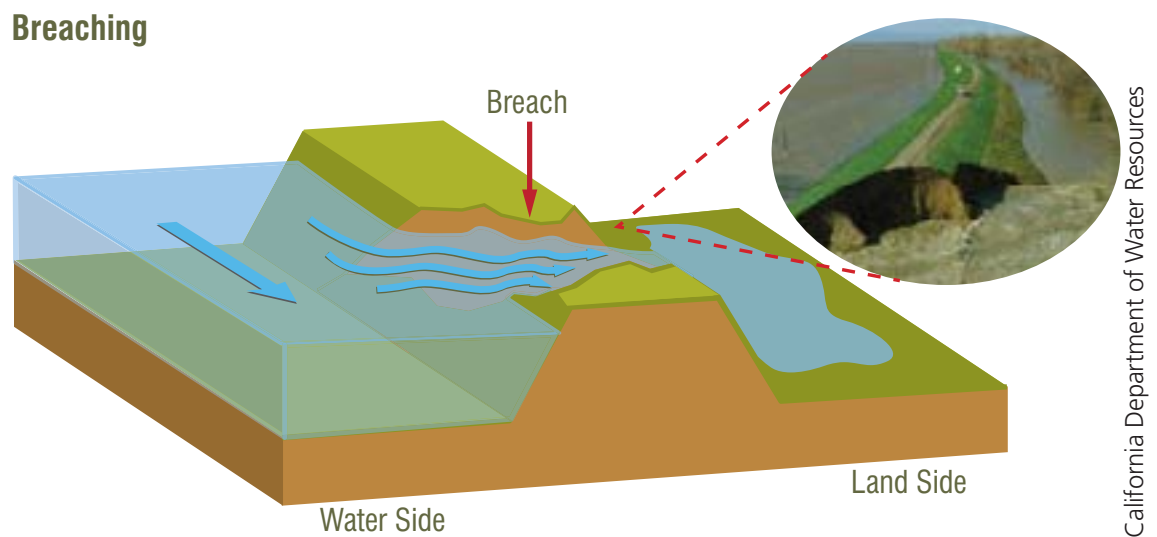
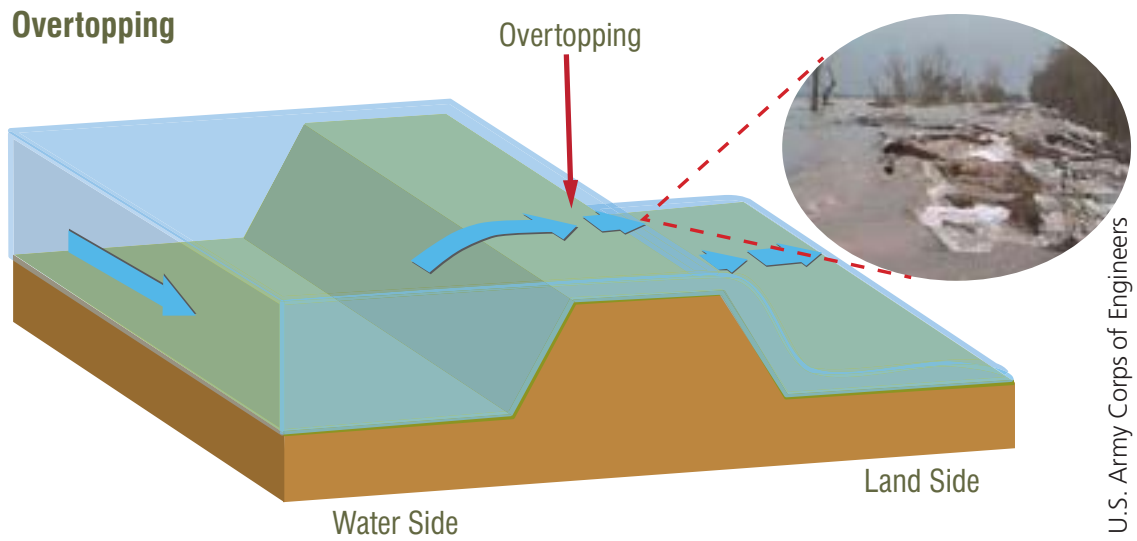


Figure 6. Illustrations of Levee Failures.  
 Source | "So You Live Behind a Levee!" 10.

In Cumberland County, New Jersey, many of the two-hundred-year old dikes have been dismantled or have failed during storms. Similar to the dikes in Cumberland County, the Gibbstown Levee in Greenwich Township in Gloucester County, New Jersey, was built over three-hundred years ago when the tides were over three feet lower than today. At the time it was built, the levee lowered the water level to permit farming. However, sea-level rise and land subsidence have increased the water levels in the farmland, which has reverted to marsh. Because the land fails to completely drain during low tide, there is no opportunity to reach normal drainage levels by opening the tide gate. Part of this levee collapsed during Hurricane Floyd in 1999, when water levels rose more than ten feet above mean low water, requiring the township to evacuate nearby residences and businesses. Many dikes in Gloucester County are deteriorating, and sea-level rise will increase the need to raise or rebuild levees at a high cost. The agricultural revenues of the farmlands are insufficient to finance maintenance of these flood barriers.<sup>123</sup> The predicted acceleration of sea-level rise, combined with the need for structural maintenance in perpetuity, may make traditional coastal engineering structures, such as levees, economically unsustainable.

*:: Adverse Effects of Constructing New Levees or Dikes*

Introducing new levees or dikes in a historic district can also adversely impact the cultural landscape. As part of the city's Disaster Preparedness and Planning Project, Baltimore, Maryland, is considering building seawalls to protect its coastal land. Aside from the prohibitive expense, Baltimore's floodplain manager, Ken Hranicky, expressed concern that seawalls would defeat the benefits of a waterfront – where residents and tourists can see the harbor without the visual interference of a wall. He further stated that because the Patapsco River branches before connecting with the Inner Harbor, one seawall would not

---

<sup>123</sup> Titus, 207-208.

protect the entire waterfront. The city would need to construct multiple walls, which would further disrupt the viewshed. Of additional importance, constructing new levees or dikes can have social and environmental costs. Hranicky acknowledged that seawall placement in Baltimore poses ethical dilemmas: “the city would be hard-pressed to put up a seawall just to protect [Inner Harbor] money while leaving [poorer communities like Baltimore’s Cherry Hill, Brooklyn and Curtis Bay neighborhoods] to protect themselves.”<sup>124</sup>

Sea-level rise knows no boundaries, posing a threat to large regions. As opposed to Dutch infrastructural planning which occurs at the regional level, American municipalities operate in autonomy – making regional cooperation in the United States difficult.<sup>125</sup> If storm-surge barriers are constructed, it is necessary to consider their potential to increase flooding in unprotected, surrounding areas. Furthermore, regulators who permit new structures should account for future sea-level rise when reviewing the design and construction of the levee to protect against overtopping during an extreme flood event.<sup>126</sup>

Though intended to disrupt the natural interaction of the shore and waves, levees or dikes can have unintended consequences that harm coastal ecosystems, accelerate erosion in front of the structure, devalue adjacent properties due to exacerbated erosion and redirection of wave action towards neighboring areas, and restrict public access to and use of the coast.<sup>127</sup> Flood barriers can also cause negative economic impacts to fisheries and tourist-related industries.<sup>128</sup> For these reasons, the construction of levees or dikes should be considered at the regional-level, and officials should balance the protective and beneficial impacts of levees with the potential added risks and vulnerabilities.

---

<sup>124</sup> Lauren Redding, “To Protect a City from Rising Seas: Build Barriers or Move,” *Sea Level Rise in Maryland*, 2013, <http://cnsmaryland.org/sealevelrise/?p=66>.

<sup>125</sup> Shorto, 20.

<sup>126</sup> Grannis, 37.

<sup>127</sup> Siders, 65.

<sup>128</sup> Grannis, 38.

## Conclusion

As diked farms have been part of the mid-Atlantic landscape for centuries, proper repair and maintenance and elevation of these structures can help protect coastal communities from sea-level rise. By proactively investing in infrastructure improvements, coastal communities can avoid replacement costs and preserve the value of historic structures and of the properties and landscapes those structures protect, yielding significant long-term savings. Alternatively, communities can build new levees, as long as the structures do not adversely affect the cultural landscape or have unintentional social, economic or environmental repercussions.

However, the best protective strategy may be in combining engineered and natural solutions through hybrid stabilization. Since soft engineering approaches maintain natural shoreline dynamics and allow shoreline migration, reduce wave energy and coastal erosion, absorb storm surge and flood waters, and maintain public access to the coasts, the Environmental Protection Agency encourages governments to implement living shorelines.<sup>129</sup> Hard engineering barriers can be strengthened with soft measures, like sand dunes, at both ends along low-lying coastal areas.<sup>130</sup> Along these lines, set-back levees – low height earth structures – use this combination of hard and soft systems. Set-back levees are constructed upland and on higher ground, allowing a portion of the floodplain to absorb some of the water volume and wave energy.<sup>131</sup> These levees are usually smaller in size, cost less, have less of an environmental impact, and are faster to build than shoreline levees.

Still, these strategies may not sufficiently protect historic communities from floods. Moreover, shoreline infrastructure may not be practical or appropriate in certain areas. In

---

<sup>129</sup> NOAA, 80-81; and Grannis, 39.

<sup>130</sup> Folger, 42.

<sup>131</sup> "Set-back levee," Sacramento River: A Guide to Recreation and Public Access, [http://www.sacramentoriver.org/glossary.php?glossary\\_id=66](http://www.sacramentoriver.org/glossary.php?glossary_id=66).

those instances, communities should consider physical modifications to their historic properties, as discussed in Chapter 4, in order to maintain their coast heritage.

## **CHAPTER 4 | ACCOMMODATION: THE IMPLICATIONS OF ELEVATING HISTORIC PROPERTIES**

“What’s the use of a fine house if you haven’t got a tolerable planet to put it on? If you cannot tolerate the planet it is on?” Written in 1860, Henry David Thoreau pointedly questioned favoring the built environment over the natural one. Yet, many historic buildings are significant due to their coastal location, as facets of communities and regional landscapes, and methods to preserve such buildings in situ, through flood-proofing or elevations, should be fully considered in light of the implications of climate change. Preservation professionals will need to respond to the potential for diminished integrity of historic districts due to sea-level rise and climate change adaptations. Stakeholders of vulnerable historic properties will need to consider ways to maintain the scale and context of, as well as how to prolong, existing communities in their place, while questioning the degree of integrity necessary for historic structures to remain significant.

### **Options for Flood-proofing**

Communities have learned to “live with water” through various accommodation methods. By modifying existing buildings and policies, coastal areas can maintain the natural character of the shore while becoming more resilient to sea-level rise. Apart from altering land-use practices and introducing financial incentives, communities can use innovative engineering strategies to protect the existing built environment. Which strategy of adaptation is executed is largely driven by the relationship of the first occupied floor of a building and the base flood elevation (BFE). If the first occupied floor is above the BFE, property owners can flood-proof the understory (basement or crawl space) with minimal

change to the structure. Property owners can create positive drainage around their building or reinforce the existing foundation systems by implementing dry- or wet-flood-proofing – meaning that portions of the building can be made watertight or allow internal flooding. Examples of flood-proofing that will not damage historic structures include installing sump pumps and relocating utilities at higher levels. If the first occupied floor is below the BFE, the building can be flood-proofed at the present elevation, but the alterations may make substantial changes to the appearance and fabric of the structure. Examples of flood-proofing that may damage historic structures include using spray-on cement or wood or metal shielding. Moreover, building materials for an area that is wet-flood-proofed should be replaced with flood-resistant materials.

Alternatively, as the frequency and height of flooding due to sea-level rise is predicted to increase, making the first occupied floor below the BFE, property owners may undertake more extensive measures by physically elevating the building and flood-proofing the new understory. Raising the building allows water to temporarily flow underneath or around it without damaging the main structure.<sup>132</sup> This chapter focuses on this strategy of elevating historic buildings.

### **Historic Precedents for Elevating Historic Buildings**

At present, the most elevations are executed for compliance with the National Flood Insurance Program (NFIP) – the lowest floor of a structure is raised above the BFE. Over a century ago, this method of protecting flood-prone buildings was employed in Galveston, Texas – an island developed because of its potential as a trading port. In response to severe

---

<sup>132</sup> FEMA, *National Flood Insurance Program: Floodplain Management Bulletin for Historic Structures*, FEMA P-467-2, May 2008, 11-12, 16, [http://www.fema.gov/media-library-data/20130726-1628-20490-7857/tb\\_p\\_467\\_2\\_historic\\_structures\\_05\\_08\\_web.pdf](http://www.fema.gov/media-library-data/20130726-1628-20490-7857/tb_p_467_2_historic_structures_05_08_web.pdf); Eastern Research Group, Inc., A-12-A-13, A-18; and Verchick and Scheraga, 239.

damage from the Great Storm of 1900, which killed six thousand people and destroyed half of the structures on the island, a Commission was formed to create a plan for reconstruction.<sup>133</sup> With assistance from the U.S. Army Corps of Engineers, a 3-mile-long seawall was built along the southern portion of the island, and the ground elevation of the whole city was raised by eight feet – seventeen feet at the seawall – with the ground sloped so the water would run off into the bay.<sup>134</sup> 2,156 buildings were raised as high as seventeen feet above their original foundation height with hand-turned “jacks and mules.”<sup>135</sup> More than sixteen million cubic yards of sand were dredged to raise the ground elevation to the underside of the raised buildings. Engineers designed an array of canals to transport the sand to quarter-mile-square sections of the city at a time.<sup>136</sup>

These adaptations not only improved the city’s resilience in future storms, they defined Galveston’s present sense of place. The city embraced its connection to the natural environment, recognizing that it “has been the greatest single influence on its history, architecture, economy and people.” Consistent efforts to preserve the built environment, including over one thousand residential and commercial historic buildings, four National Register Historic Districts and two National Historic Landmark Districts, in spite of periodic natural disasters, makes it “one of the finest examples of well preserved, historic cities in the country.”<sup>137</sup>

Galveston’s response to its climatic threats is an extreme example, considering the topography was elevated up to seventeen feet in addition to the construction of a seawall. Topographic-grade raising may not be permitted in some areas because of environmental

---

<sup>133</sup> Gianni Longo, Jean Tatge, and Lois Fishman, *Learning from Galveston* (New Brunswick, NJ: Institute for Environmental Action, 1983), 21.

<sup>134</sup> “Island History,” Galveston.com & Company, Inc., <http://www.galveston.com/history/>.

<sup>135</sup> Ira Flatow, “To Combat Rising Seas, Why Not Raise Up the Town?,” *National Public Radio*, May 3, 2013, <http://www.npr.org/2013/05/03/180824410/to-combat-rising-seas-why-not-raise-up-the-town>.

<sup>136</sup> Peter Applebome, “Lifting a Town to Escape the Next Storm,” *New York Times*, February 22, 2013, A13.

<sup>137</sup> Longo, Tatge, and Fishman, 3.





Figure 7. Before and After: This house was elevated ten feet, and the owners constructed a new porch and fence.  
*Source* | Galveston County Museum, Galveston, Texas.

justice issues and the effects of displaced water on neighboring places. Still, with this precedent in mind, preservation professionals can consider similar opportunities for elevating buildings to address climate-change threats and NFIP requirements.

### **Policy Constraints**

For the NFIP, the Federal Emergency Management Agency (FEMA) uses historical flood data to develop flood insurance rate maps (FIRMs), which divide the floodplain into different zones based on susceptibility to flooding. In order to be eligible for the Program, FEMA requires that local governments impose additional regulations in special flood hazard areas (SFHAs) – high-risk areas that would be inundated by base-flood levels, or a flood having a one-percent chance of occurring in any given year based on historical data. SFHAs include A-Zones, upland areas vulnerable to the 100-year flood, and V-Zones, which are subject to more severe damage from erosion hazards and waves that are at least three feet during a base flood, and therefore are more strictly regulated and have a higher insurance-rate structure. In SFHAs, the minimum conditions of the NFIP include requiring permits for new and substantially improved development and elevating the lowest floor of all buildings to or above the BFE. The elevation requirement can be met by raising structures on fill, piles, posts, piers, columns, walls or a crawlspace.<sup>139</sup> The space below the BFE is limited to parking, building access, and storage, and openings may only be covered by devices that permit the automatic entry and exit of floodwaters so that water is not displaced.

Apart from the difficulties this policy imposes on historic-property owners, the FIRMs that identify where these requirements apply may be out of date and may not reflect future conditions of sea-level rise. Congress has decreased map funding by more than half since

---

<sup>139</sup> Siders, 88.

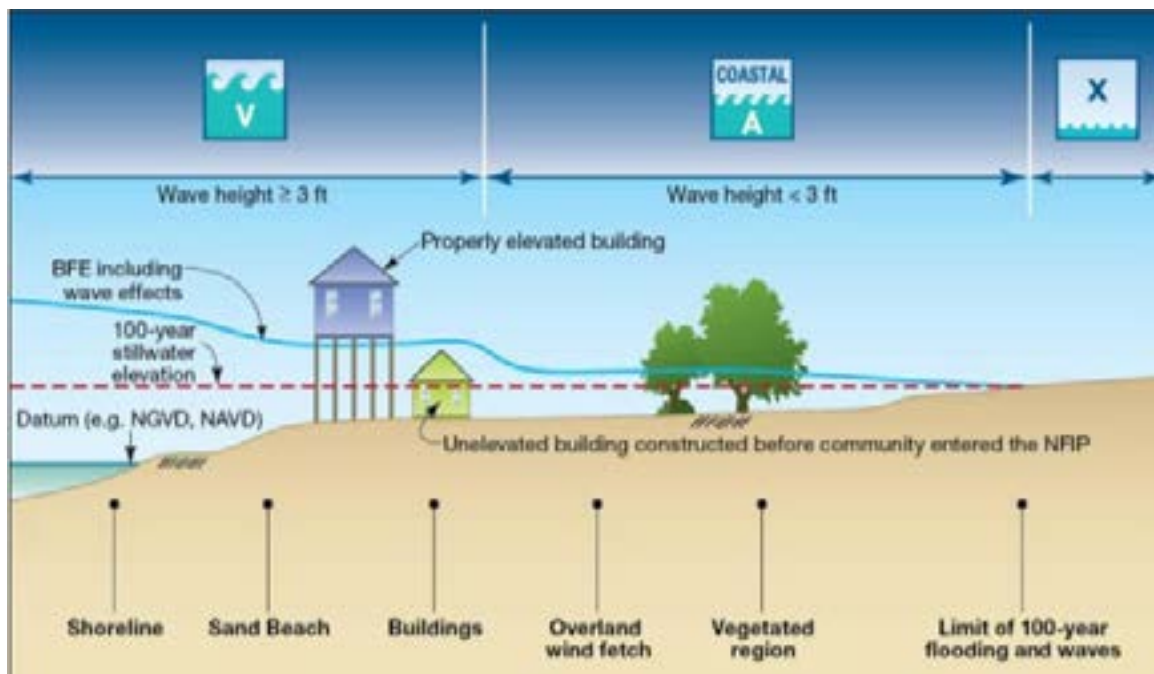


Figure 8. Flood Insurance Rate Map Zones.  
 Source | Federal Emergency Management Agency.

2010, from \$221 million to \$100 million in 2013.<sup>140</sup> Although FEMA is endeavoring to produce new maps at a fast pace, the regulatory process often takes up to two years.<sup>141</sup> Additionally, FEMA's new digitized maps "are often based on data from paper maps decades old."<sup>142</sup> Consequently, the Program requirements may not properly protect communities and manage increased risks posed by sea-level rise. To accommodate predicted sea-level rise that may not be reflected in the new maps, proponents of stricter flood insurance requirements suggest that local regulations should encourage adding freeboard (an additional height requirement above the BFE) and apply V-Zone requirements to A-Zone properties.<sup>143</sup> These recommendations pose additional threats to compromising historic properties by proposing to raise buildings higher than required and further from its original composition.

The Biggert-Waters National Flood Insurance Reform Act of 2012 (BW-12) directed FEMA to raise flood insurance rates to reflect actuarial risk and to update FIRMs in all 100-year and 500-year floodplain areas that may not have been revised in decades. To address unsustainable spending of federal tax dollars through the NFIP, BW-12 phased out, over five years, subsidized rates for newly purchased properties, lapsed policies, and policies covering properties for the first time. Premium discounts for second homes, business properties, and certain other previously eligible structures would be curtailed.<sup>144</sup> A person's primary home could be considered as a "secondary" home if the property was still in

---

<sup>140</sup> Ibid., 87.

<sup>141</sup> "Flood Elevation FAQs: New Jersey's Emergency Flood Elevation Rule," New Jersey Department of Environmental Protection, February 12, 2013, <http://www.nj.gov/dep/special/hurricane-sandy/docs/abfes-faq-20130212.pdf>.

<sup>142</sup> Siders, 87.

<sup>143</sup> Ibid., 89.

<sup>144</sup> Shiva Polefka, "Moving Out of Harm's Way," *Center for American Progress* (2013): 11, <http://www.americanprogress.org/issues/green/report/2013/12/12/81046/moving-out-of-harms-way/>.

his/her parents' names.<sup>145</sup> Any currently subsidized policies for historic buildings that fit these criteria, in addition to substantially damaged or improved properties, would be cut. The BW-12 policies would result in premium rate increases at 25% per year until full actuarial rates are achieved. BW-12 also removed grandfathered rating, meaning homeowners would be required to pay premiums based on current risk assessment and maps. Homes built before the first FIRM (Pre-FIRM) was created for their area would have a 16% to 17% increase in their premiums.<sup>146</sup> If a property in an A-Zone is four feet below BFE, the owner would have paid up to \$31,000/year. If that property were elevated, the total would drop to \$7,000/year; and if it is raised two feet above the BFE, the total would be \$3,500/year.<sup>147</sup> While the drastic reduction in premium may very well incentivize property owners to raise their homes above the BFE, building owners should be provided information regarding predicted sea-level rise so as to have sufficient data to make an informed decision about how many feet to elevate.

The cost implications of BW-12 to building owners were considered onerous, especially for those owners recovering from Superstorm Sandy. On March 21, 2014, the President signed a bill initiated by the U.S. House of Representatives, and approved by the Senate, that reduces some of the premium increases in the NFIP.<sup>148</sup> The Homeowner Flood Insurance Affordability Act (H.R. 3370), reverses some of the changes introduced by BW-12. The Senate had previously passed a bill in January 2014 that would delay BW-12's reforms and increases for four years; however, the Senate accepted the House bill one week after it was passed. Under the Grimm-Cassidy Substitute Amendment to H.R. 3370, people who have

---

<sup>145</sup> Elaine Piniat, "Rising Costs Have Sandy Victims Contemplating Walking Away," *Ocean City Patch*, April 27, 2013, <http://oceancity.patch.com/groups/editors-picks/p/rising-costs-have-sandy-victims-contemplating-walking>142c46c1a.

<sup>146</sup> Siders, 10.

<sup>147</sup> Piniat, "Rising Costs Have Sandy Victims Contemplating Walking Away."

<sup>148</sup> "Cassidy Praises Grimm-Cassidy Flood Insurance Reform Becoming Law," Congressman Bill Cassidy, March 22, 2014, <http://cassidy.house.gov/media-center/press-releases/cassidy-praises-grimm-cassidy-flood-insurance-reform-becoming-law>.

had large flood insurance rate increases due to the sale or purchase of a home would receive retroactive refunds, average annual premium increases would be capped at 15% to 18%, and grandfathering would be reinstated.<sup>149</sup>

Still, flood insurance rates are likely to continue to increase, and re-evaluated and redefined flood zones will expand. Unaffordable flood insurance rates may drive shopkeepers out of business and people on fixed-incomes out of their homes. Not only will higher rates be burdensome, but they could affect property resale values and further harm low-income households.<sup>150</sup> Likely, owners of historic properties will need to elevate their floor heights or pay high insurance premiums. The NFIP exempts historic structures from substantial improvement requirements, “provided that the alteration will not preclude the structure’s continued designation as a historic structure” – meaning it is on or eligible for individual listing on the National Register, contributes to a historic district, is listed on a State register, or is locally designated. The NFIP floodplain management regulations also contains a provision that states, “variances may be granted for the repair or rehabilitation of historic structures upon a determination that the proposed repair or rehabilitation will not preclude the structure’s continued designation as a historic structure and the variance is the minimum necessary to preserve the historic character and design of the structure.”<sup>151</sup> By using the substantial improvement definition or the variance provision, historic structures can be excluded from the NFIP elevation and flood-proofing requirements. However, under BW-12, historic property-owners would not be exempt from flood insurance rate-hikes facing all other existing building owners. Accordingly, the NFIP does not distinguish that certain historic buildings have proven to be resilient in previous storms

---

<sup>149</sup> Andrew G. Simpson, “House Passes Flood Insurance Bill; Key Senators Sign On,” *Insurance Journal*, March 4, 2014, <http://www.insurancejournal.com/news/national/2014/03/04/322194.htm>.

<sup>150</sup> Polefka, 5.

<sup>151</sup> “Historic Structures and the Biggert-Waters Flood Insurance Reform Act of 2012,” Federal Emergency Management Agency, [http://www.fema.gov/media-library-data/e279bc445f601f57c0bd81a3f401b8a6/Historic\\_Structures\\_Fact\\_Sheet\\_2013\\_2.pdf](http://www.fema.gov/media-library-data/e279bc445f601f57c0bd81a3f401b8a6/Historic_Structures_Fact_Sheet_2013_2.pdf).

and should be recognized for their inherent flood-proofing techniques instead of depreciated.

If the first occupied story of a historic building remains below the BFE, other protection measures can be integrated, but this requires a community-wide plan. Within the coastal protection section of PlaNYC's resiliency plan of 2013, one of the strategies is to provide attenuation of upland waves both off and onshore , thereby reducing damage to structures and protect infrastructure. This approach can influence the delineation of high-risk A- and V-Zones on future FIRMs and therefore reduce the costs of flood insurance – for historic and non-historic properties alike – and affect the need to elevate buildings for compliance with the NFIP within these zones.<sup>152</sup> Without a similar plan, this change in insurance rates can lead to individual property abandonment and cause more people to shy away from investing in historic properties that are below base flood levels.

Since Section 106 of the NHPA is procedural, applications to elevate historic properties using any federal grant will likely be deemed as an adverse effect, even if the State Historic Preservation Office or other reviewing agency concedes that it is the best available practice to save the historic asset. The NPS, still predominantly concerned with maintaining integrity, has not provided the public with any direction about how to apply the Standards in these circumstances. The NPS tacitly acknowledges sources like the Mississippi Development Authority's *Elevation Design Guidelines*, which provides information on adaptation to flooding and storm surge, but the NPS does not fully endorse the *Guidelines*.

Aware of the link between heritage, sustainability and climate change, the National Park Service produced *The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings*. Filled with clear delineations of which treatments the National Park Service does or does not recommend in

---

<sup>152</sup> PlaNYC, 46.

terms of planning, maintenance and incorporating alternative energy sources, the public is able to use this source to clearly understand the agency's stance on making historic buildings more sustainable.<sup>153</sup> While the acknowledgement by the National Park Service of the significance of reusing and greening existing buildings is a critical first step to integrate historic preservation into climate change policy, historic communities need a manual for implementing adaptive actions for the effects of climate change on the historic built environment. With climate adaptation as "the quintessential sustainability issue of our time,"<sup>154</sup> guidance on the Standards for Rehabilitation and climate adaptation is necessary.

### **Consideration for Historic Communities**

#### *:: Impact on Spatial Relationships*

Since the enactment of the National Historic Preservation Act of 1966, there have been few examples of state- or locally-approved applications to elevate historic structures to reduce flood risk. The range of elevation scenarios that meet NFIP standards are based on the advisory BFE for each location – varying from a few feet to over one story. The character and scale of a historic district need to be considered when elevating a property within its boundaries. In the case of detached or semi-detached buildings, states such as Mississippi and New York have emphasized using landscaping and plantings to disguise the impacts of raising the building to passers-by.<sup>155</sup>

---

<sup>153</sup> Anne E. Grimmer et al., *The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings* (Washington, DC: US Department of the Interior, National Park Service, Technical Preservation Services, 2011), <http://www.nps.gov/tps/standards/rehabilitation/sustainability-guidelines.pdf>.

<sup>154</sup> Feldman and Kahan, 61.

<sup>155</sup> Matt Chaban, "A storm-proof way to elevate city buildings," *Crain's New York Business*, May 24, 2013, [http://www.crainsnewyork.com/article/20130524/REAL\\_ESTATE/130529918/a-storm-proof-way-to-elevate-city-buildings](http://www.crainsnewyork.com/article/20130524/REAL_ESTATE/130529918/a-storm-proof-way-to-elevate-city-buildings); and Mississippi Development Authority, "Elevation Design Guidelines for Historic Homes in the Mississippi Gulf Coast Region," 8, <http://www.msdisasterrecovery.com/documents/MDA%20EDG%20Final%20110308.pdf>.



FEMA alternatively suggests that, for situations in which it is possible or necessary to preserve the building's exterior relationship to the ground, the interior floors can be raised in isolation. This option may be favored for buildings with high ceilings and elevated window sills, provided that the materials that remain below the BFE are flood-proof.<sup>156</sup> For instance, in Darlington, Wisconsin, as part of its Hazard Mitigation Plan in 1993, nineteen historic commercial buildings in the downtown business district were retrofitted to meet BFE requirements while preserving the historic entrances and storefronts. While meeting local zoning ordinances, historic preservation requirements and Hazard Mitigation Grant Program (HMGP) criteria, the town filled-in the basements of these buildings, raised the first floors to the BFE, dry-flood proofed the first floors and raised utilities to the BFE plus two feet, and constructed interior floodwalls in a vestibule area behind the entrance that separated the street level from the elevated first floor. Within the vestibule area, a flood shield slides into a frame at the top of the steps that lead to the elevated first floors, creating a sealed floodwall when flooding is imminent. The vestibule was constructed with ceramic tile or bricks that would allow floodwaters to enter the area in order to equalize the water pressure, avoiding structural damages. Additionally, historic structures were brought into conformance with the Americans with Disabilities Act – in the rear of the buildings, a shared concrete handicap access ramp was constructed to serve several buildings and act as a floodwall. The City was awarded a State Historical Society of Wisconsin Historic Preservation Achievement Award for flood-proofing nineteen commercial buildings in this way while preserving the historic storefronts.<sup>157</sup>

---

<sup>156</sup> FEMA, *Floodplain Management Bulletin*, 12.

<sup>157</sup> Wisconsin Emergency Management, "Mitigation Leads to Preservation and Economic Recovery for One Community: Darlington, Wisconsin," [http://emergencymanagement.wi.gov/mitigation/stories/hm-darlington\\_success.pdf](http://emergencymanagement.wi.gov/mitigation/stories/hm-darlington_success.pdf).

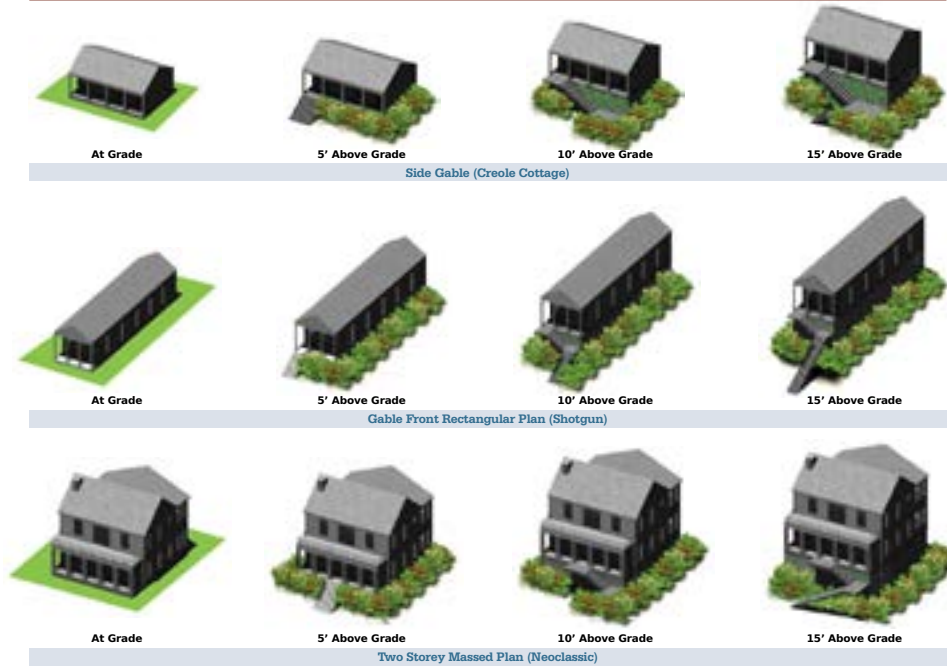


Figure 9. Landscaping as Disguise for Elevations.  
 Source | Mississippi Development Authority, 41.

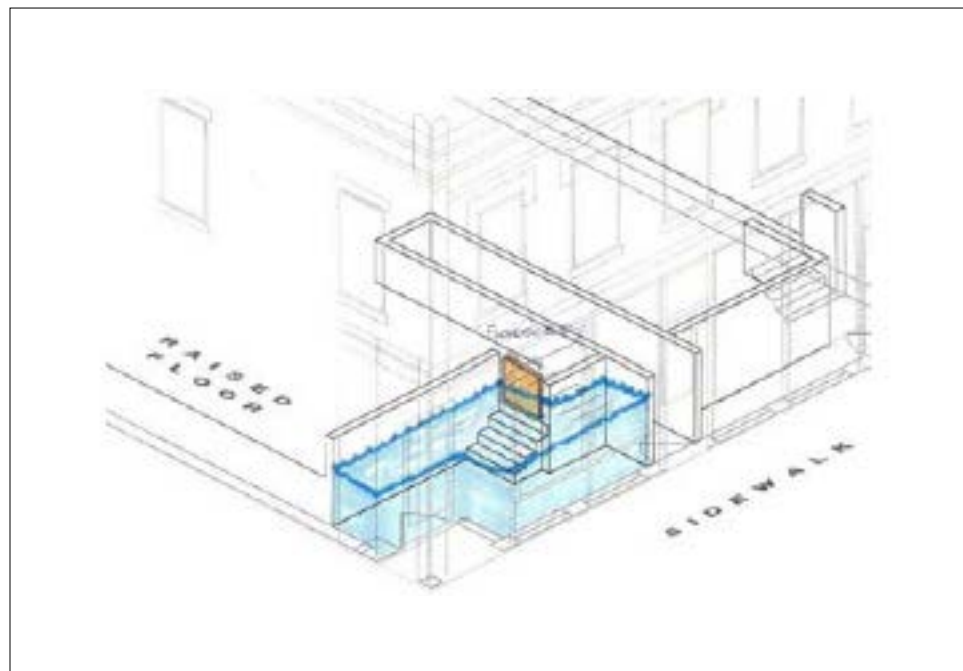


Figure 10. Interior floodwalls preserve historical facades on Darlington's Main Street.  
 Source | Wisconsin Emergency Management, "Mitigation Leads to Preservation."

During Hurricane Fran in 1996, more than sixty percent of the buildings in Belhaven, North Carolina, were damaged, including many in the National Register-listed Belhaven Historic District. With historic and economic ties to the waterfront along the Pungo River, the town chose to use HMGP funds to elevate 379 buildings in place. In cooperation with the State Historic Preservation Office, plans were developed to raise frame and brick buildings onto concrete block foundations with a brick veneer. To delineate the original structure, a projecting brick course demarcated the new foundation. With additional guidance for preserving porches, railings, balusters and steps, the historic district upheld its National Register status. Before the subsequent flood, eight percent of the planned elevations were executed, which alone saved the town over \$1.3 million in direct and indirect damages.<sup>159</sup>

After Superstorm Sandy, 1,972 houses in the barrier-island community of Beach Haven, New Jersey, were flooded and 384 remain vacant as of November 2013. Known as the “Queen City” of the Jersey Shore, Beach Haven has 384 buildings in its local and National Register historic district.<sup>160</sup> The district, evoking 19<sup>th</sup>-century resort architecture, has cohesive streetscapes appealing to year-round residents and summer residents alike. A particular challenge for the town has been developing new design guidelines that satisfy the objectives of both FEMA and the NPS. Retrofitting existing structures with flood-resistant materials sometimes adversely impacts the historic materials, and buildings are being elevated between three and seven feet above grade, at a cost of \$30,000-\$75,000 for each building. With an immediate need to rebuild, repair and protect, the town created an informal set of design guidelines from photographs and proposals presented at public meetings. Under the current zoning ordinances buildings are restricted in height, so elevating a building in compliance with the NFIP -- making the first occupied floor above the

---

<sup>159</sup> FEMA, *Floodplain Management Bulletin*, 15-16.

<sup>160</sup> It is a coincidence that the number of listed buildings is the same as the number of vacant structures.

BFE – may decrease the amount of living space available, and therefore its financial value. In response, the local government is changing set back requirements, to permit elongated front stairs, and height limits to allow for changes to the appearance of a historic building without completely losing it, hoping the next generation will appreciate what remains.<sup>161</sup>

As other cities in New Jersey are addressing the challenges of post-Sandy recovery in historic districts, elevating buildings above the BFE has had an unanticipated consequence. On a prominent, corner lot in Ocean City, New Jersey, an applicant proposed to elevate a Bungalow-style house well above the BFE – not to enhance safety, but for the economic opportunity of increasing usable space below the lowest, technically occupiable level. By raising the structure above the required amount, a ground level space, high enough for parking automobiles, will result.<sup>162</sup> In August 2013, the City Council passed an ordinance to remove garages from floor area ratio (FAR) calculations for residential structures – FAR is now limited as only habitable building areas.<sup>163</sup> Though this project was conditionally approved by the local historic commission, many preservation professionals are concerned that raising typically low-slung homes by eight to ten feet will adversely affect the building's character and spatial relationship to its neighborhood.

#### *:: Factors for Public Infrastructure*

In a bungalow community in Sheepshead Bay, Brooklyn, that was severely damaged by Superstorm Sandy, the Pratt Center for Community Development is advising the residents to elevate their houses. The bungalows, built as summer cottages in the 1920s and

---

<sup>161</sup> National Alliance of Preservation Commissions, "Commission Profile: Beach Haven, NJ," *The Alliance Review* (November-December 2013): 14-16.

<sup>162</sup> "December 3, 2013, Meeting Minutes," City of Ocean City Historic Preservation Commission, <http://api11.team-logic.com/downloadPubNewsFile.cfm?i=242&t=330&f=5147&file=1>.

<sup>163</sup> Claire Lowe, "Ocean City to homeowners: Put garages under elevated homes," *Ocean City Gazette*, August 23, 2013, <http://www.shorenwstoday.com/snt/news/index.php/ocean-city-general-news/43121-ocean-city-to-homeowners-put-garages-under-elevated-homes.html>.

converted to year-round residences in the 1940s, are located on pedestrian-only courts – each only six-feet wide. When the city raised the streets around the bungalows four to five feet sometime later, the courts were left at their original grade because they are private property. In order to provide access to the proposed-elevated homes without building steep staircases in the small front yards, the Pratt Center has suggested to build a boardwalk about four feet above the current pathway; but the entire community needs to agree to this action so that everyone can reach their homes. The consultants have found that each homeowner has concerns about his or her individual property, and it is difficult to convince everyone that the project will only be successful if the community shares the same vision for this integrated solution.<sup>164</sup>

As demonstrated in this case, though elevating buildings complies with the NFIP and safeguards these physical manifestations of heritage, elevation is only a medium-term strategy. Elevated properties still require access to ground-level infrastructure, such as roads and utilities. It will make communities more resilient to periodic inundation, but it is not an absolute solution to the gradual inundation of sea-level rise.<sup>165</sup> To combat this issue, officials in Highlands, NJ, a working-class community in a V-Zone, are proposing to raise not only every property by at least ten feet but also make topographic changes – including “every curb, crosswalk and blade of grass,”<sup>166</sup> – espousing Galveston’s response to the Hurricane of 1900. This effort will cost less than \$200 million and take two years to complete – but the Mayor stated, “the cost of doing nothing ultimately would be much higher.”

---

<sup>164</sup> Matthew Schuerman, “It Really Does Take a Village to Rebuild After Sandy,” *WNYC News*, February 10, 2014, <http://www.wnyc.org/story/it-really-does-take-a-village-to-rebuild/>.

<sup>165</sup> Margaret E. Peloso, “Rebuilding from Superstorm Sandy: Signs of Climate Adaptation?,” *Vinson&Elkins*, October 29, 2013, <http://climatechange.velaw.com/RebuildingfromSuperstormSandySignsClimateAdaptation.aspx>.

<sup>166</sup> Kevin Penton, “Highlands officials propose raising entire town 11 feet in \$200M post-Sandy project,” *Asbury Park Press*, August 8, 2013, <http://www.app.com/article/20130807/NJNEWS/308070114/Highlands-elevation>.



Figure 11. A Pratt Center design for the Sheepshead Bay courts.  
*Source* | Cristina Zubillaga and Sean Gold/Gans Studio.

### :: *Reassess the Criteria for Evaluation*

In historic preservation, significance and integrity of a resource are regarded as largely fixed once they have been assessed and determined; however, each site's significance should be "seen as time bound and in need of periodic revision...The essential nature of significance...[is] an expression of cultural meaning, it must be expected to change, involve multi-valence and contention, and be contingent on time, place, and other factors."<sup>168</sup> Since significance is constructed and situational, the assessor has the power to extract an altered building's value.<sup>169</sup> Adaptation through elevation may diminish a building's integrity, but if preservation professionals do not revise traditional notions of significance, "their work will become irrelevant to the daily challenges and long-term concerns of ordinary citizens."<sup>170</sup> The field should make the Criteria for Evaluation less restrictive in the procedural reviews of elevation applications.

### **Conclusion**

It is important that elevating buildings in historic districts be considered at the community level. The relationship of the buildings to each other and to the street partially defines the place's character. The impact of elevating one building without consulting its neighbors creates an undesirable impact on the cultural landscape of the community. Furthermore, by emphasizing accommodation rather than retreat, local governments will continue to be burdened with providing public infrastructure in vulnerable areas.<sup>171</sup> To avoid repetitive damage, some communities will need to relocate.

---

<sup>168</sup> Randall Mason, "Fixing Historic Preservation: A Constructive Critique of 'Significance,'" *Places, A Forum of Environmental Design* 16.1 (2004): 64-65.

<sup>169</sup> *Ibid.*, 68.

<sup>170</sup> *Ibid.*, 70.

<sup>171</sup> *Siders*, 89.

## CHAPTER 5 | RETREAT: THE IMPLICATIONS OF RELOCATION

As places become uninhabitable due to climate change impacts, millions of people around the world will be displaced.<sup>172</sup> The Intergovernmental Panel on Climate Change found that if Greenland is deglaciated, societies would not be able to adapt through coastal protection to the resulting amount of sea-level rise, and abandonment of coastal areas would be necessary.<sup>173</sup> Dozens of Chesapeake Bay islands have already become submerged during the last century because of sea-level rise and land subsidence. A century ago, Holland Island was 160 acres and home to a community of 350 residents. Because the Island consisted of silt and clay, the land eroded rapidly; today it is less than 80 acres and its community is gone.<sup>174</sup> While abandonment is a likely outcome in these worst-case scenarios, planned accommodation of climate change by migration will be a strategy for some populations. It is therefore necessary to consider how vulnerability to climate change and migration will affect historic communities.

### Options for Removing Human Settlements from Vulnerable Areas

Relocation – moving or dismantling and rebuilding a structure out of the floodplain – can provide the greatest security from future flood threats. Several strategies for managing retreat – the landward migration of people, property, wetlands, and beaches – from the

---

<sup>172</sup> Julie Koppel Maldonado et al., “The Impact of Climate Change on Tribal Communities in the US: Displacement, Relocation, and Human Rights,” *Climatic Change* 120 (2013): 602, doi: 10.1007/s10584-013-0746-z.

<sup>173</sup> United Nations Framework Convention on Climate Change, “An Overview of Investment and Financial Flows Needed for Adaptation,” in *The Earthscan Reader on Adaptation to Climate Change*, ed. E. Lisa F. Schipper and Ian Burton (London: Earthscan, 2009), 421.

<sup>174</sup> David A. Fahrenthold, “Last house on sinking Chesapeake Bay island collapses,” *The Washington Post*, October 26, 2010, <http://www.washingtonpost.com/wp-dyn/content/article/2010/10/24/AR2010102402996.html?sid=ST2010110800183>.



shorelines are available.<sup>175</sup> Although it is possible to carry out isolated population migration or building migration, in order to maintain cultural identity, historic communities should strive to take part in whole community migration of both the people and the buildings.

Though the cost of acquiring the land needed for retreat may be “prohibitively expensive, it may be more cost effective given the threats posed by climate change.”<sup>176</sup> When incorporated into a comprehensive coastal management plan, proactive non-structural solutions – such as land use reform – limit the expenditure of public funds on repetitive maintenance and repair of vulnerable private property and public infrastructure.<sup>177</sup> These policies – through planning, regulation, incentives, and capital investments – include implementing setback requirements, enacting conservation easements, allowing transfer of development rights, and funding buyout programs.

Since funding for buyouts does not specifically apply to cohesive population, building or community migration, this policy can lead to spotted acquisitions, property abandonment and the destruction of buildings that are worth being moved. Successful buyout programs must have a plan for relocation. Government planners can identify areas for migration and, where feasible, provide incentives for property owners to relocate within the municipality or county. This targeting can assist in maintaining the local tax base and preserving the social networks of the community.<sup>178</sup>

### **Historic Precedents for Relocation**

Migration, whether permanent or temporary, has often been a survival strategy for threatened populations. As an ancient coping mechanism, migration “does not inevitably

---

<sup>175</sup> Verchick and Scheraga, 239.

<sup>176</sup> Ibid., 269.

<sup>177</sup> Siders, 2.

<sup>178</sup> Ibid., 109.

result in negative outcomes.”<sup>179</sup> In 1975, instead of building a levee after a series of destructive floods from the Kickapoo River, residents of Soldiers Grove, Wisconsin, elected to relocate. The town hired the University of Wisconsin, with a small planning grant, to conduct a feasibility study for relocation – which resulted in validation from the University for community migration. In 1977, Soldiers Grove purchased a nearby site for the new downtown area and began extending utility services. With federal assistance, including HUD CDBGs, and state, local and private investments, the project was completed in 1983. Thirty-six businesses, three municipal facilities and twenty-two homes were relocated closer to U.S. Highway 61 – which provided economic growth for the town. The Department of Energy acknowledges that, by enacting an ordinance requiring new commercial buildings to obtain at least fifty percent of their heat from the sun, Soldiers Grove “pioneered the three-cornered strategy of relocation, renewable energy and sustainable development.” During flood events in 2007 and 2008, the new town avoided damage, but the parkland that had been created at the town’s original location was destroyed.<sup>180</sup> Relocation of Soldiers Grove not only protected the town from flood damage but improved its economic sustainability. Coastal regions can apply this strategy to enhance flood resilience in their communities.

### **Policy Constraints**

In lieu of rebuilding as a recovery outcome, land use reform emphasizes recovery as a “betterment process where pre-existing vulnerability issues are addressed.”<sup>181</sup> Rebuilding communities as they were before a natural disaster would be a maladaptation, reinforcing or even increasing a community’s exposure to environmental hazards. Land use reform, on the other hand, provides a buffer against future floods by restoring the floodplain back to its

---

<sup>179</sup> IPCC, 81.

<sup>180</sup> Siders, 118.

<sup>181</sup> IPCC, 301.

natural environmental condition. Allowing the coast to adapt naturally, retreat strategies can be used as “a cost-effective balanced approach to protect both public and private resources in the long run as impacts intensify.”<sup>182</sup> Though rebuilding restrictions can be challenged under laws governing the takings of private property, by proactively instituting these restrictions, governments provide property owners time to adjust their expectations for continued use of their property.<sup>183</sup>

Coastal floodplain buyouts are a complementary policy tool to other adaptation measures. By purchasing private land from voluntary sellers, the government uses public funds to maintain the land in an undeveloped state in perpetuity for public use.<sup>184</sup> Through its Hazard Mitigation Assistance grant programs, the Federal Emergency Management Agency (FEMA) funds buyouts through competitive grants to state and local governments. Through this program, “voluntary buyouts in the thirty top repetitive loss communities cost \$1 for every \$2 saved in future insurance claims.”<sup>185</sup> Grants can be used to acquire, demolish, or relocate threatened properties.<sup>186</sup> If FEMA approves a city or state application, the agency provides 75% of the appraised pre-flood market value of each of the flooded – and flood-prone – properties, while the state or local government funds the remainder of the cost.<sup>187</sup> In some cases, a Department of Housing and Urban Development (HUD) Community Development Block Grant (CDBG) can be used to cover the remaining 25% cost.<sup>188</sup> Additionally, The National Oceanic and Atmospheric Administration (NOAA) Coastal and Estuarine Land Conservation Program (CELCP) provides matching federal funds to

---

<sup>182</sup> J. Peter Byrne and Jessica Grannis, “Coastal Retreat Measures,” in *The Law of Adaptation to Climate Change: U.S. and International Aspects*, ed. Michael B. Gerrard and Katrina Fischer Kuh (Chicago: American Bar Association, 2012), 269.

<sup>183</sup> Grannis, 33.

<sup>184</sup> Polefka, 6.

<sup>185</sup> Siders, 109.

<sup>186</sup> Grannis, 48.

<sup>187</sup> Polefka, 6.

<sup>188</sup> Siders, 111.

state and local governments for acquisitions of coastal properties. Eligible properties must “have significant conservation, recreation, ecological, historical, or aesthetic values, or [be] threatened by conversion from their natural or recreational state to other uses, giving priority to lands which can be effectively managed and protected and that have significant ecological value.”<sup>189</sup>

In terms of preservation policies, though relocation may eliminate the need for flood insurance, relocated historic properties may be excluded from the National Register. The Criteria Considerations for the National Register exclude seven types of properties, including relocated properties. Since a listed property was considered in part due to its integrity of location and setting, the National Park Service prefers not to list moved properties and will remove a previously listed property from the National Register if it is later moved. However, “moved properties may be listed if they retain enough of their stylistic features, workmanship, feeling and association to portray their architectural values.”<sup>190</sup> To remain listed, moved properties must have an orientation, setting and environment similar to its original location. This requirement further emphasizes the need for government agencies to have a targeted area specified in a historic communities’ relocation plan.

Similarly to moved-properties, the Criteria Considerations of the National Register exclude reconstructed ones. Though the bureau claims that copies can provide important lessons when original resources have been lost, the National Park Service still asserts that reconstructions lack integrity of materials and association. To achieve listing, a reconstructed property must fulfill seven requirements, including being part of a larger group of mostly original historic resources and standing with its companion buildings on

---

<sup>189</sup> Grannis, 49.

<sup>190</sup> Patricia L. Duncan, “National Register 101: Criteria Consideration,” *Preservation in Print* 38-5 (Summer 2011), 10.

the original site.<sup>191</sup> What happens to a community that undertakes population migration but cannot relocate their buildings and attempts to reconstruct their district? Preservation has never been a zero-sum practice. A reconstruction is occasionally listed if, after an appropriate amount of time, “it has become significant in its own right. In such a case, the reconstructed resource would be important for what it illustrates about the period in which it was built rather than the historic period it depicts.”<sup>192</sup> Reconstructed buildings from vulnerable coastal communities may illustrate the significance of climate adaptation projects.

### **Considerations for Historic Communities**

#### *:: Impacts on Sense of Place and to Cultures*

Historic structures are often significant in part due to the relationship to their site and within their neighborhood context. Yet, climate-induced displacement will sever the physical ties people and structures have to the land that may be a principle feature of their cultural identity. “Whether slow and incremental or fast and abrupt, climate change is and will continue to modify the relationships of societies with the environment.”<sup>193</sup> The disconnections of geographic bonds may lead to a sense of loss for people with a strong place identity.<sup>194</sup>

Since “material and social losses compound each other,”<sup>195</sup> the loss of physical places also has associated cultural and social implications. Uprooting communities and their associated livelihoods endanger individual and social identity, resulting in fragmented social networks. As heritage is not only about places but about people, when divorcing a

---

<sup>191</sup> Ibid., 11.

<sup>192</sup> Ibid., 11.

<sup>193</sup> Adger et al., 349.

<sup>194</sup> Swim, 46.

<sup>195</sup> Oliver-Smith, 122

community from its historic center, the place itself can lose its significance. The loss of important cultural sites can undermine the community's sense of itself and create an isolating effect. Impacted people will need to reinvent their social bonds and rebuild a community that articulates continuity.<sup>196</sup>

:: *Justice Concerns*

For cases in which environmental migration is not voluntary or action is not undertaken before environmental conditions worsen, no human rights document exists that protects communities in cases of forced relocation due to climate change, either within the United States or internationally. The United Nations' *Guiding Principles on Internal Displacement* addresses displacement caused by ethnic and political violence and thus are largely inapplicable. However Robin Bronen, Director of the Alaska Immigration Justice Project, proposed "Guiding Principles on Climigration."<sup>197</sup> Climigration is "permanent community displacement caused by gradual climate-induced biophysical changes, combined with repeated extreme weather events, which severely impact infrastructure, such as health clinics and schools, and threaten the livelihoods and well-being of the people residing in the community."<sup>198</sup> A fundamental principle in protecting the collective rights of these communities is the right to self-determination. In this way, affected communities must be involved in the relocation process, and relocation must be a community-based decision.

As citizens of least developed countries and Native American tribes are already being forced to relocate due to accelerated rates of sea-level rise and land erosion, concerns about justice have thus far been limited to the impacts on these groups. In addition to matters of

---

<sup>196</sup> Oliver-Smith, 123.

<sup>197</sup> Robin Bronen, "Climate-induced community relocations: creating an adaptive governance framework based in human rights doctrine," *NYU Review of Law and Social Change* 35 (2011): 356-406.

<sup>198</sup> Koppel Maldonado et al., "The Impact of Climate Change on Tribal Communities in the US," 611.

tribes bearing the hardships of anthropogenic climate change despite their relatively minimal contributions to greenhouse gas emissions, “justice also represents a crucial framework for guiding leaders, scientists and professionals in their understanding of what actions are morally essential for supporting the institutions that tribes must rely on to adapt.”<sup>199</sup> While it is necessary to support indigenous people’s and tribes’ adaptation efforts, marginalized populations in the mid-Atlantic are also exposed to the climate change impacts that magnify existing adverse social, political, economic and environmental conditions.

There is a “fine line between essentializing indigenous populations as a romantic ‘other’ and leaving the locals out of the picture.”<sup>200</sup> Many historic communities in this the mid-Atlantic region have residents with resource-based livelihoods, homes in vulnerable environments, and multi-generational relationships with the coastal land. These group identities are also rooted in the “symbiotic relationships of the nature-culture nexus,”<sup>201</sup> and their sustainability is in peril.

Relocation is “compounded by the current lack of governance mechanisms or budgets to support the communities, which intensifies community impoverishment,” and loss of place and culture.<sup>202</sup> Many communities in the mid-Atlantic are small in terms of the concentration of residents, have limited administrative authority and public services, and lack the financial resources of larger governments.<sup>203</sup> Inadequate governance mechanisms

---

<sup>199</sup> Kyle Powys Whyte, “Justice Forward: Tribes, Climate Adaptation and Responsibility,” *Climatic Change* 120 (2013): 517, doi: 10.1007/s10584-013-0743-2.

<sup>200</sup> Barthel-Bouchier, 103.

<sup>201</sup> David R. Wildcat, “Introduction: Climate Change and Indigenous Peoples of the USA,” *Climatic Change* 120 (2013): 509, doi: 10.1007/s10584-013-0849-6.

<sup>202</sup> Koppel Maldonado et al., “The Impact of Climate Change on Tribal Communities in the US”, 603.

<sup>203</sup> William L. Waugh, Jr., “Management Capacity and Rural Community Resilience,” in *Disaster Resiliency: Interdisciplinary Perspectives*, ed. Naim Kapucuc, Christopher V. Hawkins, and Fernando I. Rivera (New York: Routledge – Taylor & Francis Group, 2013), 294.

and budgets to support adaptation may exacerbate the loss of community and culture.<sup>204</sup> Additionally, “low-income populations may be disproportionately targeted for retreat because their properties will be less costly to buyout and relocate.”<sup>205</sup> With power imbalances and limited municipal- and county- finances that can be used for adaptation methods, state- and federal- agencies need to uphold justice for these low-resource communities when allocating support funds.

## **Conclusion**

Because of place-attachment, some residents may be resistant to participate in voluntary buyout programs. Lack of community-wide participation can create a checkerboard effect in the original location, where some properties are acquired and others remain. This exclusion can cause blight and prevent governments from restoring the floodplain to its natural state, which is the primary purpose of the acquisition program.<sup>206</sup> While rebuilding restrictions can encourage individual property owners to retreat, it is important for historic communities to consider relocating as a whole to maintain their cultural identity. Ultimately, all adaptation strategies should be implemented through a place-based, community decision-making process.

---

<sup>204</sup> Koppel Maldonado et al., “The Impact of Climate Change on Tribal Communities in the US”, 601.

<sup>205</sup> Byrne and Grannis, 270.

<sup>206</sup> Grannis, 49.



## CHAPTER 6 | CONCLUSION

Methods by which coastal communities respond to environmental threats are not new concepts. Though adjustments to social and environmental pressures have not always been characterized as adaptations, “undoubtedly, we are an adaptable species.”<sup>207</sup> However, climate change adds urgency for the need to adapt, particularly where historic resources are concerned. Uncertainty regarding the precise effects of climate change should not be taken as an excuse to delay action. Though the net benefits of adaptation may not be realized for decades, taking action to prepare for the likely consequences of climate change can be less expensive than the damage that would result from doing nothing. While iterative decision-making will influence future adaptations, “immediate action is the only sensible strategy.”<sup>208</sup> As stated by Malcolm Bowman, a physical oceanographer at the State University of New York at Stony Brook, “We need to start planning immediately. Otherwise we’re mortgaging the future and leaving the next generation to cope as best it can.”<sup>209</sup> Though adaptation will require trade-offs and diverse strategies, inclusive policy-making through public, private and civil partnerships, addressing “the tension between national strategic frameworks and local flexibility for delivery” can provide a foundation to reach common objectives.<sup>210</sup>

---

<sup>207</sup> Donald R. Nelson, “Conclusions: Transforming the world,” in *Adapting to Climate Change: Thresholds, Values and Governance*, ed. W. Neil Adger, Irene Lorenzoni, and Karen L. O’Brien (Cambridge: Cambridge University Press, 2009), 491-493.

<sup>208</sup> Michael Werz and Laura Conley, *Climate Change, Migration, and Conflict: Addressing complex crisis scenarios in the 21<sup>st</sup> Century* (Washington, DC: Center for American Progress, 2012), 21.

<sup>209</sup> Folger, 43.

<sup>210</sup> Nicholson-Cole and O’Riordan, 379-380.

## **Review of Adaptation Options and Impacts**

There are three primary options for adapting to climate change on the coast: protection, accommodation, and retreat. As predicted sea-level rise will endanger coastal lands, “the most fundamental choice that people face is whether to attempt to hold back the sea or allow nature to take its course.”<sup>211</sup> To protect coastal land from inundation, erosion and flooding, communities can build physical defenses, such as levees and dikes, between the water and the built environment; or to minimize hazards and environmental impacts, communities can relocate from vulnerable areas. As a long-term solution or to prevent immediate abandonment, communities can make adjustments to the built environment through elevating buildings.

Each of these adaptation choices has critical consequences. Building coastal infrastructure disturbs the natural shorelines by applying an artificial surface, but the areas inland of the engineered structure are left mostly unchanged, allowing communities that use this strategy to maintain a sense of place. Conversely, elevating buildings can allow the shoreline to maintain its natural character, but this approach substantially alters the cultural landscape of the interior built environment. Furthermore, retreat enables shores to return to their natural state, but relocating whole communities from their historic centers can lead to a loss of cultural identity. Still, while retreat is “more socially disruptive than shore protection,” in the long term, alterations to the shore or buildings that remain in their original location can prove to be unsustainable and ultimately cause more harm.<sup>212</sup>

The issue of maintaining cultural resiliency is not without precedent; societies have historically managed the coastal impacts of weather- and climate-related events. Many communities have already begun to adapt to increase their resilience while maintaining

---

<sup>211</sup> Titus, 85.

<sup>212</sup> Ibid., 87.

their values and sustaining cultural-ecological models of wellbeing.<sup>213</sup> However, vulnerable populations are disproportionately exposed to climate change impacts due to their resource-dependent livelihoods and lack of political influence and financial resources. “Cost, feasibility, and unequal distribution of benefits versus burdens of adaptation programs remain significant obstacles.”<sup>214</sup> Adaptation will require long-term, strategic plans that include “awareness of diverse values, appreciation and understanding of specific and variable vulnerabilities to impacts, and acceptance of some loss through change.”<sup>215</sup> Since no federal agency is mandated to manage community adaptation efforts, decisions about how to adapt will be based on communal values. By cultivating strategies that respect the “cultural legitimacy” of respective stakeholders,<sup>216</sup> policies should support “the underlying values shaping preferences and decisions” to enable communities to proactively adapt.<sup>217</sup>

## **Values and Thresholds for Change**

### *:: At the Community Level*

Societies undertake actions that “are shaped in part by deeply-embedded (but not static) cultural and societal norms and values.”<sup>218</sup> Solutions are developed and evaluations are made based on intangible influences, such as attitudes towards change.<sup>219</sup> The success or failure of a proposed strategy will depend on how well the local populations within

---

<sup>213</sup> Thomas F. Thornton and Claudia Combetti, “Synergies and trade-offs between adaptation, mitigation and development,” *Climatic Change* (September 2013): 11, doi: 10.1007/s10584-013-0884-3.

<sup>214</sup> *Ibid.*, 12.

<sup>215</sup> Adger et al., “Are there social limits?,” 350.

<sup>216</sup> Olanrewaju Fagbohun, “Cultural legitimacy of mitigation and adaptation to climate change: An analytical framework,” in *International Climate Change Law and Policy: Cultural Legitimacy in Adaptation and Mitigation*, ed. Thoko Kaime (New York: Routledge, 2014), 10.

<sup>217</sup> Adger et al., “Are there social limits?,” 345.

<sup>218</sup> *Ibid.*, 344.

<sup>219</sup> IPCC, 446.

which it will be applied accept the plan.<sup>220</sup> Communal beliefs and habitual behavior, combined with perceptions of risk, may limit adaptation. These constraints are “not absolute and insurmountable but rather socially constructed, subjective and mutable.”<sup>221</sup> A values-based approach to adaptation – “recognizing that socioeconomic systems are continually evolving, driven by innovations, aspirations, and changing values and preferences of the constituents” – addresses both the “ethical question of ‘whose values count?’” and the “political question of ‘who decides?’”<sup>222</sup>

*:: For Policy-Makers*

It is important to note that, though communities are recognized to have unique cultures, various agencies, too, have a set of ideologies. Regulating adaptation is complicated by problems of control and influence. Adaptation decisions become “more diverse and contradictory as one moves from small-scales and single agents to larger-scales and multiple agents.”<sup>223</sup> Powerful organizations will favor the approach that is most aligned with their interests.<sup>224</sup> However, “the quest for common goals and visions is paramount if there is to be effective adaptation.”<sup>225</sup> This conflict that arises in decision-making requires increased solidarity among government agencies to engender collective action.

The adaptation strategies proposed by governments “are likely to require radical and fundamental shifts in socio-political structures, technological and economic systems, organizational forms, and modes of regulation.”<sup>226</sup> Since many institutions that

---

<sup>220</sup> Thoko Kaime, “Cultural legitimacy and international law and policy on climate change: an introduction,” in *International Climate Change Law and Policy: Cultural Legitimacy in Adaptation and Mitigation*, ed. Thoko Kaime (New York: Routledge, 2014), 1.

<sup>221</sup> Adger et al., “Are there social limits?,” 344.

<sup>222</sup> IPCC, 446.

<sup>223</sup> Adger et al., “Are there social limits?,” 338.

<sup>224</sup> Fagbohun, 10-11.

<sup>225</sup> Nicholson-Cole and O’Riordan, 377.

<sup>226</sup> Kaime, 1.

communities will rely on in addressing climate change were structured during a more stable climate and before adaptation frameworks were considered a key issue, it is necessary “to establish durable transitions into efficacious regulatory systems.”<sup>227</sup>

*:: Within the National Park Service*

Some preservation professionals have expressed that “climate change isn’t what we do.”<sup>228</sup> Yet, many conservationists have already documented real threats to heritage sites and perceived climate change as an issue with which the field of preservation should be concerned.<sup>229</sup> Whereas the original impetus for preservation policies was to prevent the demolition of historic buildings, the field has advanced to address other interests.

The National Park Service (NPS) assumed the mission of environmental sustainability by providing guidance in incorporating green-building objectives to the Secretary of Interiors’ Standards for Rehabilitation. Yet, preservation professionals have criticized how the NPS interprets the Standards in technical briefs, claiming that application of the Standards in accordance with this guidance has “a real propensity to try to freeze buildings in time.” The preservation community can best achieve the ideals they serve by having an open debate about whether the Secretary of Interior’s Standards are the best defense for historic properties or an obstacle. If the NPS were to develop guidance for applying the Standards to elevated historic properties, the agency would need to update its policies to reflect “the prevalence of externalities and the changing preferences over time for well-being and risk avoidance.”<sup>230</sup>

---

<sup>227</sup> Ibid., 3.

<sup>228</sup> Barthel-Bouchier, 56.

<sup>229</sup> Ibid., 179.

<sup>230</sup> Adger et al., “Are there social limits?,” 338.

Additionally, the Criteria for Evaluation for the National Register of Historic Places strictly defines *significance* and *integrity* in ways that prevent listed properties from complying with the National Flood Insurance Program without creating adverse effects. But such definitive concepts reflect “an underlying assumption that culture can be treated as a static set of artifacts” and dismisses that “there may be multiple valid arguments about the meaning of place.”<sup>231</sup> Acknowledging that culture is ever-changing, valued-centered preservation “leads, in practice, to a significance concept that is flexible and multivalent, instead of an older model that succeeded best in placing buildings and sites “under glass,” segregated from society like museum objects.”<sup>232</sup> If significance is “made, not found,” then preservation professionals have the option to recognize the continued value of historic structures that must be modified in order to survive the threats of climate change.

Perhaps the Criteria for Evaluation established for Traditional Cultural Properties can be applied to *all* properties, demonstrating “an integral relationship to traditional cultural practices or beliefs” and exist in a condition “such that the relevant relationships survive.” The standards for Traditional Cultural Properties “lift the Register’s heavy emphasis on unchanged physical conditions and place it where it should be: on the ability of the place to sustain tradition or belief.”<sup>233</sup> Furthermore, as cultural landscapes are “entirely the product of change and of the changing interplay of human and natural processes,” perhaps adaptation strategies that impact cultural landscapes can be seen as yet another change – “one of its principal attributes, fundamental to its present character.”<sup>234</sup> Though it is important to bear in mind future generations’ ability to understand and experience their

---

<sup>231</sup> Mason, 66.

<sup>232</sup> Ibid., 70.

<sup>233</sup> Ned Kaufman, *Place, Race and Story: Essays on the Past and Future of Historic Preservation* (New York :Routledge Taylor and Francis Group, 2009), 66.

<sup>234</sup> Graham Fairclough, “Cultural Landscape, Sustainability, and Living with Change?” (paper presented at the US/ICOMOS 4<sup>th</sup> International Symposium, *Managing Change: sustainable approaches to the conservation of the built environment*, Philadelphia, Pennsylvania, April 5-8, 2001).

heritage, “we cannot pass on everything that we inherited completely unchanged, because ‘everything’ encompasses our whole environment, which we need to use and adapt.”<sup>235</sup> As participants in climate change politics, the National Park Service and preservation professionals need to concede alterations that impact current notions of integrity in favor of prolonging the existence of historic communities in their original place.

### **Local and Place-Based Decision-Making**

In historic preservation, a sense of belonging drives the inhabitants of a place to continue promoting, conserving and managing their heritage.<sup>236</sup> The intangible and tangible values of a place, as well as the variation in vulnerability of coastal areas by region and locale, necessitate distinctive interventions for adaptation. There is “no silver bullet or one-size-fits-all solution for addressing the impacts of climate change.”<sup>237</sup> Addressing the particular needs and aspirations of the people who “live, work and spend time in [places] is a fundamental part of resilience” and “will result in more socially sustainable processes, yielding collectively higher levels of societal well-being.”<sup>238</sup> Moreover, change should “be developed from within cultures rather than from without.”<sup>239</sup> Therefore, communities should be directly involved in the adaptation planning process.

As choices regarding adaptation will prioritize investments and what to protect, inclusive decision-making helps achieve procedural justice and legitimization. To be effective, efficient and equitable, “adaptation requires a dimension of fairness” and

---

<sup>235</sup> Fairclough, “Cultural Landscape.”

<sup>236</sup> Getty Conservation Institute, “Historic Urban Environment: Conservation Challenges and Priorities for Action Meeting Report” (Los Angeles: J. Paul Getty Trust, 2010), 7.

<sup>237</sup> Wildcat, “Introduction,” 510.

<sup>238</sup> Jones and Mean, 66; and Jesse Dillard, Veronica Dujon, and Eileen M. Brennan, ed., *Social Sustainability: A Multilevel Approach to Social Inclusion* (New York: Routledge, 2013), 2.

<sup>239</sup> Ensor and Berger, 230.

consideration of distributional concerns.<sup>240</sup> The ability to adapt increases through the ethical treatment of “vulnerable people and places within societal decision-making structures.”<sup>241</sup> Reconciling conflicting values is an important aspect of evaluating options for adaptation across social and professional boundaries.<sup>242</sup> Local participation “suggests a mutually beneficial arrangement between policymakers and citizens which facilitates the influence of local people on decisions.”<sup>243</sup> Legal interventions will have a higher impact when their design recognizes the cultural imperatives of a community.<sup>244</sup> Participatory democracy includes the instrumental benefits of the development of locally-appropriate policies, increased local stewardship of projects, limited conflicts due to early involvement, and the creation of greater trust in government.<sup>245</sup>

#### :: *Community-Based Adaptation*

Borrowing from perspectives in international sustainable development and disaster-risk reduction, historic communities can adopt the concept of community-based adaptation (CBA), an action research approach which emphasizes “empowering local communities to reduce their vulnerabilities.”<sup>246</sup> Recent approaches to adaptation in least developed countries work with cultures and build on “the priorities, knowledge, and capacities of local people” to plan for and cope with the impacts of climate change.<sup>247</sup> Community members are empowered to take control of the process as the “rightful directors of their future.”<sup>248</sup> By

---

<sup>240</sup> Verchick and Scheraga, 238.

<sup>241</sup> Adger et al., “Are there social limits?,” 350.

<sup>242</sup> IPCC, 446.

<sup>243</sup> Karen Scott, *Measuring Wellbeing: Towards sustainability?* (New York: Routledge, 2012), 63.

<sup>244</sup> Kaime, 6.

<sup>245</sup> Scott, 63.

<sup>246</sup> Pascal Girot, Charles Ehrhard and Judy Oglethorpe, “Integrating Community and Ecosystem-Based Approaches in Climate Change Adaptation Responses,” Ecosystem and Livelihoods Adaptation Network, 3, [http://www.careclimatechange.org/files/adaptation/ELAN\\_IntegratedApproach\\_150412.pdf](http://www.careclimatechange.org/files/adaptation/ELAN_IntegratedApproach_150412.pdf).

<sup>247</sup> Hannah Reid et al., “Community-based adaptation to climate change: an overview,” in *Participatory Learning and Action* 60 (2009): 11, 13.

<sup>248</sup> Girot, Ehrhard and Oglethorpe, 6.



understanding their unique needs “through targeted and differentiated interventions (reaching poor women, the elderly, geographically isolated communities, and politically marginalized Indigenous Peoples),” CBA identifies locally appropriate solutions and effects change from within a community.<sup>249</sup>

:: *Traditional Ecological Knowledge*

The United Nations Educational, Scientific and Cultural Organization (UNESCO) and the United Nations University (UNU) published a report documenting that indigenous peoples have been able to use traditional ecological knowledge (TEK) to increase their adaptation capabilities.<sup>250</sup> With long, multi-generational histories of “interaction with their environments that include coping with environmental uncertainty, variability, and change,” indigenous people are able to respond to climate change based on their exigencies and “cumulative body of knowledge, practice, and belief.”<sup>251</sup> Though the term came into widespread use in the 1980s, the earliest studies of TEK were conducted by anthropologists through ethnoecology, “the study of systems of knowledge developed by a given culture to classify the objects, activities, and events of its universe.”<sup>252</sup>

Similarly to issues of climate migration, the formal concept of TEK has been limited to indigenous citizens of developing countries. However, TEK can be useful for identifying culturally-appropriate adaptations in non-aboriginal historic coastal communities. This approach to adaptation “can harness the diverse strengths of existing community capacities and cultural assets,” including local knowledge, values and ways of living.<sup>253</sup> Such understandings have been used in Louisiana, where scientists have integrated the

---

<sup>249</sup> Ibid., 5.

<sup>250</sup> Douglas Nakashime et al., *Weathering Uncertainty: Traditional Knowledge for Climate Change Assessment and Adaptation* (Paris: UNESCO and UNU, 2012).

<sup>251</sup> Wildcat, 509; and Fikret Berkes, *Sacred Ecology* (London:Routledge, 2012), 3.

<sup>252</sup> Berkes, 2.

<sup>253</sup> Thornton and Combetti, 12.

knowledge of local fisherman and workers in costal restoration projects. With a \$500,000 grant from the state Coastal Protection and Restoration Authority, a team called Sci-TEK, which stands for Scientific and Traditional Ecological Knowledge, developed a method to harness the local knowledge of people living in coastal communities who otherwise have limited input in the design of projects that affect them directly. As Michelle Esposito, research associate of the University of New Orleans Center for Hazards Assessment, Response and Technology, stated: "Coastal residents have a wealth of information on conditions they observe on a daily basis, whether it is weather, currents, tide or other factors that could affect a project. Residents also see the fate of projects that have been built before."<sup>254</sup> By incorporating the local observations and priorities of thirteen people – recommended to Sci-TEK by four-hundred people congregated around boat docks and shops and then verified by the community – into a physical science map of geology, hydraulics, and biology, the TEK method provides the state with a way to use local knowledge in the planning process. An analogous program can be applied to decision-making processes in the mid-Atlantic region.

## **Conclusion**

While other professions tend to make decisions "on the basis of their separation from the public – the more abstract and elevated the position the better," preservation professionals are uniquely positioned to garner community consensus. Through experience working directly with locals, preservation professionals understand that communities care about the potential loss of their cultural identity due to climate change, not simply the

---

<sup>254</sup> Amy Wold, "Using local knowledge to help coastal restoration design: Planners tap knowledge of Gulf dwellers," *The Advocate*, April 8, 2013, <http://theadvocate.com/home/5611720-125/using-local-knowledge-to-help>.

financial costs of adaptation.<sup>255</sup> “The current methods of valuing loss do not include cultural and symbolic values, leading to an undervaluation in comparison with more easily valued and tangible assets.”<sup>256</sup> Culture creates and reinforces “a sense of social solidarity that allows people to live and work together on common goals.”<sup>257</sup> For heritage preservation “to be successful, it must directly concern itself with issues of social justice” and “work toward the creation of livable communities for all.”<sup>258</sup> Though decisions about adaptation will involve trade-offs “regarding economic efficiency, environmental effectiveness, equity and political legitimacy,” being sensitive to the pluralistic and often conflicting public policy values through the planning and implementation process will lead to increased resiliency and triple-bottom-line – or perhaps quadruple-bottom-line, incorporating culture as the fourth pillar – sustainability of historic coastal communities.<sup>259</sup> Through a collaborative, community-based effort, historic coastal communities can create a “successful reconciliation of multiple goals” for long-term societal adaptation.<sup>260</sup>

---

<sup>255</sup> Bathel-Bouchier, 191.

<sup>256</sup> Adger et al., 349-350.

<sup>257</sup> Bathel-Bouchier, 191.

<sup>258</sup> Ibid., 188.

<sup>259</sup> IPCC 305; and Jon Hawkes, *The Fourth Pillar of Sustainability: Culture's essential role in public planning* (Melbourne: Cultural Development Network, 2001).

<sup>260</sup> IPCC, 448.

## BIBLIOGRAPHY

- Adger, W. Neil, Irene Lorenzoni, and Karen L. O'Brien. *Adapting to Climate Change: Thresholds, Values and Governance*. Cambridge: Cambridge University Press, 2009.
- Adger, W. Niel, Suraje Dessai, Marisa Goulden, Mike Hulme, Irene Lorenzoni, Donald R. Nelson, Lars Otto Naess, Johanna Wolf, Anita Wreford. "Are there social limits to adaptation to climate change?" *Climatic Change* 93 (2009): 335-354. doi: 10.1007/s10584-008-9520-z.
- American Society of Civil Engineers. "So You Live Behind a Levee!" 2010. <http://content.asce.org/files/pdf/SoYouLiveBehindLevee.pdf>.
- Applebome, Peter. "Lifting a Town to Escape the Next Storm." *New York Times*, February 22, 2013.
- Bohle, H. G., T. E. Downing, and M. J. Watts, ed. "Climate Change and Social Vulnerability." In *Global Environmental Change* 4-1 (1994): 37-48.
- Barthel-Bouchier, Diane. *Cultural Heritage and the Challenge of Sustainability*. Walnut Creek, CA: Left Coast Press, Inc., 2013.
- Berkes, Fikret. *Sacred Ecology*. London: Routledge, 2012.
- Birnbaum, Charles A. "Preservation Brief 6: Protecting Cultural Landscapes: Planning, Treatment and Management of Historic Landscapes." *National Park Service Technical Preservation Services*. <http://www.nps.gov/tps/how-to-preserve/briefs/36-cultural-landscapes.htm>.
- Bronen, Robin. "Climate-induced community relocations: creating an adaptive governance framework based in human rights doctrine." *NYU Review of Law and Social Change* 35 (2011): 356-406.
- Burton, Ian, Robert W. Kates, and Gilbert F. White. *The Environment As Hazard*, 2<sup>nd</sup> edition. New York: The Guildford Press, 1993.
- Byrne, J. Peter and Jessica Grannis. "Coastal Retreat Measures." In *The Law of Adaptation to Climate Change: U.S. and International Aspects*, edited by Michael B. Gerrard and Katrina Fischer Kuh, 267-306. Chicago: American Bar Association, 2012.
- Cassar, May. *Climate Change and the Historic Environment*. London: The Centre for Sustainable Heritage, University College London, 2003.

- Cassidy, Bill. "Cassidy Praises Grimm-Cassidy Flood Insurance Reform Becoming Law." March 22, 2014. <http://cassidy.house.gov/media-center/press-releases/cassidy-praises-grimm-cassidy-flood-insurance-reform-becoming-law>.
- Chaban, Matt. "A storm-proof way to elevate city buildings." *Crain's New York Business*, May 24, 2013. [http://www.crainsnewyork.com/article/20130524/REAL\\_ESTATE/130529918/a-storm-proof-way-to-elevate-city-buildings](http://www.crainsnewyork.com/article/20130524/REAL_ESTATE/130529918/a-storm-proof-way-to-elevate-city-buildings).
- City of Ocean City Historic Preservation Commission. "December 3, 2013, Meeting Minutes." <http://api11.team-logic.com/downloadPubNewsFile.cfm?i=242&t=330&f=5147&file=1>.
- Colette, Augustin. *Case Studies on Climate Change and World Heritage*. Paris: UNESCO World Heritage Centre, 2007. <http://whc.unesco.org/uploads/activities/documents/activity-473-1.pdf>.
- Copeland, Baden, Josh Keller and Bill Marsh, "What Could Disappear." *New York Times*, November 24, 2012. [http://www.nytimes.com/interactive/2012/11/24/opinion/sunday/what-could-disappear.html?\\_r=1&#g-footnote-anchor](http://www.nytimes.com/interactive/2012/11/24/opinion/sunday/what-could-disappear.html?_r=1&#g-footnote-anchor).
- Crate, Susan A., and Mark Nuttall, ed. *Anthropology and Climate Change: From Encounters to Actions*. Walnut Creek, CA: Left Coast Press, Inc., 2009.
- David, Maia and Amanda Campbell. *Summary of Potential Climate Change Impacts, Vulnerabilities, and Adaptation Strategies in the Metropolitan Washington Region*. Washington, DC: Metropolitan Washington Council of Governments, 2013.
- Dillard, Jesse, Veronica Dujon, and Eileen M. Brennan, ed. *Social Sustainability: A Multilevel Approach to Social Inclusion*. New York: Routledge, 2013.
- Delaware Coastal Programs. *Preparing for Tomorrow's High Tide: Sea Level Rise Vulnerability Assessment for the State of Delaware*. Dover, DE: Department of Natural Resources and Environmental Control, 2012.
- Deyle, Robert E., and William H. Butler. "Resilience Planning in the Face of Uncertainty: Adapting to Climate Change Effects on Coastal Hazards." In *Disaster Resiliency: Interdisciplinary Perspectives*, edited by Naim Kapucuc, Christopher V. Hawkins, and Fernando I. Rivera, 178-206. New York: Routledge – Taylor & Francis Group, 2013.

- Duncan, Patricia L. "National Register 101: Criteria Consideration." *Preservation in Print* 38-5 (Summer 2011).
- Ensor, Jonathan and Rachel Berger. "Community-based adaptation and culture in theory and practice." In *Adapting to Climate Change: Thresholds, Values and Governance*, edited by W. Neil Adger, Irene Lorenzoni, and Karen L. O'Brien, 227-239. Cambridge: Cambridge University Press, 2009.
- Eastern Research Group, Inc.. *What Will Adaptation Cost? An Economic Framework for Coastal Community Infrastructure*. South Carolina: National Oceanic and Atmospheric Administration Coastal Services Center, 2013.
- Fagbohun, Olanrewaju. "Cultural legitimacy of mitigation and adaptation to climate change: An analytical framework." In *International Climate Change Law and Policy: Cultural Legitimacy in Adaptation and Mitigation*, edited by Thoko Kaime, 9-28. New York: Routledge, 2014.
- Fahrenthold, David A. "Last house on sinking Chesapeake Bay island collapses." *The Washington Post*, October 26, 2010. <http://www.washingtonpost.com/wp-dyn/content/article/2010/10/24/AR2010102402996.html?sid=ST2010110800183>.
- Fairclough, Graham. "Cultural Landscape, Sustainability, and Living with Change?" Paper presented at the US/ICOMOS 4<sup>th</sup> International Symposium, *Managing Change: sustainable approaches to the conservation of the built environment*, Philadelphia, Pennsylvania, April 5-8, 2001.
- Federal Emergency Management Agency (FEMA). *Analysis and Mapping Procedures for Non-Accredited Levee Systems – New Approach*, July 2013. [http://www.fema.gov/media-library-data/20130726-1922-25045-4455/20130703\\_approachdocument\\_508.pdf](http://www.fema.gov/media-library-data/20130726-1922-25045-4455/20130703_approachdocument_508.pdf)
- \_\_\_\_\_. "Historic Structures and the Biggert-Waters Flood Insurance Reform Act of 2012." [http://www.fema.gov/media-library-data/e279bc445f601f57c0bd81a3f401b8a6/Historic\\_Structures\\_Fact\\_Sheet\\_2013\\_2.pdf](http://www.fema.gov/media-library-data/e279bc445f601f57c0bd81a3f401b8a6/Historic_Structures_Fact_Sheet_2013_2.pdf)
- \_\_\_\_\_. *Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning: State and Local Mitigation Planning How-to Guide*, FEMA 386-6. 2005. <http://www.fema.gov/media-library-data/20130726-1522-20490-2886/howto6.pdf>.

\_\_\_\_\_. "The National Flood Insurance Program." <http://www.fema.gov/national-flood-insurance-program>.

\_\_\_\_\_. "National Flood Insurance Program Community Rating System." <http://www.fema.gov/national-flood-insurance-program-community-rating-system>.

\_\_\_\_\_. *National Flood Insurance Program: Floodplain Management Bulletin for Historic Structures*, FEMA P-467-2, May 2008. [http://www.fema.gov/media-library-data/20130726-1628-20490-7857/tb\\_p\\_467\\_2\\_historic\\_structures\\_05\\_08\\_web.pdf](http://www.fema.gov/media-library-data/20130726-1628-20490-7857/tb_p_467_2_historic_structures_05_08_web.pdf).

Feldman, Ira R. and Joshua H. Kahan. "Preparing for the Day After Tomorrow: Frameworks for Climate Change Adaptation." *Sustainable Development Law & Policy* 8:1 (Fall 2007): 61-89.

Flatow, Ira. "To Combat Rising Seas, Why Not Raise Up the Town?" *National Public Radio*, May 3, 2013. <http://www.npr.org/2013/05/03/180824410/to-combat-rising-seas-why-not-raise-up-the-town>.

Folger, Tim. "Rising Seas." *National Geographic*, September 2013.

Ford, James, Tristan Pearce, Barry Smit, Johanna Wandel, Mishak Allurut, Kik Shappa, Harry Ittusujurat, Kevin Qrunnut. "Reducing Vulnerability to Climate Change in the Arctic: The Case of Nunavut, Canada." *Arctic Institute of North America* 60-2 (2007): 102-166, <http://dx.doi.org/10.14430/arctic240>.

Galveston.com & Company, Inc. "Island History." <http://www.galveston.com/history/>.

Gerrard, Michael B. "Introduction and Overview." In *The Law of Adaptation to Climate Change: U.S. and International Aspects*, edited by Michael B. Gerrard and Katrina Fischer Kuh, 3-18. Chicago: American Bar Association, 2012.

Getty Conservation Institute. "Historic Urban Environment: Conservation Challenges and Priorities for Action Meeting Report." Los Angeles: J. Paul Getty Trust, 2010.

Girof, Pascal, Charles Ehrhard, and Judy Oglethorpe. "Integrating Community and Ecosystem-Based Approaches in Climate Change Adaptation Responses." Ecosystem and Livelihoods Adaptation Network. [http://www.careclimatechange.org/files/adaptation/ELAN\\_IntegratedApproach\\_150412.pdf](http://www.careclimatechange.org/files/adaptation/ELAN_IntegratedApproach_150412.pdf).

- Goldner, Brandon. "Rising seas, sinking land put Maryland's waterfront communities at risk." *Sea Level Rise in Maryland*, 2013. <http://cnsmaryland.org/sealevelrise/?p=62>.
- Grannis, Jessica. *Adaptation Tool Kit: Sea-Level Rise and Coastal Land Use: How Governments Can Use Land-Use Practices to Adapt to Sea-Level Rise*. Washington, DC: Georgetown Climate Center, 2011.
- Grimmer, Anne E., Jo Ellen Hensley, Liz Petrella, and Audrey T. Tepper. *The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings*. Washington, DC: US Department of the Interior, National Park Service, Technical Preservation Services, 2011. <http://www.nps.gov/tps/standards/rehabilitation/sustainability-guidelines.pdf>.
- Gurian, Scott. "How will State spend next batch of federal funding for Sandy recovery?" *NJ Spotlight*, January 27, 2014. <http://www.njspotlight.com/stories/14/01/26/how-will-state-spend-next-batch-of-federal-funding-for-sandy-recovery/?p=all>.
- Hawkes, Jon. *The Fourth Pillar of Sustainability: Culture's essential role in public planning*. Melbourne: Cultural Development Network, 2001.
- Hill, M. "A goals-achievement matrix for evaluating alternative plans." *Journal of the American Planning Association* 34-1 (1968) 19-29.
- Horowitz, Ann. "The Effects of Sea Level Rise on Historic Districts and the Need for Adaptation." MA thesis, Goucher College, 2013.
- Intergovernmental Panel on Climate Change (IPCC). *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*. New York: Cambridge University Press, 2012.
- Jones, Samuel and Melissa Mean. *Resilient Places: Character and Community in Everyday Heritage*. London: Demos, 2010.
- Kaime, Thoko. "Cultural legitimacy and international law and policy on climate change: an introduction." In *International Climate Change Law and Policy: Cultural Legitimacy in Adaptation and Mitigation*, edited by Thoko Kaime, 1-6. New York: Routledge, 2014.
- Kaufman, Ned. *Place, Race and Story: Essays on the Past and Future of Historic Preservation*. New York :Routledge Taylor and Francis Group, 2009.
- Koppel Maldonado, Julie, Christine Shearer, Robin Bronen, Kristina Peterson, and Heather Lazrus. "The Impact of Climate Change on Tribal Communities in the US:



- Displacement, Relocation, and Human Rights." *Climatic Change* 120 (2013): 601-614. doi: 10.1007/s10584-013-0746-z.
- Kowalski, Megan. "Rising seas threaten national landmarks on the Chesapeake Bay." *Sea Level Rise in Maryland*, 2013. <http://cnsmaryland.org/sealevelrise/?p=131>.
- Lambert, Audrey M. *The Making of the Dutch Landscape: an historical geography of the Netherlands*. New York: Seminar Press LTD, 1971.
- Lecocq, Frank, and Zmarak Shalizi. *Balancing Expenditures on Mitigation of and Adaptation to Climate Change: An Exploration of Issues Relevant to Developing Countries, Policy Research Working Paper 4299*. Washington, DC: The World Bank Development Research Group, August 2007. [http://www-wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/2007/08/02/000158349\\_20070802095523/Rendered/PDF/wps4299.pdf](http://www-wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/2007/08/02/000158349_20070802095523/Rendered/PDF/wps4299.pdf).
- Longo, Gianni, Jean Tatge, and Lois Fishman. *Learning from Galveston*. New Brunswick, NJ: Institute for Environmental Action, 1983.
- Lowe, Claire. "Ocean City to homeowners: Put garages under elevated homes." *Ocean City Gazette*, August 23, 2013. <http://www.shorenwstoday.com/snt/news/index.php/ocean-city-general-news/43121-ocean-city-to-homeowners-put-garages-under-elevated-homes.html>.
- Marzeion, Ben, and Anders Levermann. "Loss of Cultural World Heritage and Currently Inhabited Places to Sea-level Rise." *IOP Science: Environmental Research Letters* 9 (March 2014): 034001. doi:10.1088/1748-9326/9/3/034001.
- Mason, Randall. "Fixing Historic Preservation: A Constructive Critique of 'Significance.'" *Places, A Forum of Environmental Design* 16.1 (2004): 64-71.
- Mississippi Development Authority. "Elevation Design Guidelines for Historic Homes in the Mississippi Gulf Coast Region." <http://www.msdisasterrecovery.com/documents/MDA%20EDG%20Final%20110308.pdf>
- Moench, Marcus. "Adapting to Climate Change and the Risks Associated with Other Natural Hazards: Methods for Moving from Concepts to Action." In *The Earthscan Reader on Adaptation to Climate Change*, edited by E. Lisa F. Schipper and Ian Burton, 249-282. London: Earthscan, 2009.

- Morgan, David W., Nancy I. M. Morgan, and Brenda Barrett. "Finding a Place for the Commonplace: Hurricane Katrina, Communities, and Preservation Law." *American Anthropologist* 108-4 (2006): 706-718.
- Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change. *Assessing the Costs and Benefits of Adaptation Options: An Overview of Approaches*. Bonn, Germany: United Nations Framework Convention on Climate Change, 2011.
- Nakashime, Douglas Jennifer Rubis, Ameyali Ramos Castillo, Kirsty Galloway McLean and Hans Thulstrup. *Weathering Uncertainty: Traditional Knowledge for Climate Change Assessment and Adaptation*. Paris: UNESCO and UNU, 2012.
- National Alliance of Preservation Commissions. "Commission Profile: Beach Haven, NJ." *The Alliance Review* (November-December 2013): 14-16.
- National Flood Insurance Program Regulations (44CFR65.10).  
<http://www.gpo.gov/fdsys/pkg/CFR-2002-title44-vol1/pdf/CFR-2002-title44-vol1-sec65-10.pdf>.
- National Oceanic and Atmospheric Administration (NOAA). *Adapting to Climate Change: A Planning Guide for State Coastal Managers*. Silver Spring, MD: NOAA Office of Ocean and Coastal Resource Management, 2010.
- NOAA Coastal Service Center. "Sea Level Rise and Coastal Flooding Impacts."  
<http://csc.noaa.gov/slr/viewer/>.
- National Park Service (NPS). *National Park Service Climate Change Response Strategy*. Fort Collins, CO: National Park Service Climate Change Program, 2010.
- \_\_\_\_\_. "National Register of Historic Places." <http://www.nps.gov/history/nr/>.
- \_\_\_\_\_. "The Secretary of the Interior's Standards."  
<http://www.nps.gov/hps/tps/standguide/index.htm>.
- National Research Council. *Adapting to the Impacts of Climate Change*. Washington, DC: The National Academies Press, 2010.
- Natural Lands Trust, Inc. *Downe Township, NJ: Helping a Delaware Bayshore community adjust to climate change*. Millville, NJ: U.S. Environmental Protection Agency and the William Penn Foundation, 2013.

- Nelson, Donald R. "Conclusions: Transforming the world." In *Adapting to Climate Change: Thresholds, Values and Governance*, edited by W. Neil Adger, Irene Lorenzoni, and Karen L. O'Brien, 491-500. Cambridge: Cambridge University Press, 2009.
- New Jersey Department of Environmental Protection. "Flood Elevation FAQs: New Jersey's Emergency Flood Elevation Rule." February 12, 2013.  
<http://www.nj.gov/dep/special/hurricane-sandy/docs/abfes-faq-20130212.pdf>.
- New York-Connecticut Sustainable Communities Consortium. *Coastal Climate Resilience: Urban Waterfront Adaptive Strategies*. New York: HUD Sustainable Communities Regional Planning Grant and the City of New York, 2013.  
[http://www.nyc.gov/html/dcp/pdf/sustainable\\_communities/urban\\_waterfront.pdf](http://www.nyc.gov/html/dcp/pdf/sustainable_communities/urban_waterfront.pdf).
- Nicholson-Cole, Sophie, and Tim O'Riordan. "Adaptive governance for a changing coastline: science, policy and publics in search of a sustainable future." In *Adapting to Climate Change: Thresholds, Values and Governance*, edited by W. Neil Adger, Irene Lorenzoni, and Karen L. O'Brien, 368-383. Cambridge: Cambridge University Press, 2009.
- Nuckols, William H, Peter Jonston, Daniel Hudgens and James G. Titus. "Maryland." In *The Likelihood of Shore Protection along the Atlantic Coast of the United States, Volume 1: Mid-Atlantic*, edited by James G. Titus and Daniel Hudgens, 511-662. Washington, DC: U.S. Environmental Protection Agency, 2010.
- Nutt, Amy Ellis. "Hurricane Sandy's Impact on South Jersey: A Precarious Situation That's Only Likely to Get Worse." *NJ.com*, October 25, 2013.  
[http://blog.nj.com/ledgerupdates\\_impact/print.html?entry=/2013/10/hurricane\\_sandy\\_impact\\_on\\_south\\_jersey\\_a\\_precarious\\_situation\\_thats\\_only\\_likely\\_to\\_get\\_worse.html](http://blog.nj.com/ledgerupdates_impact/print.html?entry=/2013/10/hurricane_sandy_impact_on_south_jersey_a_precarious_situation_thats_only_likely_to_get_worse.html).
- O'Brien, Karen L. "Do values subjectively define the limits to climate change adaptation?" In *Adapting to Climate Change: Thresholds, Values and Governance*, edited by W. Neil Adger, Irene Lorenzoni, and Karen L. O'Brien, 164-180. Cambridge: Cambridge University Press, 2009.
- O'Brien, Karen L., and Robin M. Leichenko. "Double Exposure: Assessing the Impacts of Climate Change within the Context of Economic Globalization." In *The Earthscan Reader on Adaptation to Climate Change*, edited by E. Lisa F. Schipper and Ian Burton, 323-344. London: Earthscan, 2009.

- Oliver-Smith, Anthony. "Climate Change and Population Displacement: Disasters and Diasporas in the Twenty-First Century." In *Anthropology and Climate Change: From Encounters to Actions*, edited by Susan A. Crate and Mark Nuttall. Walnut Creek, CA: Left Coast Press, Inc., 2009.
- Parry, M. L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden, and C.E. Hanson, ed. *Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge: Cambridge University Press, 2007.
- Parry, Martin, Nigel Arnell, Pam Berry, David Dodman, Samuel Fankhauser, Chris Hope, Sari Kovats, Robert Nicholls, David Satterthwaite, Richard Tiffin, Tim Wheeler. *Assessing the Costs of Adaptation to Climate Change: A Review of the UNFCCC and Other Recent Estimates*. London: International Institute for Environment and Development and Grantham Institute for Climate Change, 2009.
- Peloso, Margaret E. "Rebuilding from Superstorm Sandy: Signs of Climate Adaptation?" *Vinson&Elkins*, October 29, 2013.  
<http://climatechange.velaw.com/RebuildingfromSuperstormSandySignsClimateAdaptation.aspx>.
- Penton, Kevin. "Highlands officials propose raising entire town 11 feet in \$200M post-Sandy project." *Asbury Park Press*, August 8, 2013.  
<http://www.app.com/article/20130807/NJNEWS/308070114/Highlands-elevation>.
- Perch-Nielsen, Sabine L., Michele B. Battig, and Dieter Imboden. "Exploring the link between climate change and migration." *Climatic Change* 91 (2008): 375-393. doi: 10.1007/s10584-008-9416-y.
- Piniat, Elaine. "Rising Costs Have Sandy Victims Contemplating Walking Away." *Ocean City Patch*, April 27, 2013. <http://oceancity.patch.com/groups/editors-picks/p/rising-costs-have-sandy-victims-contemplating-walking142c46c1a>.
- PlaNYC. *A Stronger, More Resilient, New York*. New York: NYC Special Initiative for Rebuilding and Resiliency, 2013.  
[http://nytelecom.vo.llnwd.net/o15/agencies/sirr/SIRR\\_spreads\\_Lo\\_Res.pdf](http://nytelecom.vo.llnwd.net/o15/agencies/sirr/SIRR_spreads_Lo_Res.pdf).
- Polefka, Shiva. "Moving Out of Harm's Way." *Center for American Progress* (2013): 1-18.  
<http://www.americanprogress.org/issues/green/report/2013/12/12/81046/moving-out-of-harms-way/>.

- Powys Whyte, Kyle. "Justice Forward: Tribes, Climate Adaptation and Responsibility." *Climatic Change* 120 (2013): 517-530. doi: 10.1007/s10584-013-0743-2.
- Redding, Lauren. "To Protect a City from Rising Seas: Build Barriers or Move." *Sea Level Rise in Maryland*, 2013. <http://cnsmaryland.org/sealevelrise/?p=66>.
- Region III Climate Network Climate Adaptation Working Group. "Draft Climate Change Adaptation Implementation Plan." US Environmental Protection Agency: Mid-Atlantic Region III, 2013. <http://www.epa.gov/climatechange/Downloads/impacts-adaptation/region-3-plan.pdf>.
- Reid, Hannah, Mozaharul Alam, Rachel Berger, Terry Cannon, Saleemul Huq, and Angela Milligan. "Community-based adaptation to climate change: an overview." In *Participatory Learning and Action* 60 (2009): 11-38.
- Rockman, Marcy. "Cultural Resources and Climate Change Response" and "Revisiting the Seven Adaptation Options." Presented at the Preserving Coastal Heritage Workshop, New York, April 3-4, 2014.
- Sabbioni, C., M. Cassar, P. Brimblecombe, J. Tidblad, R. Kozlowski, M. Drdacky, C. Saiz-Jimenez, T. Grontoft, I. Wainwright, X. Arino. "Global Climate Change Impact on Built Heritage and Cultural Landscapes." In *Heritage, Weathering and Conservation*, edited by R. Fort et al., 395-401. London: Taylor & Francis/Balkema, 2006. [http://noahsark.isac.cnr.it/publications/Publication\\_3.pdf](http://noahsark.isac.cnr.it/publications/Publication_3.pdf).
- Sacramento River: A Guide to Recreation and Public Access. "Set-back levee." [http://www.sacramentoriver.org/glossary.php?glossary\\_id=66](http://www.sacramentoriver.org/glossary.php?glossary_id=66)
- Schuerman, Matthew. "It Really Does Take a Village to Rebuild After Sandy." *WNYC News*, February 10, 2014. <http://www.wnyc.org/story/it-really-does-take-a-village-to-rebuild/>.
- Scientific Expert Group on Climate Change (SEG). *Confronting Climate Change: Avoiding the Unmanageable and Managing the Unavoidable*. Washington, DC: Sigma Xi and the United Nations Foundation, 2007.
- Scott, Karen. *Measuring Wellbeing: Towards sustainability?* New York: Routledge, 2012.
- Shorto, Russell. "Water Works." *New York Times Magazine*, April 13, 2014.
- Siders, Anne. *Managed Coastal Retreat: A Legal Handbook on Shifting Development Away from Vulnerable Areas*. New York: Columbia Center for Climate Change Law, 2013.

- Simpson, Andrew G. "House Passes Flood Insurance Bill; Key Senators Sign On." *Insurance Journal*, March 4, 2014.  
<http://www.insurancejournal.com/news/national/2014/03/04/322194.htm>.
- Swim, Janet. *Psychology & Global Climate Change: addressing a multifaceted phenomenon and set of challenges*. Washington, DC: American Psychological Association Task Force on the Interface between Psychology and Global Climate Change, 2009.  
<http://www.apa.org/science/about/publications/climate-change.aspx>.
- Thornton, Thomas F., and Claudia Combetti. "Synergies and trade-offs between adaptation, mitigation and development." *Climatic Change* (September 2013): 1-14. doi: 10.1007/s10584-013-0884-3.
- Titus, James G. *Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region*. Washington, DC: U.S. Climate Change Science Program and the Subcommittee on Global Change Research, 2009.
- Titus, James G., D. E. Hudgens, D. L. Trescott, M. Craghan, W. H. Nuckols, C. H. Hershner, J. M. Kassakian, C. J. Linn, P. G. Merritt, T. M. McCue, J. F. O'Connell, J. Tanski, and J. Wang. "State and local governments plan for development of most land vulnerability to rising sea level along the US Atlantic coast." *Environmental Research Letters* 4 (2009): 1-7.
- United Nations Framework Convention on Climate Change. "An Overview of Investment and Financial Flows Needed for Adaptation." In *The Earthscan Reader on Adaptation to Climate Change*, edited by E. Lisa F. Schipper and Ian Burton, 395-438. London: Earthscan, 2009.
- University of Maryland Center for Environmental Science. "Sea level along Maryland's shorelines." *Phys.org*, June 26, 2013. <http://phys.org/news/2013-06-sea-maryland-shorelines-feet.html>.
- Van Raalten, D. *San Francisco Bay: Preparing for the next level*. San Francisco: San Francisco Bay Conservation and Development Commission, 2009.  
[www.bcdc.ca.gov/planning/climate\\_change/SFBay\\_preparing\\_%20for\\_the\\_next\\_Level.pdf](http://www.bcdc.ca.gov/planning/climate_change/SFBay_preparing_%20for_the_next_Level.pdf).
- Veerkamp, Anthony. "The Impacts of Climate Change on the Chesapeake Bay." Statement presented at the U.S. House of Representatives Committee on Natural Resources' Subcommittee on National Parks, Forests and Public Lands and the Subcommittee on Insular Affairs, Oceans and Wildlife, July 2, 2009.

<http://www.preservationnation.org/information-center/sustainable-communities/additional-resources/NTHP-Chesapeake-Bay-Climate-Change.pdf>.

Verchick, Robert R.M. and Joel D. Scheraga. "Protecting the Coast." In *The Law of Adaptation to Climate Change: U.S. and International Aspects*, edited by Michael B. Gerrard and Katrina Fischer Kuh, 235-266. Chicago: American Bar Association, 2012.

Walsh, Bryan. "Sand: What a Coastal U.S. Can Learn from Other Threatened Cities." *Time Magazine*, November 5, 2012. <http://science.time.com/2012/11/05/sandy-what-a-coastal-u-s-can-learn-from-other-threatened-cities/>.

Waugh, Jr., William L. "Management Capacity and Rural Community Resilience." In *Disaster Resiliency: Interdisciplinary Perspectives*, edited by Naim Kapucuc, Christopher V. Hawkins, and Fernando I. Rivera, 291-307. New York: Routledge – Taylor & Francis Group, 2013.

Waxman, Henry A., Bobby L. Rush, and Earl Blumenauer. *Implementing the President's Climate Action Plan: U.S. Department of the Interior*. Washington DC: United States Congress Bicameral Task Force on Climate Change, 2013.  
<http://www.whitehouse.senate.gov/download/?id=19dcfe67-2b3d-4fa6-95d5-500ddcf7c84c&download=1>.

Werz, Michael, and Laura Conley. *Climate Change, Migration, and Conflict: Addressing complex crisis scenarios in the 21<sup>st</sup> Century*. Washington, DC: Center for American Progress, 2012.

The White House. "Executive Order – Preparing the United States for the Impacts of Climate Change," November 1, 2013. <http://www.whitehouse.gov/the-press-office/2013/11/01/executive-order-preparing-united-states-impacts-climate-change#!>.

Wildcat, David R. "Introduction: Climate Change and Indigenous Peoples of the USA." *Climatic Change* 120 (2013): 509-515. doi: 10.1007/s10584-013-0849-6.

Wisconsin Emergency Management. "Mitigation Leads to Preservation and Economic Recovery for One Community: Darlington, Wisconsin."  
[http://emergencymanagement.wi.gov/mitigation/stories/hm-darlington\\_success.pdf](http://emergencymanagement.wi.gov/mitigation/stories/hm-darlington_success.pdf).

Wold, Amy. "Using local knowledge to help coastal restoration design: Planners tap knowledge of Gulf dwellers." *The Advocate*, April 8, 2013.  
<http://theadvocate.com/home/5611720-125/using-local-knowledge-to-help>.

## INDEX

- adaptation limits, 7, 22, 66, 77
- adaptive capacity, 5, 22
- climate change, 1, 7
- Community Development Block Grants, 11, 67
- community-based adaptation, 81
- Criteria for Evaluation, 9, 10, 61, 62, 70, 79
- cultural landscape, 40, 44, 62, 75
- Department of Housing and Urban  
Development, 31, 39, 67, 68, 92
- dikes, 34, 35, 37, 38, 40, 41, 42, 43, 44, 45, 75,  
*See* levees
- elevations, 21, 36, 41, 48, 51, 52, 57, 62, 63, 75
- ethics, 7, *See* justice
- Federal Emergency Management Agency, 10,  
11, 17, 21, 23, 36, 38, 39, 48, 51, 52, 53, 58,  
60, 67, 87, 88
- Hazard Mitigation Grant Program, 11, 58, 59
- integrity, 9, 19, 24, 47, 56, 61, 69, 79, 80
- justice, 1, 2, 6, 30, 40, 51, 71, 72, 81, 84
- legitimacy, 27, 76, 87, 89
- levees, 34, 36, 37, 40, 41, 42, 43, 44, 45, 75,  
*See* dikes
- livelihoods, 4, 6, 13, 23, 42, 70, 71, 72, 76
- National Flood Insurance Program, 10, 36, 37,  
38, 48, 51, 52, 53, 54, 55, 57, 63
- National Historic Preservation Act, 9, 10, 56
- National Oceanic and Atmospheric  
Administration, 2, 13, 30, 31, 33, 46, 67, 91
- National Park Service, 9, 13, 14, 18, 19, 56, 60,  
78, 91
- National Register of Historic Places, 4, 9, 10,  
79, 91
- retreat, 15, 21, 26, 31, 64, 65, 66, 72, 73, 74,  
75
- sea-level rise, 3, 95
- Secretary of the Interior's Standards, 10, 21,  
56, 57, 89, 91
- significance, 9, 17, 18, 20, 26, 57, 61, 70, 79
- sustainability, 5, 21, 23, 30, 56, 57, 69, 72, 78,  
81, 84, 89, 94
- Traditional Ecological Knowledge, 82, 83
- Traditional Cultural Properties, 41, 78
- values, 1, 6, 7, 22, 23, 26, 30, 32, 34, 41, 55, 67,  
69, 75, 76, 80, 81, 83, 84, 92
- vulnerability, 7, 12, 13, 15, 22, 28, 85, 86, 88,  
91
- vulnerable, 10, 12, 13, 22, 24, 27, 40, 44, 47,  
51, 64, 66, 72, 75, 76, 81, *See* vulnerability