

CLIMATE CHANGE AND CULTURAL LANDSCAPES

A GUIDE TO RESEARCH, PLANNING, AND STEWARDSHIP



Cover photographs (front and back):

The elevation of the buildings at Portsmouth Village, at Cape Lookout National Seashore in North Carolina, are situated on the land 1m below sea level.

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CLIMATE CHANGE AND CULTURAL LANDSCAPES: A GUIDE TO RESEARCH, PLANNING, AND STEWARDSHIP



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Storm surge levels marked inside a building in Portsmouth Village, North Carolina. All storm events have occurred since 2003.

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Once an extensive source of shade throughout Shenandoah National Park, many eastern hemlock trees have died. The spread of the culprit, a pest known as the hemlock wooly adelgid, has been fostered by changing climate patterns.

PREFACE

Cultural landscapes, like all cultural resources, continue to experience the many impacts of projected climate change. Such valued places benefit from a concerted effort to understand these impacts and respond to the management challenges of protecting them now and for future generations. This requires a team that integrates a diverse range of skills, including those of cultural landscape specialists, climate scientists, historic preservationists, ecologists, biologists, resource managers, historical architects, material conservators and others; theirs is the task to directly tackle what may often be an uncomfortable level of uncertainty. The National Park Service, through its Climate Change Response Program and its Cultural Landscapes Program, plays a leading role in developing and testing creative tools and models to support this effort, as anchored in cultural resource management policy and protocol. It is, and must be, an on-going, dynamic process, with foundational insights derived from careful efforts, reports and models fostered by those programs. Their investment forms an indispensable part of cultural landscapes' shared legacy.

The intended audience for this Guide includes managers of cultural landscapes facing projected climate change impacts at all levels. The following pages offer ideas to engage this challenge, whether within or beyond the National Parks. The first step, as shown in the following pages, is to understand and document the existing system of a cultural landscape's significant features, including buildings and structures. Although beyond the explanatory scope addressed here, an understanding of a cultural landscape's history and condition – as established in a Cultural Landscape Inventory and/or Cultural Landscape Report – remains a necessary starting point for this process.

Appreciation is extended to the NPS Cultural Landscapes Program, both nationally and in the Pacific West Region; the NPS Climate Change Response Program; and the NPS Associate Director, Cultural Resources, Partnerships, and Science. Very special thanks to the NPS National Center for Preservation Technology and Training for financial support and flexibility, as well as the University of Oregon Office of the Vice President for Research and Innovation.

A number of colleagues and research assistants have also offered sage advice and welcome critique. They are listed in the Acknowledgments, and have our sincere thanks.



Scotty's Castle Historic District, in Death Valley National Park, has experienced the effects of climate change in the form of more frequent storms. The route into Grapevine Canyon, closed by severe damage in the October 2015 flood event, is vital both for visitor and emergency access to the site, and forms a part of the historic Bonnie Clare Road cultural landscape.

INTRODUCTION

Cultural landscapes reveal the history of human relationships with the land and its natural systems, and a wide variety of cultural traditions, habits and practices. These places are reminders of individual and societal actions that have shaped the American story and our understanding of the endless large and small ways in which our decisions – whether daily, seasonally, yearly or across generations – have created, altered and affected these places that we value for their meaning and significance. Cultural landscapes, at the intersection of human and natural processes, remind us where we are—both in time and space.

As the impacts of climate change become more and more evident, however, the effects on cultural landscapes require a concerted effort to understand and address the changes already underway. Moreover, they prompt the development of appropriate strategies and responses for those not yet visible.

Now and in future there is a need for guidance and direction to address impacts on many significant cultural landscapes throughout our national parks. This guide is intended to assist National Park Service superintendents, resource managers, partners, communities and other on-site decision-makers to identify, evaluate and respond to the effects of climate variables on identified cultural landscapes within NPS units. It follows the NPS Cultural Resources Climate Change Strategy (2016), and is intended to augment that strategy by focusing in greater detail on cultural landscapes.

In the National Park Service, the study of a shifting climate is a multidisciplinary “stewardship science” that involves biophysical, socioeconomic, and cultural disciplines. Stewardship science considers national parks and surrounding areas as integrated human-ecological systems and focuses on ecosystem, landscape, and regional scales, designed to inform natural and cultural resources and facility management. Key elements include the synthesis of existing information, research, inventory and monitoring, and delivery of relevant information to managers and stakeholders to support decision-making. That approach demonstrates four overarching goals: connecting impacts and information; understanding scope; integrating practice; and learning and sharing. This new work builds on those goals, and is intended to support NPS personnel and others in addressing the many ways in which climate change variables are now altering cultural landscapes, underlining the development of research, planning and stewardship options (see *Director’s Policy Memo 14-02*, Appendix B).

What follows is a framework for making informed decisions; it is not a checklist or menu. The process illustrated throughout the guide anticipates that site managers will work in close coordination with other NPS personnel, including superintendents, regional directors, the Climate Change Adaptation Coordinator for Cultural Resources, the Park Cultural Landscape Program Manager, and the Associate Director, Cultural Resources, Partnerships, and Science.



Saint-Gaudens National Historic Site, located near Cornish, New Hampshire, is projected to experience a substantial shift in average seasonal temperatures, as well as dramatic increase in precipitation. These changes directly affect vegetation at Saint-Gaudens, including the prominent allée of paper birch trees as a significant cultural resource.

This guide is organized around a Decision Tree, which models a core process for addressing the impacts of climate change on cultural landscapes. It is organized on three planning themes: research, planning and stewardship. Each section of the Decision Tree includes recommended tools and resources. Each section includes cultural landscapes examples, demonstrating how that step is adapted to different types of cultural landscapes in various ecological zones.

While the Decision Tree is presented in a linear mode, the process in the field is often cyclical and even repetitive. It requires that management and research teams assess the current state of information about a cultural landscape and climate variables, and then adjust the core process to meet the resource needs.

As with all cultural resources within the National Park System, cultural landscapes face many issues, including the need for in-depth research, preservation planning and resource stewardship. Affecting all of these issues are the impacts of projected climate change variables that require specific attention. Climate change science reveals that impacts, while systemically global, affect different ecoregions in specific ways, at both the macro and micro scales. This includes the most recognizable impacts, such as sea-level rise at Portsmouth Village, at Cape Lookout National Seashore in North Carolina, to the more subtle ones, such as the shifting ecosystem due to changing growing seasons and precipitation patterns at Saint-Gaudens National Historic Site in New Hampshire.

Each cultural landscape will be threatened by specific climate change impacts, requiring management decisions and actions that respond to trends and events as well as the park's legislative mandate, management strategy, resource priorities, budget realities, staff expertise, and visitor access.

The challenge is to develop management strategies, actions, treatments and interventions that respond to climate change impacts for specific landscapes, while upholding NPS policies and legislative mandates. This guide provides a framework for managers to develop action plans to make informed decisions about specific cultural landscapes.



Babb Cemetery
Cape Lookout National Seashore
Portsmouth Village, NC



Lava rock construction
Pu'ukohola Heiau NHS
Kawaihae, HI



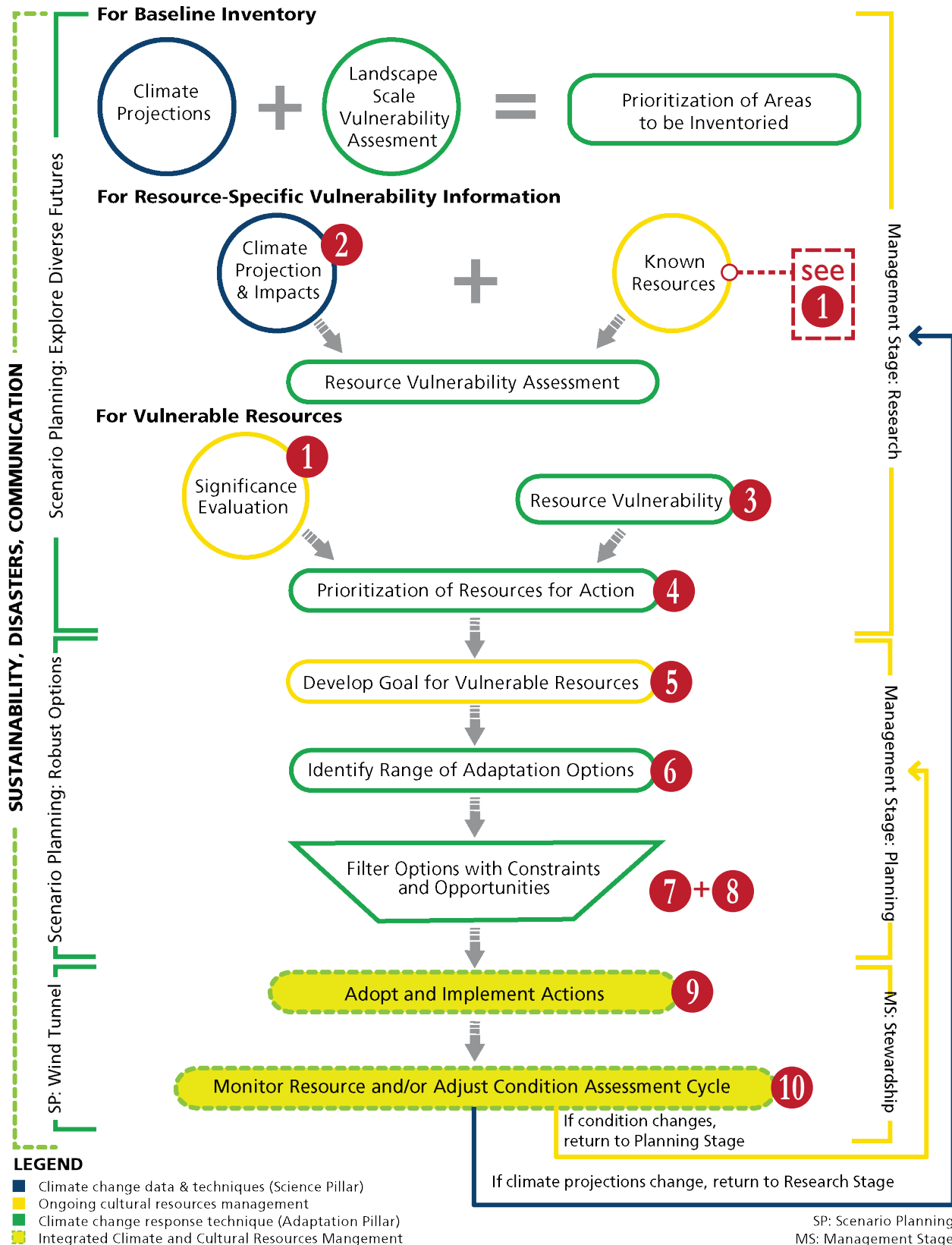


Reconstructed windmill
John Muir NHS
Martinez, CA

THE DECISION-MAKING PROCESS: RESEARCH, PLANNING, AND STEWARDSHIP

An informed approach to addressing climate change impacts on cultural landscapes draws on a number of foundational understandings from several fields of knowledge. Together, they form a parallel process, engaging both cultural landscape information and climate science data to equip landscape managers. Decision-making is divided into three broad phases: research, planning, and stewardship. These phases are delineated in the 2006 NPS Management Policies for cultural resources, which underscore the importance of fostering ongoing, cooperative work and broad dissemination of knowledge among park stewards.

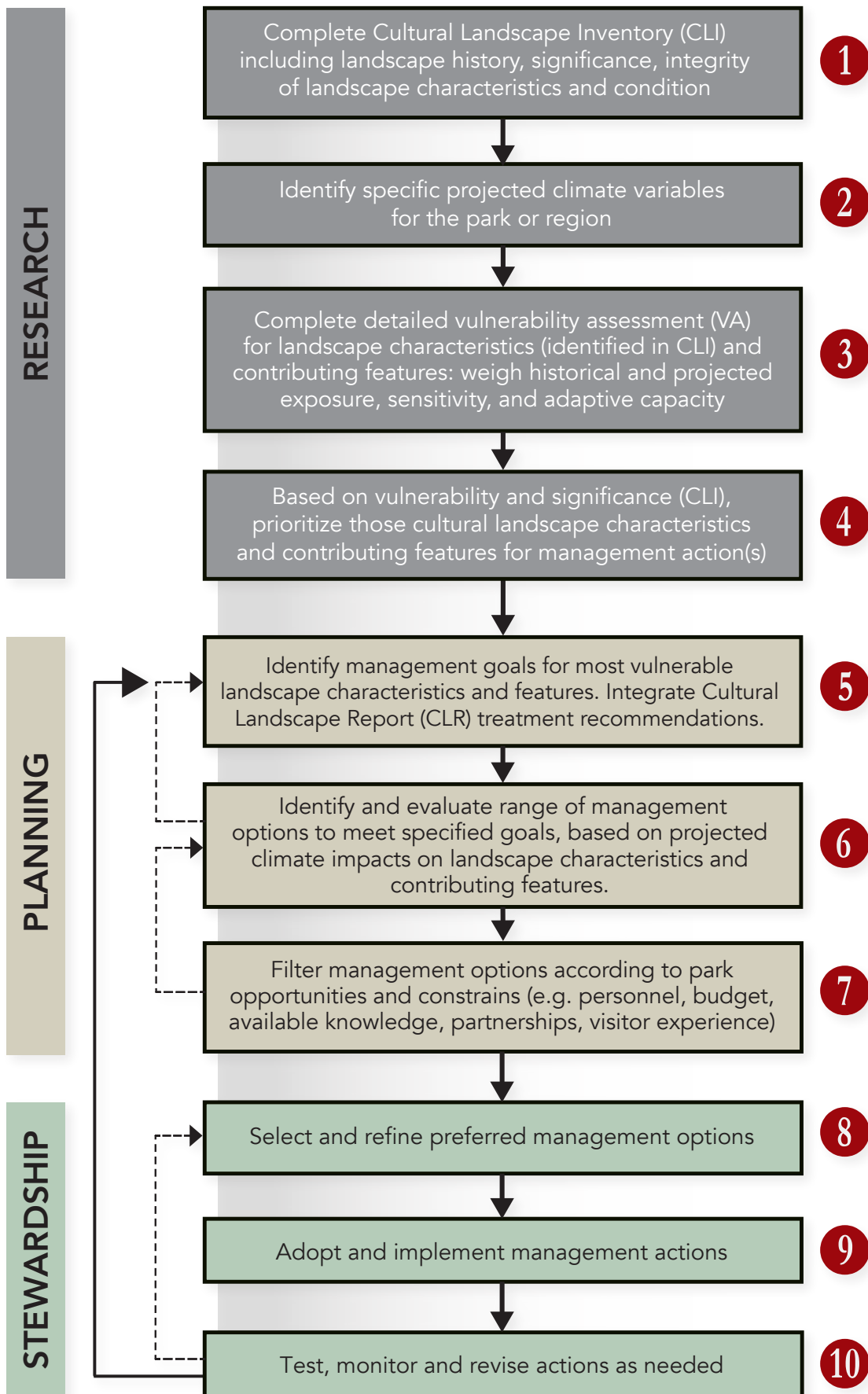
- *Research* includes gathering a body of longterm knowledge about the significant cultural landscape as well as climate data for the locale and its eco-region. This phase employs well established NPS policies, procedures, and techniques to better understand the cultural landscape and those who have shaped it. Together, these two sets of information (specific to the cultural landscape and to relevant climate variables) provide the basis for a vulnerability assessment, that further informs management adaptation options.
- The *Planning* phase includes determining management goals for cultural landscape preservation practice, the development and evaluation of a range of management options, and assessing those options in the context of other management opportunities and constraints, such as budget, personnel, and visitor experience.
- *Stewardship* encompasses the long term care given a cultural landscape through implementing, testing, evaluating and revising preferred options. Testing may also result in modification of management goals.

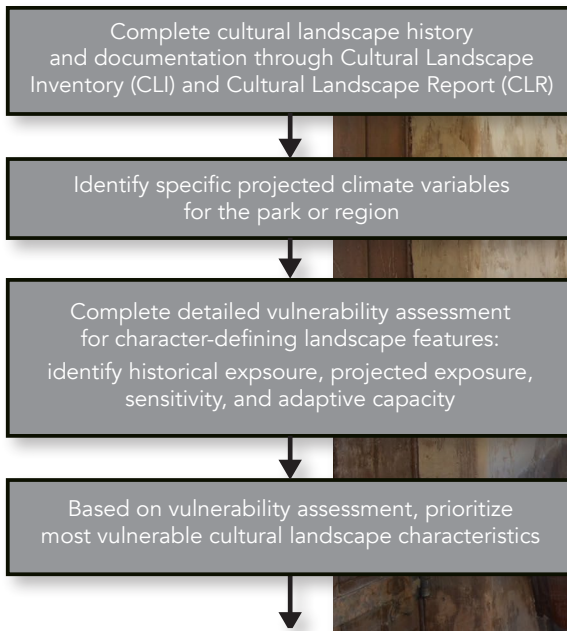


The NPS Cultural Resources Climate Change Strategy (CRCCS) [Rockman et al, 2016] outlines a process for integrating climate change across major stages of cultural resources management, *above*.

The Climate Change and Cultural Landscapes decision tree, *opposite*, expands on these stages in detail for cultural landscapes. Numbered symbols indicate connections between the stages in each chart.

CLIMATE CHANGE AND CULTURAL LANDSCAPES





Researchers review post-flood conditions at Scotty's Castle, Death Valley National Park

The cultural landscape should be identified and a cultural landscape inventory (CLI) or a cultural landscape report (CLR) completed. This information forms the basis for making and implementing management decisions. This will also include a condition assessment, and the evaluation of the current state of character-defining features within the landscape.

Additionally, climate data for the landscape should be collected and organized, including historic climate data, climate projections and climate variable impacts, both known (historic) and anticipated (future), on the cultural landscape. This requires understanding the climate projections for a landscape's eco-region, and anticipating, to the extent possible, the broad impacts of those projections. For example, a region may have a gradual increase in average temperature and a gradual reduction in precipitation. The impact of these projections on a given agricultural landscape might include increased drought conditions and, in turn, additional stress on native plant communities along with traditional crops.

The vulnerability assessment anticipates the broad impact of climate change projections on the cultural landscape's character-defining features, identifying, to the best extent possible, those character-defining resources that are most likely to be seriously impacted by climate variables. Understanding a landscape's vulnerability requires four components: its historic climate data; projected climate data; sensitivity of character-defining landscape features to climate data (historic and projected); and their adaptive capacity.

It is important to differentiate between a feature's adaptive capacity and

management adaptation options, as described in the Planning phase.

The vulnerability assessment is expressed in the following format:

$$(\text{historic exposure} + \text{projected exposure}) \times \text{sensitivity} \times (\pm \text{adaptive capacity}) = \text{vulnerability}$$

In this equation, *historic exposure* includes data about past climate trends and events, and the historic rate of variation. *Projected exposure* models the latest projections of anticipated shifts in climate variables including temperature, precipitation and sea level rise, and other projected changes, such as storm frequency and severity, drought, and wind patterns. Within the cultural landscape, each character-defining feature has a unique level of *sensitivity* to the projected climate variables. In contrast, *adaptive capacity* can be understood as natural ability of that feature to respond to the variables. This is particularly important for some vegetation, for example, but may not always be applicable.

GUIDING CONSIDERATIONS

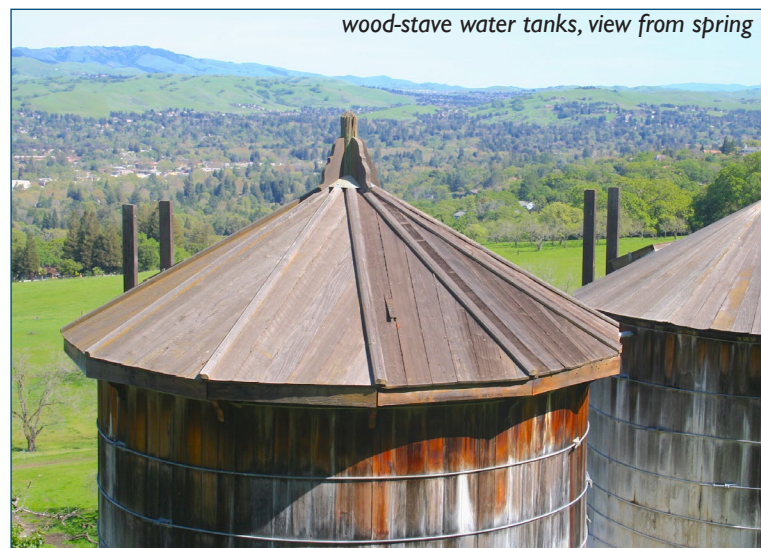
- Gather complete cultural landscape history and detailed documentation. Is there a recently completed CLI and/or CLR?
- Identify historic climate data and specific projected climate variables for the park and region. Has the Climate Change Response Program completed a climate brief for the park? Are there other sources for relevant climate data?
- Identify past climate-related hazards (erosion, flood, fire, etc.) and projected climate variables / impacts for the park or region. What is the historic range of variation (HRV) for the park's climate, and how is that projected to change in the future? How sensitive are the character-defining features to the projected climate variables, and what is the adaptive capacity for each? What uncertainties can be identified or described?
- Determine range of expertise needed based on type of sensitive or vulnerable character-defining cultural landscape features. (e.g. geology, horticulture, fluvial geomorphology, traditional craftsmanship, structural or civil engineering, etc.)



Ornamental vegetation and brick paving, southeast corner of Tao House courtyard (Spring 2016)



Tao House, view from courtyard gate



wood-stave water tanks, view from spring

EUGENE O'NEILL NATIONAL HISTORIC SITE

The 13.19 acre Eugene O'Neill National Historic Site is situated within the foothills of Las Trampas at 700' elevation, at the western edge of the city of Danville, California. Projected changes in precipitation and temperature underscore the need to examine the site's sources of historic significance through the lens of climate trends, such as ongoing moisture stress. The Cultural Landscape Inventory (2003) identified a suite of these features:

Natural Systems and Features:

natural topography of Las Trampas, and the presence of a spring located just above the building complex, which supplied water to the property.

Spatial Organization:

several distinct areas surrounding the Tao House: the entry road and turnaround, formal gardens surrounding this building (including the courtyard) and the arrangement of the buildings, fruit and nut orchards, and open fields (managed as pasture by East Bay Regional Park District).

Buildings and Structures:

all but one of the original buildings and structures built between 1937 and 1944 remains.

Circulation:

entry drive (Kuss Road and the turnaround); fire road; road to the swimming pool; brick walkways surrounding the Tao House and within the courtyard.

Small Scale Features:

brick bench near the chicken coop, bird bath in the courtyard, Blemie's grave stone, gateposts, and the garbage enclosure on the north side of the house.

Views and Vistas:

views from the Tao House remain of San Ramon Valley and Mount Diablo; courtyard views of the bird bath, pathways, and flowers as focal points in the garden.

Vegetation:

ornamental trees and shrubs and orchard trees can be found throughout the historic site; contributing orchard trees are found in the walnut orchard, the almond orchard, and the fruit orchard on the north side of the Tao House.



east orchard, view from O'Neill study





Coconut palms near shoreline, view north



Pu'ukohola Heiau, view east (note goats on heiau walls)

PU'UKOHOLA HEIAU NATIONAL HISTORIC SITE

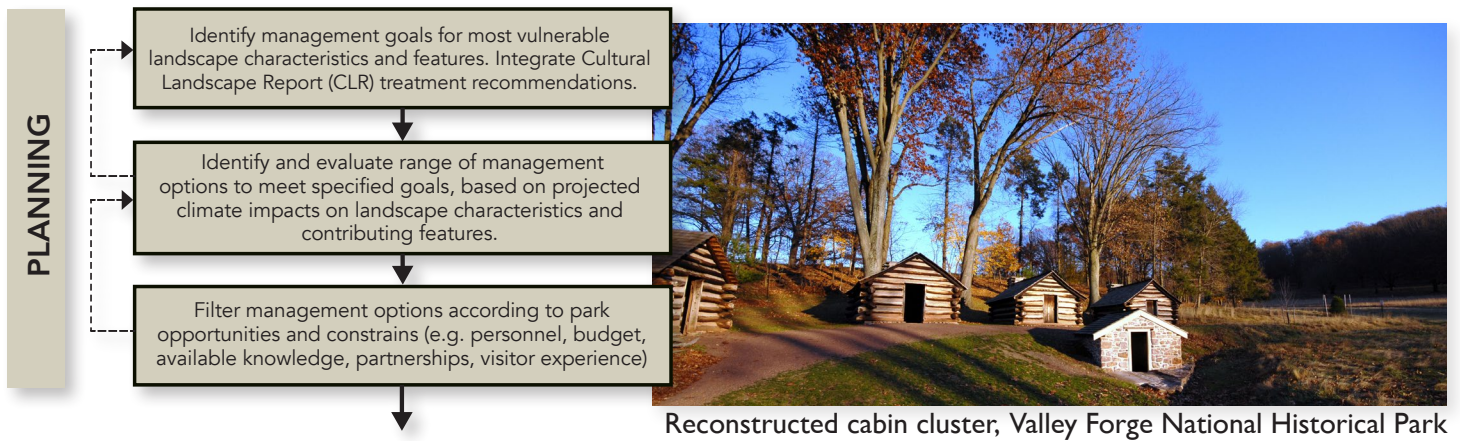
Spanning 86.24 acres, Pu'ukhola Heiau is located on the Island of Hawai'i on the northwest coast above Kawaihae Bay. The heiau was built for King Kamehameha the Great between 1790 to 1791. This sacred temple site was constructed using traditional techniques: native craftsmen placed lava rocks without the use of mortar, cement, or any other bonding materials.

Vulnerability analysis revealed that some character-defining landscape features are susceptible to sea-level rise, especially a stand of coconut palm trees (*Cocos nucifera*), on the site's west shore. An invasive pest, the Asiatic or coconut rhinoceros beetle (*Oryctes rhinoceros*) also poses a threat to this feature, along with trunk and heart rot (both fungal diseases). Native pili grass remains susceptible to drought, in addition to the population of non-native buffalograss, which was introduced in the 1930s as cattle forage.

Overall, the cultural landscape is vulnerable to coastal flooding, erosion from waves and storm surges, and damage caused by hydrologic flooding from Makahuna Gulch. Non-native goats continue to threaten the heiau and other structures, which in recent years climb these built features, in turn causing damage to the rockwork. Potential climate impacts to other archeological sites and petroglyphs remain undetermined.



NPS staff discuss landscape inventory updates



The Planning phase includes the development and evaluation of management adaptation options for long-term trends and events.

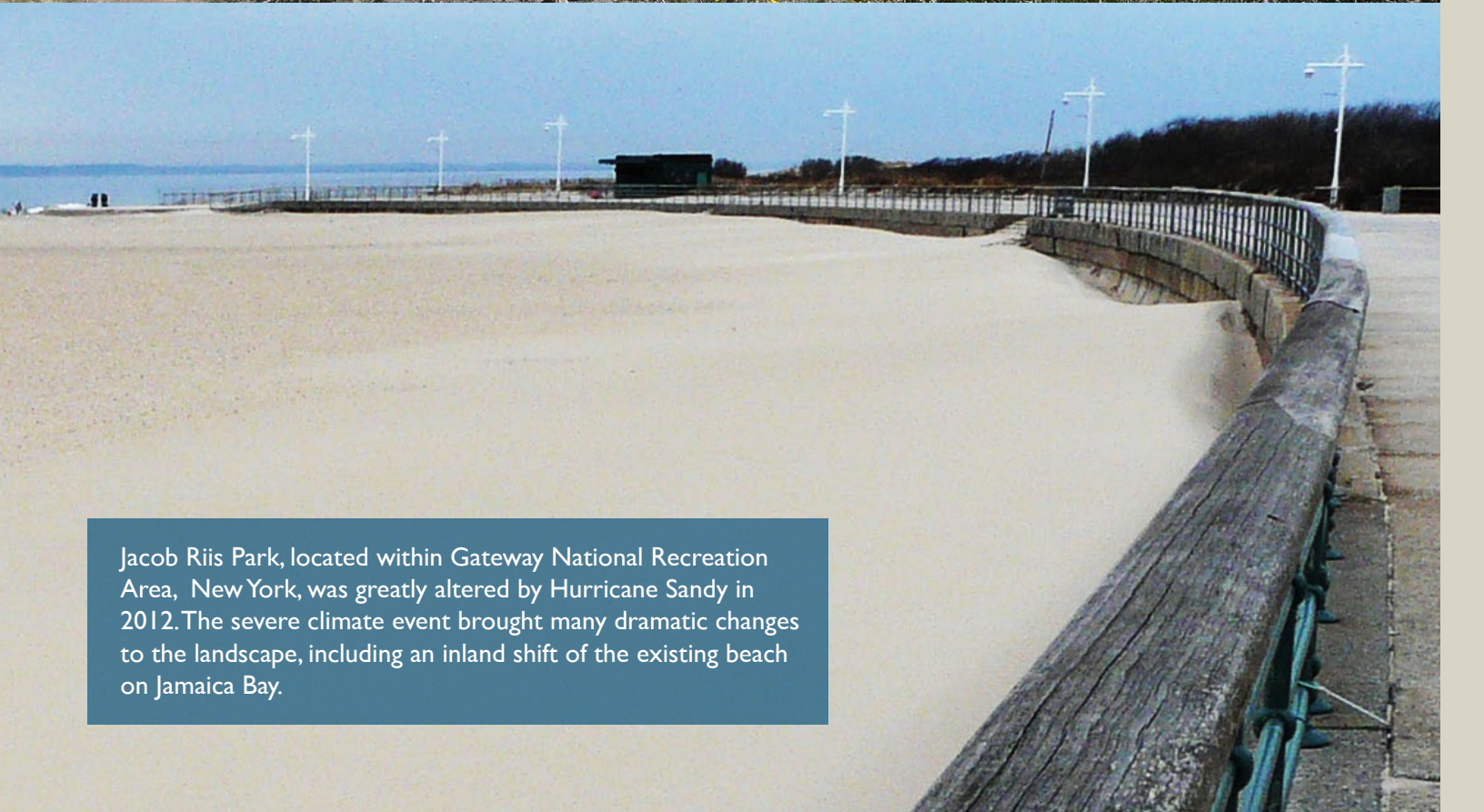
Consideration should be given to other factors, such as budget, personnel, legislative mandates, research capacity, and current knowledge base. The development of adaptation options cannot be achieved in isolation from other park circumstances, and should be incorporated into existing NPS policies and procedures. As a result, management options require that a level of flexibility be incorporated into plans to address specific climate change impacts.

GUIDING CONSIDERATIONS

- Determine that the cultural landscape is *not* in immediate danger of negative impact, and take no action.
- Attempt to mitigate the climate change impact through action off site from the significant cultural landscape, thereby offsetting the direct impact on the landscape.
- Improve cultural landscape resilience by making compatible alterations and additions that meet the *Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for the Treatment of Cultural Landscapes*. Climate resilience can be generally defined as the capacity to, first, absorb stresses and maintain landscapes function in the face of external stresses imposed by climate change; and, second, adapt and evolve in order to improve the sustainability of the cultural landscape, leaving it better prepared for future climate change impacts.
- Allow change to occur in the cultural landscape, attempting to limit the impact on some character-defining features that are high priority and have higher feasibility for preservation.
- Allow the resource to deteriorate, without intervention. Take no adaptation action. Undertake extensive and detailed landscape documentation and data recovery. This may be considered “landscape hospice”-- caring for the cultural landscape in the best way possible without taking extreme steps to save it.

A wide-angle photograph of the Scotty's Castle Historic District in Death Valley National Park. The castle, a large stone structure with multiple towers and a central spire, sits atop a hill. It is surrounded by several smaller buildings with red-tiled roofs. The landscape is arid, with sparse desert vegetation and sand dunes in the foreground. In the background, rugged, layered mountains rise under a clear blue sky.

Cultural resource managers at Death Valley National Park today grapple with soil erosion in the canyon walls surrounding Scotty's Castle Historic District, among other impacts linked to flood. A rare wildflower "superbloom" prompted a recent tourist influx in the park, yet damage estimated above \$20M has closed access to district through 2019.

A photograph of Jacob Riis Park, showing a wide, sandy beach in the foreground. A wooden boardwalk with a metal railing runs along the right side of the beach. In the background, the ocean is visible under a clear blue sky. Several white poles with cross-arms are spaced along the boardwalk. A small, dark building is situated near the water's edge.

Jacob Riis Park, located within Gateway National Recreation Area, New York, was greatly altered by Hurricane Sandy in 2012. The severe climate event brought many dramatic changes to the landscape, including an inland shift of the existing beach on Jamaica Bay.



Douglas fir seedlings continue to encroach into Elk Camp prairie, blurring its historic edge



Bald Hills Road, view northwest from Schoolhouse Peak



NPS staff and researchers discuss fire ecology at Elk Camp

LYONS RANCHES HISTORIC DISTRICT

The Lyons Ranches Historic District is located within the Bald Hills of Redwood National Park, Humboldt County, California, and is set among the upland prairies, oak woodlands, and conifer forest of the Redwood Creek watershed. The 5,660-acre district is comprised of a series of eight prairies and the features within these prairies, surviving from the Lyons family sheep ranching era after 1868. The eight character-defining prairies of the district extend approximately six miles along the Bald Hills Road, with each prairie no more than a mile distant from the next.

Recent climate trends in temperature and precipitation have resulted in a number of threats to this cultural landscape: increased fire danger due to longer periods of drought; reduction of prairie size and declining edge integrity due to Douglas fir encroachment and invasive species; erosion hazards linked to flash flood conditions; and vulnerability of buildings to high winds and storms.

A prairie management plan, including use of prescribed burns, has been implemented by the park, in addition to continued monitoring for other related impacts.

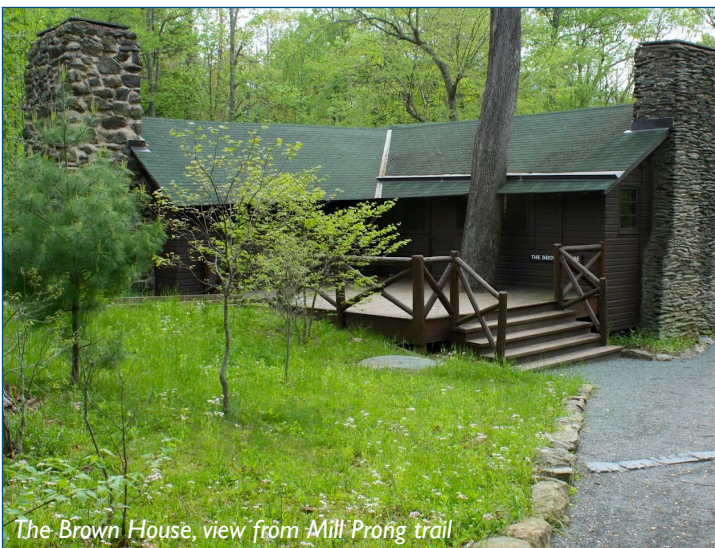


bunkhouse at Home Place ranch





Loss of



The Brown House, view from Mill Prong trail



Severe eastern hemlock mortality throughout the park

RAPIDAN CAMP NATIONAL HISTORIC LANDMARK DISTRICT

Rapidan Camp is the former retreat and “summer White House” of President Herbert Hoover, situated on a level area of land at the headwaters of the Rapidan River, in a remote and rugged area of Shenandoah National Park in Madison County, Virginia. The site, a designated National Historic Landmark also known as Camp Hoover, today encompasses approximately 106 acres and is accessed by Rapidan Fire Road, which connects to Skyline Drive at Big Meadows.

A Cultural Landscape Report (2014, *below*), prepared by the Olmsted Center for Landscape Preservation, directly addressed the loss of character-defining eastern hemlock trees dating to the period of significance (1925-1949). Since the mid-1990s, storm events, diseases, and pests, especially the woolly adelgid (*Adelges tsugae*), have caused a dramatic loss of the towering hemlocks and other trees that shaded the site. Considerably more sunlight now characterizes this landscape, along with increased understory vegetation growth where none existed during the Hoover era.

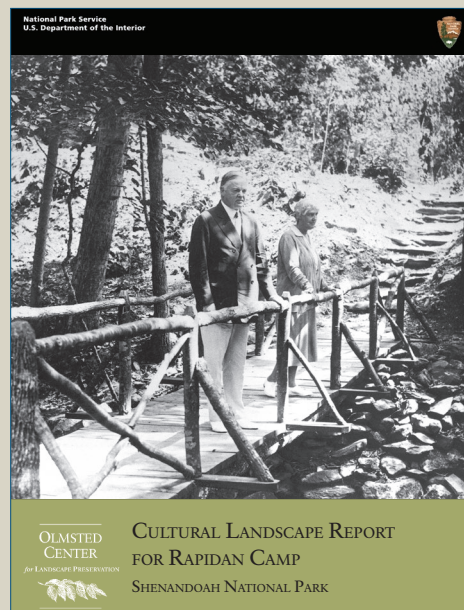
The CLR proposed a complex, multi-year plan to reestablish the historic landscape character: planting fast-growing (but short lived) trees to block the sun and limit understory vegetation. Eventually, these temporary plantings will be replaced with adelgid-resistant hemlock varieties.



of shading has resulted in continued change in the forest understory

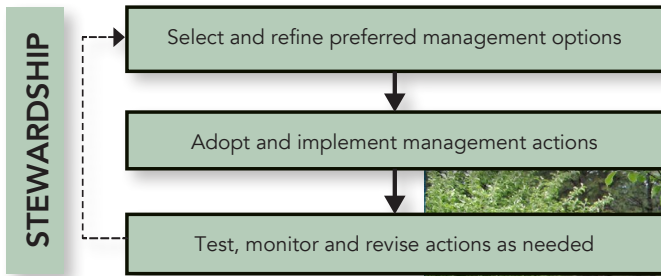


Outdoor fireplace (photo: NPS/SHEN, 2017)



OLMSTED
CENTER
for LANDSCAPE PRESERVATION

CULTURAL LANDSCAPE REPORT
FOR RAPIDAN CAMP
SHENANDOAH NATIONAL PARK



Orchardist Laurie Thompson examines prunings for signs of powdery mildew (caused by the fungus *Podosphaera leucotricha*) in historic fruit trees, part of regular monitoring practiced at Buckner Homestead, in Lake Chelan National Recreation Area, North Cascades National Park.

Stewardship is the longterm care of a cultural landscape by implementing ongoing preservation maintenance activities. Physical interventions involve routine maintenance on a monthly, yearly or multi-year cycle, as well as repair and replacement in-kind of severely deteriorated character defining features. The philosophic framework for preservation maintenance is provided by the *Secretary of the Interior's Standards for the Treatment of Historic Properties* (Standards for Preservation Treatment), with *Guidelines for the Treatment of Cultural Landscapes*.

The goal of stewardship is to physically protect a cultural landscape, without attempting to arrest change. As landscapes are inherently dynamic, change is inevitable, and often even desirable. The role of stewardship is to manage change within defined parameters, as demonstrated in the Olmsted Center's *Guide to Developing a Preservation Maintenance Plan for a Historic Landscape* (see Coffin and Bellavia, 1998).

Adaptation is a specific form of stewardship (see Management Adaptation Options, p.29), intended to determine the parameters of acceptable change more broadly—allowing more change to occur. Acceptable changes remain compatible with the preservation of landscape characteristics and character-defining features to the greatest extent possible; substitutions or alterations should be designed to increase the resilience or durability of the landscape within a changing climate. The ethical framework for adaptation is anchored in

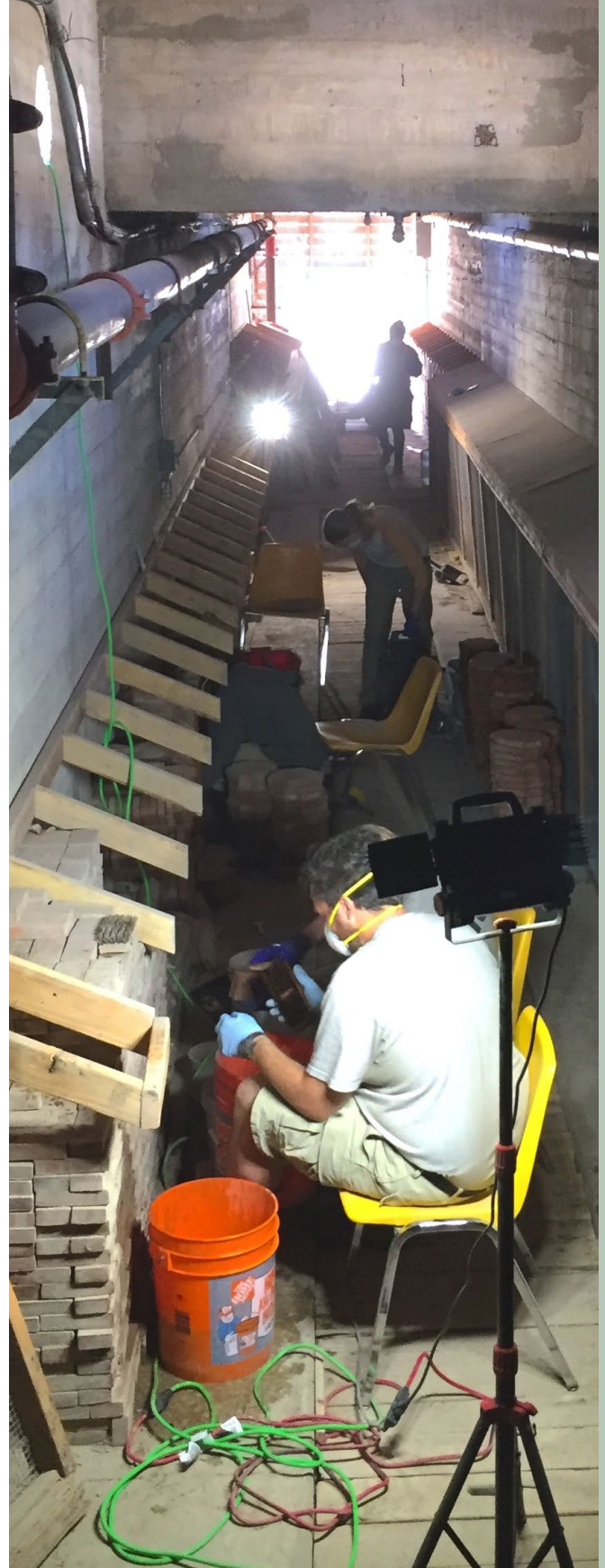
the Secretary of the Interior's Standards for Rehabilitation Treatment.

This process results in the adoption and implementation of management options, followed by diligent monitoring of the success and shortcomings of these actions over time, to inform revisions as needed. Stewardship efforts may also include the development of a new range of adaptations, depending upon the success of adopted tools.

A need for clarity in ongoing site knowledge, finally, remains implicit for effective stewardship. Current management actions, like changing conditions, are constantly becoming a part of the cultural landscape's history. While CLI and CLR formats encompass tools designed to track aspects of management history (e.g. previous treatments, recent changes in conditions), managers at all levels enrich this record through further informational techniques. What may seem like everyday decisions for current managers, thoughtfully documented, can better inform the work of future decision-makers.

GUIDING CONSIDERATIONS:

- Are previously-used treatment techniques effective within the preferred adaptation management option(s)? What is working, what is not, and why?
- Is there agreement or consensus on adopted options?
- How are changes to character-defining- and other cultural landscape features being recorded? What gaps have not yet been addressed in baseline documentation?
- Are monitoring cycles timed effectively to provide appropriate knowledge about conditions and change?
- What future partnership opportunities exist for longterm care of cultural landscape resources (e.g. conservation organizations, field schools, university programs, etc.)



AmeriCorps crew members assist NPS staff in efforts to inventory and clean museum collections housed within tunnels beneath Scotty's Castle, following a severe 2015 flood event. The tunnel system remains a character-defining feature of this significant cultural landscape in Death Valley National Park.



Core orchard, view east (note wild deer, allowed to browse fallen apples—in turn reducing bear damage)



Sluice used to regulate irrigation feeder ditch



Buzzard Cabin; earliest built feature (1889-90), chimney added 1912

BUCKNER HOMESTEAD HISTORIC DISTRICT

The Buckner Homestead Historic District is located on a horseshoe bend of the Stehekin River in Lake Chelan National Recreation Area, in the remote North Cascades of central Washington State. First developed between 1889 and 1910, this 160-acre homestead eventually included approximately 50 acres of fruit orchards, along with construction of several buildings and structures to support both residential needs and orchard operations.

Buckner Homestead faces a number of threats from climate-related variables—primarily related to the projected increase of 4.9°C in mean average temperature by 2010 (relative to 1950); projections also indicate a 9% increase in precipitation for the same period, with varying periods of drought. A number of stresses are anticipated for this cultural landscape, requiring special attention to the orchards as a central, character-defining feature. With projected temperature increases, trees will need more frequent watering; fruit may decline in size and yield. Associated stress could result in a loss of vigor, limb structure, and overall decline of tree health and vitality.

The Common Delicious apple variety experiences bark loss more than any other variety in the orchard. Adequate irrigation can also be an issue during the summer and in periods of drought, as the hand-dug ditches, flumes, and headgates rely on water supplies from nearby Rainbow Creek. While flooding from the Stehekin River has eroded the historic pasture, this impact has not reached the orchards. With increased grass growth, irrigation ditches may require additional mowing, trimming, and prescribed burns. Depending on humidity levels, powdery mildew, which stunts the vigor of the Jonathan apple variety, raises another concern.

In response to these stresses, the Buckner orchardist has researched and employed historic pruning and grafting techniques to improve the potential for the trees to thrive. Use of these techniques as a management tool are regularly reviewed, sometimes tree by tree, and modified as necessary.



Traditional bridge grafts, used as a preservation treatment



White birch allée, bordering hemlock and white oak hedge that encloses Shaw Memorial, view west

Path between hemlock and white oak hedges within the site's central core, view west



SAINT-GAUDENS NATIONAL HISTORIC SITE

Saint-Gaudens National Historic Site in New Hampshire preserves and interprets properties associated with Augustus Saint-Gaudens (1848-1907), the nation's foremost sculptor during the late-nineteenth and early-twentieth centuries. Saint-Gaudens's home and studios, Aspet, forms the core of the park and also includes a series of garden rooms displaying sculptural works of Augustus Saint-Gaudens, and defined by distinctive hemlock and white oak hedges. The cultural landscape is also accentuated by distinctive brick walkways that enable visitors to tour the site, house, studios and other buildings.

Managers have begun addressing two major climate-related impacts. As has occurred in Shenandoah National Park, Saint-Gaudens NHS faces the growing risk of infestation by the spread of hemlock woolly adelgid (*A. tsugae*). This invasive pest poses a potential threat to the site's character-defining hemlock hedges. While not yet present, the park recognizes this regional threat and is seeking ways to anticipate it and respond to the impact. Recently, New Hampshire winters have been marked by increased freeze-thaw cycles, in contrast to historical norms extending from early winter to late spring. The current cycles, accompanied by the earlier onset of spring, have caused the historic brick pathways to heave, damaging both path stability and historic brick materials. The park is replacing damaged bricks, but also the underlayment in order to avoid similar problems in the future.

Along with the walkway problems, the spring onset has resulted in earlier blooming periods and, subsequently, higher visitation during periods in which the park is normally closed. The park has responded accordingly, addressing the hiring of seasonal employees on a different cycle.



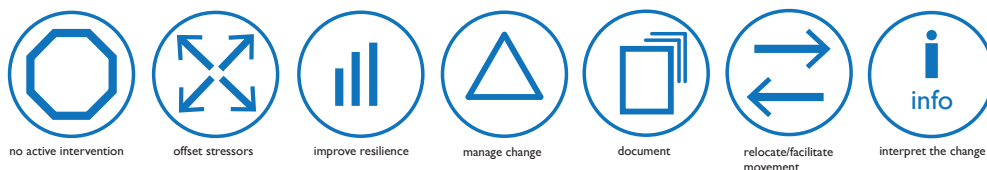
Brick path damaged by freeze-thaw cycling





Repeated flooding has led to widespread structural deterioration in Portsmouth Village, Cape Lookout National Seashore, North Carolina. Many of the surviving buildings require immediate stabilization or repair. Subsidence affects the foundation of the Methodist Church; its brick piers remain urgently in need of repair.

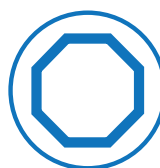
MANAGEMENT ADAPTATION OPTIONS FOR CULTURAL LANDSCAPES



Climate change adaptation options are a range of alternative management approaches designed to mitigate impacts on cultural resources. Below on the left, are the National Park Service Adaptation Options for cultural resources and climate change response (CRCCS [Rockman et al. 2016]). On the right, the Adaptation Options are adapted by the Cultural Landscape Research Group specifically for cultural landscapes.

NO ACTIVE INTERVENTION

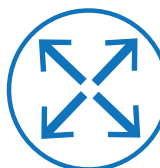
Taking no action is a decision. This may be an appropriate decision in situations of low vulnerability (no action warranted) or when, due to one or more of a range of constraints, including lack of technological or economic feasibility, no action can be taken. This decision may include assessment of the need for monitoring of resource condition, with a plan to revisit a no-action decision at a future point in time.



Cultural landscapes: this includes monitoring the rate and degree of landscape dynamics, to assess whether or not they are within the historic range.

OFFSET STRESS[ES]

Removing or deflecting stress is one or more actions taken at some distance from the resource to reduce or remove the environmental or other force(s) acting on the resource. The goal of this option is to enhance survival while minimizing physical or material changes to the resource. Constraints on this option are likely to include impacts of actions to surrounding resources, such as natural habitat or infrastructure.



Cultural landscapes: consideration should recognize those climate variables operating at a full 'landscape' scale, in addition to the individual, sometimes minute feature scale. This range of awareness helps to ensure that an effort to deflect or remove a source of stress in one feature does not result in a negative impact to the larger ecosystem or cultural landscape. As with other cultural resources, such actions may include both temporary and long-term measures.

IMPROVE RESILIENCE

Improving resilience/resistance consists of one or more actions that change the nature and/or setting of a resource that are designed to make a resource better able to withstand or be recovered from environmental or other forces. The goal of this option is survival of the resource, despite possible impacts of actions on integrity of the resource, although this option does not necessarily mean the resource will be impaired.



Cultural landscapes: special attention is given to plant communities, soil structure, and natural systems. This includes the integration of natural with cultural features, as in historic cotton or rice plantations. In an environment with increased temperatures and more arid climates, soil structure may require soil aeration to increase permeability and reduce root compaction. Soils are a critical component of resilience. With adequate aeration, these support a microbial ecosystem providing nutrients, water and oxygen to plant roots. The activity of microbes help to buffer drought, and sustain the vitality of vegetation.

MANAGE CHANGE

Managing change is an action or set of actions that incorporate change into the form of the resource and/or into its management plan. The goal of this option is to maintain character-defining features of a resource, even if original specific materials or individual species are no longer part of the resource.



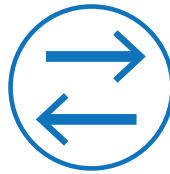
Cultural landscapes: this also requires a broader acceptance of change as an essential process and often character-defining aspect. In historic nut orchards, for example, as part of a normal agricultural practice, trees reaching the end of their productive cycles are regularly removed and replaced. This may require the addition of species that are resilient to changes in climate patterns, such as at Rapidan Camp.

RELOCATE / FACILITATE MOVEMENT

Relocating/facilitating movement includes two types of action: (a) moving a resource, and (b) allowing movement to happen.

(a) Moving a resource is an action or set of actions to relocate all or a portion of a resource that cannot move on its own to a less vulnerable location.

(b) Allowing movement to happen involves action(s) either to enable movement or otherwise remove impediments to movement of living portions of resources to less vulnerable or more stable locations.



Cultural landscapes: relocation/movement comprises an unusual or rare instance and movement is not feasible for a whole landscape. This option may be an appropriate choice for character-defining features of a landscape once the *whole* cannot be saved. An example would be to allow for the migration of character-defining vegetation that is threatened by saturation or inundation to a more upland, location with better drainage.



Identifying adaptation and management challenges for horticulture at Eugene O'Neill NHS

DOCUMENT AND PREPARE FOR LOSS

Any action modifying a resource includes appropriate documentation. “Document and Prepare for Loss” is a set of actions to record a resource and then subsequently allow the geographic location of the resource to undergo full effects of environmental or other forces that are likely to destroy or remove all or portions of the resource.

Documentation may be exhaustive, such as data recovery (full excavation) of an archeological site, or detailed recording of a building or structure or cultural landscape (such as HABS/HAER/HALS photographic, drawing, and laser scanning documentation, or a Cultural Landscape Inventory). Documentation also may be done at a less than exhaustive level. This may be appropriate when exhaustive approaches are infeasible (due to limitations in access, time, or financial constraints), not warranted (due to nature and scale of impacts), or there is merit in not recovering or preserving the whole of the resource (such as an archeological site may become inaccessible, but is not anticipated to be destroyed).



Cultural landscapes: it may also be especially valuable to include video recording, to ensure that the three-dimensional aspects of the landscape are documented to the best extent possible. Additionally, tools and techniques such as infrared aerial photography should be considered to record those features, such as abandoned roadbeds, that are no longer visible to the naked eye. It is necessary to document the cultural landscape during different seasons, as conditions will change throughout a yearly cycle. For rare plant specimens, collection of seeds or scion wood (i.e. orchard trees) for off-site propagation or storage embodies a documentary tool-- as seen in efforts to clone the “King” Giant sequoia (*Sequoiadendron giganteum*), a significant feature of the John Muir National Historic Site.

This option differs from the data recovery in that it requires consideration and documentation of the sampling and preservation approach.

INTERPRET THE CHANGE

Climate change is the heritage of the future. Interpreting the Change is an action or set of actions that acknowledges and then serves to engage people in the future with the effects of climate change on a resource. This option may be used on its own or in combination with any of the other options.

While interpretation may be developed across any of the adaptation options on this list, for this option, interpretation addresses not only preservation and history of the resource, but also climate change itself, and seeks to tell the story of the place and climate change and how they are interacting.



interpret the change

Cultural landscapes: this also includes interpreting landscape change before, during, and since the period of significance, to better demonstrate the impact of climate change within the context of landscape dynamics. Landscape interpretation also provides an opportunity for an educational opportunity, telling the on-going story of the integration of natural and cultural systems, and the nature and rate of change.

Public signage, social media, and educational videos comprise examples of valuable interpretation tools.

CONCLUDING COMMENTS

SUSAN DOLAN

Program Manager, NPS Park Cultural Landscapes Program

Pacific Coast as seen from Schoolhouse Peak, Bald Hills, Redwood National Park (May 2017)

This guide is the first of its kind to provide management strategies for climate change response in NPS cultural landscapes. It underscores that while we have no short-term solutions to control climate change, we do have options for future management strategies, with good data in hand. In setting our expectations to manage rather than control change, we are in good company. Among the things cultural landscapes have taught us, is that human beings have been responding to environmental change for thousands of years. Likewise, our successors will learn from our responses to climate change in cultural landscapes. I take solace from the human ability to adapt, and from the capacity of the next generation to expand upon our current knowledge.

We have the privilege of managing cultural landscapes today because former generations were able to hold on to them and leave them to us. The lives of our predecessors weren't without adversity, and their landscapes were continually subject to environmental stressors. Yet they managed to convey this legacy to us, with all its challenges. Part of our responsibility is to figure out how to hold on to this heritage for the next generation, who may be better equipped than us to address our planetary challenges.

I place great importance upon “buying time” therefore, whereby we attempt to manage landscape change as best we can, with the best-available knowledge and perspective we have now. Buying time not only yields cultural and educational value for current generations, but allows time for documentation and further research to take place in the landscape;

allows for a coming to terms with change and possible loss, and makes time for scientific knowledge to grow through monitoring and adaptation. Climate science data is growing, and future discoveries can be anticipated. We must research, plan, steward, and contribute to the evolving body of knowledge, but our decisions should not foreclose upon the opportunity for future generations to inherit, learn, and contribute.

One powerful action we can take is stewardship, through ongoing preservation maintenance, repair and replacement in-kind. Deteriorated resources are more vulnerable to further degradation than those maintained in good repair with healthy growing conditions. Preservation maintenance is our first line of defense against stressors, and the integration of natural and cultural management is critical. But as this guide demonstrates, a further range of strategies for stewardship exist, even within our current, limited understanding of the trajectory of climate change. The guide presents these strategies within a decision-making framework that can be applied across ecoregions and landscape types. The authors have crafted a valuable framework that can fit within NPS law, policy and guidelines. The various management strategies may be used in isolation or in combination, and at different temporal scales.

The guide's decision-making framework is informed by the parallel processes of cultural landscape research and climate science research. These datasets are mutually informative, and become entwined in planning and stewardship strategies. Interdisciplinary expertise and current data is paramount, along with an expectation that the direction of future management cannot be linear. The guide charts a cyclic process for adaptive management. Research, planning, and stewardship are followed by monitoring, periodic re-examination, leading to more research, planning, and stewardship and monitoring.

Now more than ever, we are in need of excellent baseline data from Cultural Landscape Inventories, and creative approaches to rehabilitation plans in Cultural Landscape Reports. Climate science data and projections must be available for local areas, and the public, local stakeholders and partners must be engaged and have frequent opportunities to shape our strategies. While the intensity, rate of acceleration and combination of environmental forces is new, the phenomenon of change in landscapes is not. By resetting our expectations to cycles of short term interventions rather than long term investments, we may be able to move towards in perpetuity for cultural landscapes, one human generation at a time.

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APPENDIX A

SELECTED TERMS

Adaptation

Adjustment or preparation of natural or human systems to a new or changing environment which moderates harm or exploits beneficial opportunities.

Adaptive capacity

The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

Adaptive management

A systematic approach for improving resource management by learning from management outcomes.

Carbon footprint

Total amount of greenhouse gases that are emitted into the atmosphere each year by a person, family, building, organization, or company. One person's carbon footprint includes greenhouse gas emissions from fuel that an individual burns directly, such as by heating a home or riding in a car. It also includes greenhouse gases that come from producing the goods or services that the individual uses, including emissions from power plants that make electricity, factories that make products, and landfills where trash gets sent.

Character-defining feature

Prominent or distinctive aspect, quality, or characteristic of a cultural landscape contributing significantly to its physical character.

Climate

Those “average weather” patterns or trends for a particular region over a period of many years.

Climate change

Change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer.

Climate change adaptation

Management strategy that involves identifying, preparing for, and responding to expected climate changes in order to promote ecological resilience, maintain ecological function, and provide the necessary elements to support biodiversity and sustainable ecosystem services.

Exposure

The nature and degree to which a system is exposed to significant climate variations.

Intergovernmental Panel on climate Change (IPCC)

Established jointly by the United Nations Environment Programme and the World Meteorological Organization in 1988. The

purpose of the IPCC is to assess information in the scientific and technical literature related to all significant components of the issue of climate change. The IPCC draws upon hundreds of the world's expert scientists as authors and thousands as expert reviewers. Leading experts on climate change and environmental, social, and economic sciences from some 60 nations have helped the IPCC to prepare periodic assessments of the scientific underpinnings for understanding global climate change and its consequences. With its capacity for reporting on climate change, its consequences, and the viability of adaptation and mitigation measures, the IPCC is also looked to as the official advisory body to the world's governments on the state of the science of the climate change issue. For example, the IPCC organized the development of internationally accepted methods for conducting national greenhouse gas emission inventories.

Mitigation

Human intervention to reduce the human impact on the climate system; it includes strategies to reduce greenhouse gas sources and emissions and enhancing greenhouse gas sinks.

Phenology

Timing of natural events, such as flower blooms and animal migration, which is influenced by changes in climate. Phenology is the study of such important seasonal events. Phenological events are influenced by a combination of climate factors, including light, temperature, rainfall, and humidity.

Resilience

Amount of change or disturbance that can be absorbed by a system (e.g., an organism, population, community, or ecosystem) before the system is redefined by a different set of processes or structures (i.e., the ecosystem recovers from the change or disturbance without a major phase shift).

Sensitivity

Degree to which a system is affected, either adversely or beneficially, by climate-related stimuli.

Significance

Meaning or value ascribed to a cultural landscape based on the National Register criteria for evaluation.

Storm Surge

Abnormal rise in sea level accompanying a hurricane or other intense storm, whose height is the difference between the observed level of the sea surface and the level that would have occurred in the absence of the cyclone.

Uncertainty

An expression of the degree to which a value (e.g., the future state of the climate system) is unknown.

Vulnerability

Degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes.

Vulnerability assessment

Key tool for carrying out adaptation planning, and informing the development and implementation of climate-smart resource management practices.

SOURCES:

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<https://www3.epa.gov/climatechange/glossary.html>

- Glick, P., B.A. Stein, and N.A. Edelson, eds. 2011. *Scanning the Conservation Horizon: A Guide to Climate Change Vulnerability Assessment*. National Wildlife Federation: Washington, D.C.
www.nwf.org/vulnerabilityguide
- Intergovernmental Panel on Climate Change (IPCC). 2012. *Glossary of terms*. In: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)], 555-564. *Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC)*. Cambridge University Press. New York, NY.
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<http://www.achp.gov/docs/preserve-coastal-heritage.pdf>
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<https://www.nps.gov/tps/standards/four-treatments/landscape-guidelines/terminology.htm>

APPENDIX B

NPS DIRECTOR'S POLICY MEMORANDUM 14-02

Climate Change and Stewardship of Cultural Resources

Date: February 10, 2014
To: All Employees
From: Director /s/ Jonathan B. Jarvis
Subject: Climate Change and Stewardship of Cultural Resources

This policy memorandum provides guidance and direction regarding the stewardship of cultural resources in relation to climate change. It follows my March 6, 2012, memorandum, *Applying National Park Service Management Policies in the Context of Climate Change*, which addressed the implications of climate change on the guiding principles of National Park Service (NPS) resource management. Additional guidance, in the form of a Cultural Resource Climate Change Strategy, will be forthcoming.

Background

Since my first climate change memorandum was issued in 2012, the risks posed by climate change to parks and communities across the Nation have become even more apparent. Climate science projections anticipate that the rate and intensity of climate change effects will continue to increase for the foreseeable future. Climate change poses an especially acute problem for managing cultural resources because they are unique and irreplaceable — once lost, they are lost forever. If moved or altered, they lose aspects of their significance and meaning. Every year, we lose irreplaceable parts of our collective cultural heritage, sometimes before we even know they exist. Therefore, the decisions we make and the priorities we set today will determine the effectiveness of NPS stewardship of cultural resources in the coming decades.

The NPS leads the Nation in the care and management of our country's cultural resources through the national park system and our programs. On behalf of the Secretary of the Interior, we manage preservation programs that extend to nearly every American community. The National Register of Historic Places and National Historic Landmark Programs, the Federal Historic Preservation Tax Incentives Program, Technical Preservation Services, National Heritage Areas, National Scenic and National Historic Trails, certification of local governments, and our partnerships — including collaborations through the Landscape Conservation Cooperatives, and with tribal governments, States, universities, and other Federal agencies — form a framework for historic preservation inside parks and around the country. Our leadership role in cultural resources now requires engaging this framework to set priorities, to share techniques for protecting significant resources, and to help guide our collective actions with respect to climate change.

NPS cultural resource management must keep in mind that (1) cultural resources are primary sources of data regarding human interactions with environmental change; and (2) changing climates affect the preservation and maintenance of cultural resources. The NPS will integrate these concepts into information and data gathering and analysis within each of the four components of the *NPS Climate Change Response Strategy*: science, adaptation, mitigation, and communication. The Cultural Resource Climate Change Strategy currently being prepared will provide further guidance.

Several recent documents set out approaches for the NPS to address current and future effects of climate change: *Climate Change Response Strategy* (2010), *A Call to Action* (Action Item 21: Revisit Leopold 2011), *Revisiting Leopold: Resource*

Stewardship in the National Parks (2012), *Green Parks Plan* (2012), *Climate Change Action Plan* (2012), and the forthcoming Cultural Resources Challenge. The guidance included in this policy memorandum should be integrated, as applicable, into all actions stemming from those documents.

Based upon discussions across the Service, I address three essential questions with respect to NPS cultural resources and climate change: (1) what is climate change adaptation for cultural resources; (2) how should we make decisions related to cultural resources in light of climate change; and (3) how do we communicate regarding climate change science and impacts.

I. Climate Change Adaption for Cultural Resources

The focus for cultural resources adaptation in an era of climate change must be on our research and management practices. Following the Intergovernmental Panel on Climate Change and as incorporated into the *NPS Climate Change Response Strategy*, adaptation is “an adjustment in natural or human systems that moderates harm or exploits beneficial opportunities in response to change.” Because cultural resources have strong ties to place, risk the loss of integrity if moved or altered, and are in large part non-living, their capacity to move or change as environments around them change is limited. Therefore, we must take a flexible approach in our management actions. Our long-standing policies and the regulations we help administer require that management decisions consider the specific characteristics and significance of each cultural resource. Climate change does not alter these requirements, but it does challenge us to manage these resources in the best possible manner given uncertainty and sometimes rapidly changing conditions.

Specific foci for adaptive research and management activities will include:

A. Integration of Natural and Cultural Resources: Modeling of climate change impacts and the collecting of environmental monitoring data should, wherever feasible, integrate the data needs of both cultural and natural resource managers. Cultural resources exist within or include parts of the natural world. A given climate variable can affect natural and cultural resources quite differently — heat stresses pikas differently than historic wooden buildings. However, both are stressed and the tracking of that trend provides critical information to both cultural and natural resource managers. Such information should be integrated into standardized reporting for both cultural and natural resources, such as *State of the Parks* reports. In turn, cultural resources also have tremendous potential to provide critical information for climate science, such as data about past climates at local scales and the history of human impacts on the environment. We must work with our partners to tap this information more fully and use it effectively in establishing baselines, assessing change, undertaking planning efforts, and setting management goals.

B. Innovation for Emergent Threats: Effective adaptive management requires that our decision processes be nimble and flexible. Because climate change-related impacts to cultural resources can occur rapidly, often with less warning than our budgeting cycle is designed to accommodate, I encourage managers to use appropriate discretion and innovation in their actions and decision processes, including reallocating funds, where appropriate, to address emergent threats.

C. Incorporation of Cultural Resources into Sustainability Actions: Cultural resources should be important components of efforts to mitigate the effects of climate change nationwide by improving energy efficiency and reducing greenhouse gas emissions. The adaptive reuse of historic buildings and installation of energy-saving design elements, for example, can be more climate friendly than new construction. As the recently revised *Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings* make clear, rehabilitation to meet current needs often can be done while maintaining historic integrity in accordance with *The Secretary of the Interior's Standards for the Treatment of Historic Properties*. Within the NPS, cultural

resources are integral to full implementation of the *NPS Green Parks Plan*. I encourage managers to incorporate historic structures and cultural landscapes into their carbon reduction strategies and planning.

D. **Evaluation of Siting of Museum Facilities and Collections:** In light of the risks posed by climate change, we must revisit past decisions about museum facilities and collections. As part of a broader effort to update how we site and use facilities, I direct the Associate Director for Cultural Resources, Partnerships, and Science to undertake a vulnerability study of our museum facilities and collections, and develop a plan for improving stewardship of them.

2. Cultural Resources Decision-making in an Era of Climate Change

Cultural resources have long been subject to environmental forces. The risks of climate change for cultural resources lie in the alteration and recombination of these forces, which together are increasing the types and intensity of impacts on cultural resources. My memorandum of March 6, 2012, addressed the impairment prohibition of the NPS mission and charged the NPS with continuing to work to preserve resources unimpaired from in-park activities. It directed us to engage fully in cooperative conservation and civic engagement to mitigate the impacts arising from external forces. For cultural resources, this work must include the following:

A. **Refocus Inventory Responsibilities:** As per our responsibilities under section 110 of the National Historic Preservation Act (16 USC 470h-2), NPS policy is to identify resources, evaluate their significance and eligibility for the National Register of Historic Places, and assess any threats of impairment. Accordingly, parks should focus their resource inventory work on lands not yet investigated in those areas most vulnerable to observed and projected climate change impacts and other threats. These areas may include wilderness.

B. **Integrate Resource Vulnerability and Significance:** We will prioritize cultural resource funding and management actions on projects that integrate vulnerability and resource significance. The current Service-wide Comprehensive Call already prioritizes such work. As such, all identified cultural resources should be evaluated in terms of their vulnerability and significance so that management decisions are directed to resources that are both significant and most at risk.

C. **Understand the Range of Climate Change Effects:** Cultural resources are vulnerable to dramatic and well-publicized effects of climate change, such as sea level rise or storm surge. Evidence from across the Service is beginning to indicate they are also vulnerable to inland and other more subtle effects of climate change, such as the impacts of more freeze/thaw cycles on stone walls or more rapid wetting and drying cycles on adobe buildings. We must improve our understanding of these additional impacts, address them in our stewardship practices, and be able to communicate them to the public.

D. **Consult Broadly:** Consultation to inform the assessment of resource significance must engage a broad array of stakeholders. This will ensure that our actions are based upon thorough, up-to-date understandings of how and why our resources are valued by many diverse groups, including Native Americans and other traditionally associated people, visitors, and the scientific community. It is critical that we engage with all stakeholders to identify their important stories and strengthen our understanding of cultural resources and their values. The National Register of Historic Places eligibility criteria provide a sound framework for assessing significance. In addition, we may discover during consultation that the contemporary significance of our parks and resources transcends the enabling legislation for individual parks. Consultation to glean and understand the contemporary significance of cultural resources to the American people will help keep the national park system and the NPS relevant for generations to come.

E. Value Information from the Past: National Register criteria challenge us to identify and manage not only our known and honored heritage, but also to understand how cultural resources can address questions about the past. Such questions must now include how our modern climate situation has come about and how human societies have responded to climatic and environmental variability in the past. What do resilient and sustainable societies look like? The resources in our parks, including the ones we have not yet identified, have a vital role to play in answering these questions for our multiple publics. Incorporating these questions into our significance evaluations is another critical piece in maintaining NPS relevance into the future.

F. Recognize Loss: We will ensure that our management options recognize the potential for loss. Responsible stewardship requires making choices that promote resilience and taking sustainable management actions. Funding temporary repairs for resources that cannot, because of their location or fragility, be saved for the long term, demands careful thought. Managers should consider choices such as documenting some resources and allowing them to fall into ruin rather than rebuilding after major storms. Such decisions for loss cannot be made lightly nor without appropriate consultation and compliance. They must incorporate interdisciplinary research and should be coordinated on a consistent and Service-wide basis. As with many aspects of climate change adaptation, as yet there are no specific guidelines for these decisions. Guidance and tools to support them are being built in the Cultural Resource Climate Change Strategy, other documents in preparation, and through the continued collaboration and best practices of our parks, regions, and national programs. History will judge us for the choices we make, and we will take comfort in knowing that sometimes the hard choices are also the ones that are best for our resources, our parks, and our Nation.

3. Communicating about Climate Change Science and Impacts

The NPS has taken significant strides in communicating about climate change through interpretive and educational programs in our parks and through our Service-wide programs. Cultural resources and the stories they anchor are one of the most powerful means we have to share experiences and connect changes in parks to trends across the Nation and worldwide. Impacts to cultural resources provide tangible examples of the effects of climate change at the human scale. Cultural resources offer lessons in past human successes, and failures, in adapting to environmental changes, and provide insight into the origins of the modern climatic situation. There is much to learn and share from traditional ecological knowledge and the weather- and disaster- related memories, practices, and architecture of traditional communities.

Every place has a climate story, many have more than one. Some are told in various ways by the people who have lived and worked on the land for generations. Building on the communication goals of the *NPS Climate Change Response Strategy*, each park and program should engage its staff, including facilities and maintenance staff, rangers, resource managers, scientists, and superintendent, and its surrounding communities to begin to identify and share their climate stories. It is important to do this — even when doing so is uncomfortable — so that they can spark discussion and inform choices. We must be committed to talking about climate change Service-wide, in our internal and external communications, including acknowledging the uncertainty we face as we make management decisions that will have long-term consequences for cultural resources. We will leverage the additional message about climate change into ongoing stories and programs where appropriate.

Looking Forward

Climate change is one of the great challenges of the 21st century. It is remaking our world and substantially influencing how we set priorities and make management decisions. The process of adaptation will not return us to the way things have been done before, but it will assist us in making choices in the face of uncertainty and change. Cultural resources remind us of

who we are and where we have come from. They offer clues on past climate variability and speak to the many different ways humans have adapted to changing environments over time, in our parks and across the country. We need their information and their inspiration.

We must be well-informed and creative in our approach to resource management given the effects of climate change. The paths climate change will take remain uncertain so we must be open to the unexpected, search out new and useful ideas, and share the innovations we develop. This cannot be a NPS-only effort, but instead will require a collaborative approach in order to be successful. This effort will include our international partners, as we learn from their work and perspectives, and share our own. While we cannot afford to wait for absolute certainty about where and when impacts will occur, we must act based on the best available sound science even as we continue to incorporate new information as it becomes available. I challenge all of us to continue to strengthen our work with our many partners to recognize and respond to the effects of climate change on cultural resources. As stewards of America's greatest national treasures, we must draw on our strengths and join with our partners to meet this challenge over the long term.

[End of Policy Memorandum]

APPENDIX C

SELECTED SOURCES OF INFORMATION

NPS Climate Change Response Program (CCRP)

<https://www.nps.gov/orgs/ccrp/index.htm>

NPS Cultural Landscapes Program

<https://www.nps.gov/subjects/culturallandscapes/index.htm>

Environmental Protection Agency (EPA): Glossary of Climate Change Terms

<https://www3.epa.gov/climatechange/glossary.html>

Intergovernmental Panel on Climate Change (IPCC)

<http://ipcc.ch/>

National Register of Historic Places

<https://www.nps.gov/nr/>

National Center for Preservation Technology and Training (NCPTT)

<https://www.ncptt.nps.gov/>

NPS Guidelines for the Treatment of Cultural Landscapes

<https://www.ncptt.nps.gov/articles/c2a/guidelines-for-treatment-of-cultural-landscapes/>

NPS Integrated Resource Management Applications (IRMA)

<https://irma.nps.gov/Portal>

United States Geological Survey (USGS) National Climate Change Viewer (NCCV)

https://www2.usgs.gov/climate_landuse/clu_rd/nccv/updates.asp

