

**USDOJ SOUTHEAST CLIMATE SCIENCE CENTER  
FINAL PROJECT MEMORANDIUM**

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**Project Title:** Connecting Landscape Adaptation and National Cultural Resource Policy to Climate Change and Cultural Resource Adaptation Decisions

**Agreement number:** G15AP00141

**Date of report:** 03/26/18

**Period of performance:** 08/01/15 through 12/31/2017

**Actual total cost:** \$202,768

**PUBLIC SUMMARY:**

This project brings cultural resource management into local and regional decision contexts for climate change planning. Cultural resources hold multiple and diverse values to local communities, visitors and the public. Yet, sea level rise and episodic storm events threaten many coastal cultural resources. Strategies for climate adaptation need to emerge from values-based decision processes that enable evaluations of the vulnerability and uniqueness of resources on a landscape. Such efforts will facilitate the prioritization of specific cultural resource management actions (e.g., move, elevate, stabilize, or document a resource). This project used a structured decision-making (SDM) process with National Park Service (NPS) personnel and other key stakeholders to develop and pilot test a decision support tool at Cape Lookout National Seashore. The decision support tool enables park managers to visualize optimal strategies for adapting historic buildings to current and projected flooding and erosion impacts under various financial scenarios.

**TECHNICAL SUMMARY:**

This project utilizes decision analysis to enhance the transparency of cultural resource climate adaptation planning and decision-making. Specifically, the project utilized a structured decision-making (SDM) process to: (a) develop a measurement framework of cultural resource values (significance and use potential) specific to buildings designated on the National Register of Historic Places; (b) frame the decision context within the context of climate-related vulnerability and uncertainty; and (c) identify optimal adaptation strategies under various budget scenarios. Although the project originally expected a cultural resource vulnerability index, project investigators discovered that this may replicate another project funded by the National Park Service and project investigators adapted this goal and developed an optimization model, the Optimal Preservation (OptiPres) Model. Therefore, the primary accomplishments of this project included developing (a) a measurement framework for evaluating and assessing the relative value (historical significance and use potential) of historic buildings, and (b) an algorithm to optimize the relative value of historic

buildings by applying adaptation actions annually over a 30-year planning horizon to buildings given fiscal constraints and resource vulnerabilities.

Products of this project advance cultural resource planning and decision-making. The National Park Service has determined that the OptiPres Model has utility and, as such, has provided additional funding to test the transferability to another park unit.

#### **4. PURPOSE AND OBJECTIVES:**

The objectives of this project were to utilize a structured decision-making (SDM; Gregory et al., 2012) process to: (a) develop a conceptual framework of cultural resource values of historic villages at Cape Lookout National Seashore (CALO); (b) frame the decision context within the context of climate-related vulnerability and uncertainty; and (c) explore potential management strategies and actions. It was also expected that this effort will (d) result in the development of a cultural resource vulnerability index (CRVI) of the historic structures and landscapes at CALO. The project used a subset of 17 historic buildings at Cape Lookout National Seashore as a pilot test to assess the possibility of landscape-level cultural resource decision-making. Although the project originally anticipated the development of a CRVI, project investigators discovered that this may replicate another project funded by the National Park Service and project investigators adapted this goal and developed an optimization model, the Optimal Preservation (OptiPres) Model.

The SDM process included a set of iterative workshops and meetings with National Park Service (NPS) personnel, State Historic Preservation Office (SHPO) personnel, and other stakeholders. Ongoing engagement enabled the co-production of a measurement model of historical significance and use potential (attributes and metrics), as well as the selection of adaptation costs and associated costs for the 17 pilot structures. The weighting of the attributes and the values of the metrics were revised through an online expert elicitation with the workshop participants, as well as historic preservation experts and cultural resource managers at workshops hosted in conjunction with the Annual Meeting of State Historic Preservation Officers Conference (March 2017) and the George Wright Society Conference (April 2017). We collaborated with researchers from Western Carolina University to integrate their vulnerability assessment into the decision support tool that was developed by USGS personnel; decision rules for the OptiPres model were developed in collaboration with NPS personnel.

#### **5. ORGANIZATION AND APPROACH:**

This project included (a) a series of workshops, meetings, evaluation survey questionnaires, and online expert elicitation to develop a measurement framework for historic buildings, and (b) collaboration with USGS decision analysts to develop the OptiPres model. The measurement framework was refined by integrating the evaluations and assessments of metrics from CALO personnel and WASO NPS personnel, as well as during workshops conducted with self-identified participants of the 2018 National Conference for State Historic Preservation Officers and the 2018 George Wright Society Conference. We collaborated with researchers from Western Carolina University to integrate their vulnerability assessment into the decision support tool. We collaborated with Mitch Eaton (USGS, DOI Southeast Climate Science Center) and Max Post van der Burg (USGS, Northern Prairie Wildlife Research Center) to develop and run the algorithm for the OptiPres Model.

The processes and approaches for the development of SDM for prioritizing cultural building

conservation of CALO are listed below.

2015

- Preparatory meetings with CALO managers
- Draft problem statement
- Workshop I with NPS & NC SHPO staff (pre-post survey questionnaire)
- Final problem statement
- Draft objectives
- Draft adaptation actions

2016

- Systematic literature review
- Iterative meetings with CALO managers
- Refinement of historical significance and use potential attributes
- Refinement of adaptation actions
- Meeting with NC SHPO staff
- Refinement of historical significance and use potential attributes
- Iterative meetings with CALO managers
- Refinement of historical significance and use potential attributes
- Adaptation action costs estimated
- Online elicitation with Workshop I participants (online survey questionnaire)
- Metrics and weights of attributes
- Beta version of OptiPres Model
- Integration of vulnerability, significance and use potential attributes with adaptation action costs and alternative budget allocations
- Workshop II with NPS and NC SHPO staff (pre-post, in-person survey questionnaire)
- Review and feedback of OptiPres Model Beta Version
- Deliberation of alternatives and optimization tradeoffs
- Refinement of model attributes, adaptation costs, budget allocations, and scenarios

2017

- Iterative meetings with CALO managers
- Refinement of model attributes, adaptation costs, budget allocations, and scenarios
- Online elicitation with Workshop I participants (online survey questionnaire)
- Metrics and weights of attributes
- Workshop III at National SHPO Conference (post-workshop, in-person survey questionnaire)
- Metrics and weights of attributes
- Workshop IV at George Wright Society Forum (post-workshop, in-person survey questionnaire)
- Metrics and weights of attributes
- OptiPres Model Refinements

## 6. PROJECT RESULTS:

First, we conducted a systematic literature review & published these findings in *Climatic Change* (see section 10 for citation). Then, we developed and refined a measurement framework for assessing the historical significance and use potential of historic buildings with input from the National Park Service, NC State Historic Preservation Office and other experts in the field of cultural resource management, which was applied to 17 structures at CALO as a pilot study. The result was a



**Figure 1. Optimal actions applied under a \$222,00 annual budget allocation**

## **8. CONCLUSIONS AND RECOMMENDATIONS:**

The measurement framework and the OptiPres Model have been assessed by the NPS as useful products for informing climate adaptation planning and decision-making for buildings located in historic districts. As with any modeling effort, we made revisions to the model and its associated metrics and model dynamics based on limitations encountered throughout the project period. However, we could not address all of the limitations identified during the project period.

## **9. MANAGEMENT APPLICATIONS AND PRODUCTS:**

### **Key project collaborators:**

- Mitch Eaton (USGS), beta OptiPres Model development.
- Max Post van der Burg (USGS), full OptiPres Model development and refinement.
- Ellen Bean (consultant) and Elise Irwin (USGS) facilitators during the first CALO workshop.

### **Key contributors to measurement framework from NPS:**

- Pat Kenney, CALO Park Superintendent;
- Jeri DeYoung, CALO Chief of Resources;
- Curtis Rintz, CALO Exhibits Specialist;
- Janet Cakir, Southeast Region Climate change, Socioeconomics, and Adaptation Coordinator;
- Cat Hoffman-Hawkins, Climate Response Program Chief;
- Marcy Rockman, Climate Change Adaptation Coordinator for Cultural Resources; and
- Brian Goeken, Technical Preservation Services Chief.

### **Key contributors to measurement framework from NC State Historic Preservation Office**

Ramona Bartos, Deputy State Historic Preservation Officer; and,  
John Wood, Preservation/Restoration Specialist.

The NPS has determined that further investment (by the NPS) in refining & testing the transferability to the model is warranted and has funded an effort to apply the measurement framework and OptiPres Model at another NPS unit. Additionally, the NPS has determined that further investment (by the NPS) to develop measurement frameworks for other cultural resources, with the ultimate goal of adapting the OptiPres Model to include other cultural resources, is warranted and is in the process of funding an effort to develop a measurement framework for archeological resources.

## **10. OUTREACH:**

This project has diverse approaches of outreach, including:

1. Webinar
  - a. Erin Seekamp, Nov 2017. Climate adaptation planning for historic districts: A support tool for evaluating optimal portfolio decisions. National Park Service Climate Change Response Program, Climate Change in America's National Parks Webinar Series
2. Presentations

- a. Fatorić, S., and Seekamp, E. 2016. Application of structured decision making to climate adaptation planning of coastal cultural resources: The case of Cape Lookout National Seashore. Paper presented at the *2016 NOAA Social Coast Forum*, February 9-11, Charleston, South Carolina.
  - b. Fatorić, S. 2016. Using structured decision making for climate change adaptation of cultural heritage. Poster presented at the *2016 NC State University Postdoctoral Research Symposium*, May 17, Raleigh, North Carolina.
  - c. Fatorić, S., Seekamp, E., and Smith, J.W. 2016. Moving toward optimal climate change adaptation? Structured decision making approach for coastal cultural resource preservation. Paper presented at the *22<sup>nd</sup> International Symposium on Society and Resource Management (ISSRM)*, June 22-26, Houghton, MI.
  - d. Seekamp, E. 2017. Enhancing transparency of climate adaptation planning for cultural resource management. *Building the Global Change Community Seminar Series*. February 9, Department of Interior, Southeast Climate Science Center, Raleigh, North Carolina.
  - e. Seekamp, E., S. Fatorić, M. Eaton, M. Post van der Burg, P. Kenney, and J. DeYoung. Decision support for cultural resources climate adaptation planning: Advancing an optimization model piloted at Cape Lookout National Seashore. Organized Compass Session Workshop at the *19th George Wright Society (GWS) Conference*, April 2-7, Norfolk, Virginia.
  - f. Seekamp, E., S. Fatorić, M. Eaton, and M. Post van der Burg. 2017. Shades of historical significance: A decision analytic process for increasing transparency in cultural heritage climate adaptation planning. Paper presented at the *23rd International Symposium on Society and Resource Management (ISSRM)*, June 19-22, Umeå, Sweden.
3. Journal Articles
    - a. Fatorić, S., and Seekamp, E. 2017. Are cultural heritage and resources threatened by climate change? A systematic literature review. *Climatic Change*, 142 (1-2), 227-254. doi:10.1007/s10584-017-1929-9
    - b. Fatorić, S., and E. Seekamp. 2017. Evaluating a decision analytic approach to climate change adaptation of cultural resources along the Atlantic Coast of the United States. *Land Use Policy*, 68, 254-263. doi.org/10.1016/j.landusepol.2017.07.052
    - c. Fatorić, S., and E. Seekamp. In Press. A measurement framework to increase transparency in historic preservation decision-making under changing climate conditions. *Journal of Cultural Heritage*.
  4. Reports
    - a. Fatorić, S., and Seekamp, E. 2017. *Assessing Historical Significance and Use Potential of Buildings within Historic Districts: An Overview of a Measurement Framework Developed for Climate Adaptation Planning*. AG- 832. Raleigh, NC: NC State Extension.