NPVuln: Vulnerability Assessment Needs – An Overview

Introduction

We know with certainty that climate change is affecting national parks and will continue to do so. To manage parks effectively, we need to know which parks are most vulnerable to climate change. The NPVuln project evaluated climate change factors and their potential effects to determine relative vulnerability of parks and identify those that warrant consideration as high priority for further study.

Wise allocation of funds and resources to meet management needs across more than 400 national park sites is an essential step to address the challenges of climate change. Because the resources and values protected by the National Park Service are so numerous and varied, ranking and sorting climate change impacts required several different approaches. As a result, the NPVuln project used several strategies to evaluate climate change vulnerability that address the multiple and unique aspects of park resources.

Methods

We used 47 climate change vulnerability indicators to evaluate national parks' exposure to climate changes, their sensitivity to those changes, and their adaptive capacity to climate changes. We combined the 47 indicators in different ways to create vulnerability scores for all national parks in the contiguous US, and where data were sufficient, in Alaska. These scores allow the NPS to identify parks at high risk from climate change, thus indicated as high priority for more detailed studies.

The vulnerability scores helped to identify the most vulnerable national parks in several ways. We identified any park that is at risk from the high-impact climate change factors of fire, drought, sea level rise, and forest pest/disease as high priority for more detailed assessments. These are potentially transformative

factors that can fundamentally and permanently alter park ecosystems or resources. For example, increases in wildfire could eliminate Joshua trees from Joshua Tree National Park or saguaros from Saguaro National Park. Parks with high vulnerability scores for a wide variety of indicators were also identified as high priority for more detailed assessments. We sorted and filtered the vulnerability scores by ecoregion, management regions, resource type, etc., and determined the parks and resources of highest priority under each of those classifications.
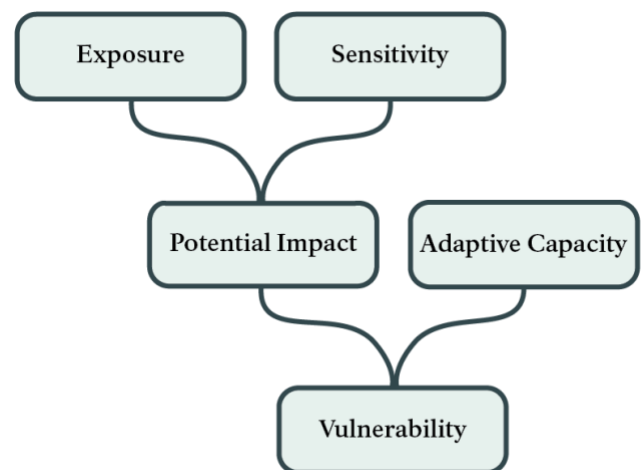

Figure 1 Climate vulnerability results from exposure to climate changes, sensitivity to those changes, and the ability of the resource to adapt to those changes.

Results

Each of these approaches to examining the effects of climate change on national parks provided useful information to guide

decisions for full vulnerability assessments. Seventy-one percent of all national parks in the contiguous US were shown to be at high risk from the effects of climate change under this analysis. Fifty-seven percent of parks evaluated were found to be at high risk from at least one potentially transformative, high-impact climate change factor. Many parks, like Wind Cave National Park, were found to be at high risk from multiple high-impact factors.

The analyses highlighted how the effects of climate change vary across the country. Many parks in the western US are at risk due to a small number of potentially transformative high-impact climate change factors, like wildfire. In contrast, many parks in the (inland) eastern US are at high risk because climate change may exacerbate existing challenges, such as poor air quality and restricted habitats. These results emphasize the role of climate change as a "threat multiplier." Coastal parks in the southeastern U.S. are much more vulnerable to sea level rise than coastal parks on the west coast. Additionally, we found that many eastern parks have limited adaptive capacity because of intensive human land use that decreases ecological connectivity surrounding parks.

These 'regional similarities' also suggest strategic opportunities for efficiently and economically undertaking the more detailed vulnerability assessments needed to guide adaptation at the park level. These strategies include facilitating climate assessments for groups of parks with similar resources, supporting regional studies of high-impact vulnerability factors, and conducting assessments of specific resources across large groups of parks. Parks with near-term plans for large investments are obvious priorities for detailed vulnerability assessments, since these parks have an immediate opportunity for adaptation. NPS is already employing some of these strategies, as illustrated by the series of sea-level rise studies and development of tools to assess cultural resources.

This analysis revealed that numerous parks are highly vulnerable to climate change. Identifying where resources are vulnerable, and why, is an important step to support park planning for adaptation strategies. Climate change poses an ongoing challenge to park managers, with ongoing needs for climate vulnerability assessments since vulnerability changes over time. The results of this study can assist the NPS in determining efficient approaches to provide climate change vulnerability information across the National Park System.

Gulf Island National Sea Shore's Historic District flooding after Hurricane Ivan.

Full report:

Michalak JL, Lawler JJ, Gross JE, Littlefield CE. 2021. A strategic analysis of climate vulnerability of national park resources and values. Natural Resource Report. NPS/NRSS/CCRP/NRR—2021/2293. National Park Service. Fort Collins, Colorado. https://doi.org/10.36967/nrr-2287214

Additional Information

John Gross, Ph.D.,
john_gross@nps.gov, Climate Change Response Program, Ft. Collins, CO, Tel: 970 267-2111

Julia Michalak, Ph.D.,
michalaj@uw.edu, Research Scientist, School of Environmental and Forest Sciences, University of Washington, Seattle

Josh Lawler, Ph.D.,
jlawler@uw.edu, Professor, School of Environmental and Forest Sciences, University of Washington, Seattle