



# Assessing the Vulnerability of Park Resources

## Background

Increasing heat, fires, snowmelt, vegetation shifts, and other impacts of climate change make plants, animals, cultural resources, and national park infrastructure vulnerable to harm. Vulnerability analyses examine the susceptibility of resources to climate change and identify the most vulnerable areas as well as potential refugia. They provide scientific information needed to prioritize the location and timing of climate change adaptation and management measures.

## Approach

Vulnerability to climate change is the degree to which a system is susceptible to and unable to cope with adverse effects. Design features of robust vulnerability analyses include:

- Examination of all three components of vulnerability: exposure, sensitivity, and adaptive capacity. Exposure is the extent of climate change experienced by a species or ecosystem. Sensitivity is the change in a species or ecological variable for each increment of change in climate. Adaptive capacity is the ability of a species or ecosystem to adjust.
- Detection and attribution of historical changes. Historical changes provide data on sensitivity and adaptive capacity.
- Analyses of historical data and future projections. Because of time lags between the emission of greenhouse gases, the expression of changes in climate, and ecological responses, vulnerability is a function of historical and future climate changes.
- Quantification of uncertainties. Computer model errors, future emissions scenario assumptions, field measurement errors, and statistical variation all combine to create a range or probability distribution of possible values for any calculation.
- Identification of vulnerable areas and potential refugia. Spatial analyses that map patterns of vulnerability will identify the locations of the most vulnerable areas and potential refugia. This provides the scientific data needed to prioritize areas for adaptation.

## Status and Next Steps

Scientists from the NPS, the U.S. Geological Survey, and universities are collaborating on vulnerability analyses of fundamental resources in national parks and surrounding landscapes:

- Bristlecone pine, desert tortoise, milkvetch, pika (3 Utah National Parks)
- Coasts and lake shores (22 National Parks)
- Cultural resources and grasslands (Badlands National Park)
- Desert bighorn sheep (9 southwestern U.S. National Parks)



Scientists are conducting vulnerability assessments to understand how climate change may impact the habitat of the American Pika. NPS photo.

- Floodplain species (Congaree National Park)
- Giant Sequoia, Sierra Nevada vegetation (Sequoia and Kings Canyon National Parks)
- Hawai'i coasts (2 Hawai'i National Parks)
- Karner blue butterfly (Indiana Dunes National Lakeshore)
- Pacific Coast ecosystems (Point Reyes National Seashore)
- Pika (8 western U.S. National Parks)
- Salamander (Shenandoah National Park)
- Salt marshes (Acadia National Park)
- Tidal freshwater marshes (5 National Capitol National Parks)
- Threatened and endangered beach mice (Gulf Islands National Seashore)
- Vegetation shifts (U.S., Canada)

Planning for vulnerability analyses for other resources and places and training of staff are in progress.

## More Information

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