Assessing the Vulnerability of Park Resources

Background

Vulnerability analyses quantify the potential responses of plants, animals, cultural resources, and infrastructure to increasing temperatures, sea level rise, range shifts, extreme events, and other climate change impacts. They identify vulnerable areas and potential refugia, providing key information to prioritize areas for climate adaptation measures.

Approach

Vulnerability to climate change is the degree to which a system is susceptible to and unable to cope with adverse effects. Robust analyses:

- Examine all three components of vulnerability: exposure (degree of change in climate variables), sensitivity (change of a resource for each increment of change in climate), and adaptive capacity (ability of a species or ecosystem to adjust).
- Analyze historical data and future projections - Because of time lags among the emission of greenhouse gases, the expression of changes in climate, and ecological responses, vulnerability is a function of historical and future climate changes.
- Quantify uncertainties - Computer model errors, future scenario assumptions, statistical variation, and other factors combine to create a range or probability distribution of possible vulnerability values.
- Identify vulnerable areas and potential refugia - This provides scientific data to help prioritize areas for adaptation.

Completed

Scientists from the NPS, universities, the U.S. Geological Survey, and other partners have collaborated on analyses of resources in national parks examining the vulnerability of:

- Bristlecone pine, desert tortoise, milkvetch, and pika to range shifts (3 Utah national parks)
- Coasts to sea level rise and lake shores to water level changes (22 national parks)
- Cultural resources to physical damage and plant communities to range shifts (Badlands NP)
- Eastern tree species to range shifts (Acadia NP)
- Forest ecosystems to catastrophic wildfire (Yellowstone and Grand Teton NPs)
- Hawai'i coastal ecosystems and infrastructure to sea level rise (2 Hawai'i national parks)
- Joshua trees to range shifts (Joshua Tree NP)
- Salt marshes (Acadia NP)

Scientists are analyzing vulnerabilities of Sierra Nevada ecosystems to changes in wildfire caused by climate change; NPS photo.

- Pacific Coast vegetation and subtidal habitats to range shifts (Point Reyes NS)
- Pacific Northwest fish, roads, vegetation, wildlife (Olympic NP)

In Progress

Efforts in progress are analyzing the vulnerability of:

- Desert bighorn sheep (9 southwestern U.S. national parks)
- East coast marshlands (Gateway NRA)
- Eastern tree species (118 parks)
- Ecosystems to continental vegetation shifts (U.S., Canada)
- Floodplain vegetation communities (Congaree NP)
- Giant Sequoia and Sierra Nevada vegetation to wildfire (Sequoia and Kings Canyon NPs)
- Karner blue butterflies (Indiana Dunes NL)
- Pikas (8 western U.S. national parks)
- Salamanders (Shenandoah NP)
- Threatened and endangered beach mice (Gulf Islands NS)
- Tidal freshwater marshes (5 National Capitol national parks)

More Information

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