



Organ Pipe Cactus National Monument: How might future warming alter visitation?

Background

Climate change will affect not only natural and cultural resources within national parks, but also visitation patterns. Where, when, and how many people visit parks is likely to change with continued warming. For example, visitors may avoid extremely warm months in low-latitude parks and the visitation season may extend across additional weeks to months at northern parks. Whether park visitors track climate change and shift their behavior will depend on multiple environmental and socioeconomic factors. However, understanding potential change in visitation based on historical trends and future patterns of temperature change is a crucial first step for park managers and local communities to anticipate, plan for, and proactively affect future visitation. Recent research ([Fisichelli et al. 2015](#)) examined the relationship between park visitation and temperature across 340 NPS units. Here, we summarize and interpret results for Organ Pipe Cactus National Monument. Park-specific briefs for all parks in the study are available at the [National Park Service Science and Nature website](#).

Methods

To assess the relationship between temperature and park visitation at Organ Pipe Cactus National Monument, we evaluated historical monthly average air temperature and visitation data (1979-2013) and modeled potential future visitation (2041-2060) based on two warming-climate scenarios (decreased future greenhouse gas emissions [low emissions RCP 4.5] and business as usual [high emissions RCP 8.5]) and two visitation-growth scenarios (maximum growth within +5% [low] and +25% [high] of average historical visitation of the busiest month). We averaged each month's total recreation visits across all available years in order to capture historical long-term averages in temperature and visitation. We use these data and future climate projections to estimate potential future long-term average visitation. Using a single

explanatory variable, air temperature, we assume others factors as constant (e.g., income, population size, demography, and leisure time availability). See [Fisichelli et al. \(2015\)](#) for a detailed explanation of methods.

Results

Historical relationship between visitation and temperature

Across the national park system, parks varied widely in the historical relationship between long-term average monthly visitation and temperature. Temperature was a significant predictor of visitation at 95% of parks (324 of 340), and temperature explained 12-99% (mean = 79%) of the variation in visitation at these individual parks. The historical visitation-temperature relationship at Organ Pipe Cactus National Monument was Moderately weak (F-test = 10.5, p-value = 0.0088). Temperature explained 46% of the variation in visitation in a 1st-order polynomial model. Observed historical monthly visitation, air temperature, and their association are shown in Figures 1 and 2. Due to the relatively weak relationship between historical visitation and temperature, we do not report potential future visitation change for the park.

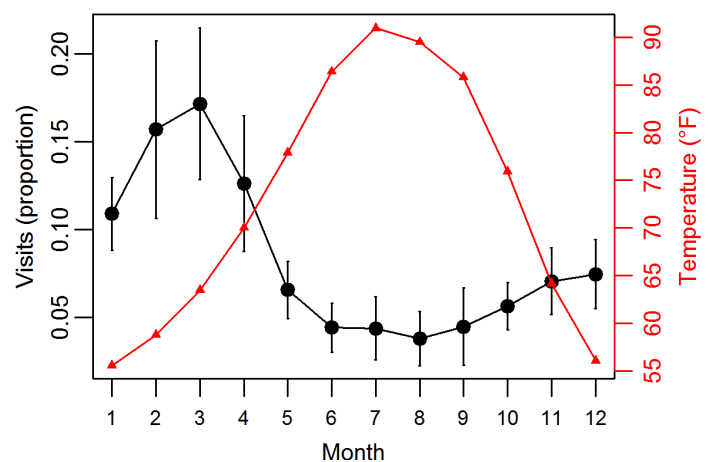


Figure 1. Observed (1979-2013) long-term average monthly visitation (black circles) and temperature (red triangles) at Organ Pipe Cactus National Monument. Historical (black) error bars are +/- one standard error. Each month's visitation is expressed as a proportion of the annual total.

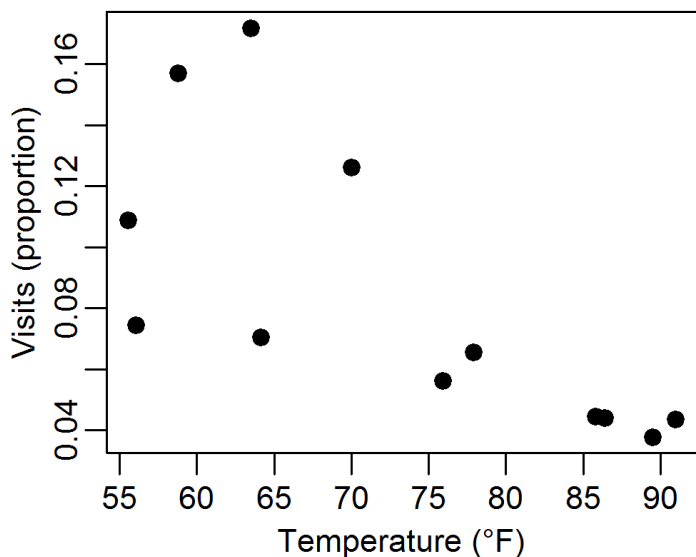


Figure 2. Bivariate scatterplot showing the relationship between observed (1979-2013) long-term average monthly visitation and temperature at Organ Pipe Cactus National Monument. Each month's visitation is expressed as a proportion of the annual total.

Interpreting Output

The research presented here does not support a strong historical relationship between temperature and visitation at Organ Pipe Cactus National Monument. This does not necessarily mean that park visitors are not responding to climate. Visitors may be responding to other aspects of climate in addition to temperature, such as precipitation, or to shorter-term weather patterns, such as storms and heat waves. Non-climate factors may also be significant drivers of visitation. It is important to note that visitor response to climate may shift or strengthen with ongoing climate change. These models are intended as tools to help managers envision potential future changes and their management implications. Many factors will alter and constrain actual future visitation patterns, including population changes, economic trends, travel costs, future disposable income, leisure time availability, and the capacity of parks and local communities to expand services to meet changing visitor needs. Additional questions for managers to explore in the context of visitation:

- What other non-modeled factors are driving visitation at your park?
- When does the temperature model perform poorly and what else is occurring in those months?

- What other factors might change in the future and further affect visitation?
- How might you combine the climate projections with other factors to develop future visitation scenarios?

Implications – Adapting to Change

The National Park Service is about to begin its second century of preserving America's natural and cultural heritage and providing for visitor enjoyment. A changing climate is likely to have cascading and complex effects on park visitation, management, and local economies. Parks and surrounding communities will need to adapt to both the challenges and opportunities posed by changing visitation. Understanding the relationship between visitation and temperature presents an opportunity to plan for the future. Increased efforts to measure human visitation trends, the analyses provided here, and further research into short-term visitation patterns and other drivers of visitation can help park managers adapt to the effects of climate change and remain effective resource stewards while promoting visitor experience.

More Information

This project is part of ongoing work of the National Park Service Climate Change Response Program and collaborators to support park adaptation to changing conditions. View more information online for [NPS managers](#) and for the [public](#).

Source Publication

[Fisichelli, N.A., Schuurman, G.W., Monahan, W.B., and Ziesler, P.S. 2015. Protected area tourism in a changing climate: will visitation at US national parks warm up or overheat?. PLOS ONE doi: 10.1371/journal.pone.0128226.](#)

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