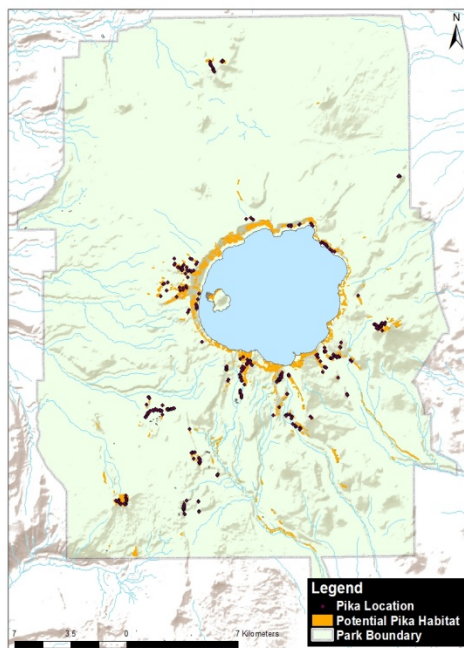




Objective 3:

Predicting pika population vulnerability to global climate change



Map of Crater Lake National Park showing where pika were detected during 2010–2012.

Objective 3

- Use pika distribution and habitat information (Objective 1) in conjunction with genetic connectivity information (Objective 2) to conduct a vulnerability assessment of pika in each park.
- Predict changes in available suitable habitat, population **connectivity**, and **metapopulation dynamics** in each park using **downscaled global climate change models** at the present and at two future time steps.
- Use these findings to inform pika conservation on NPS lands, through the development of proactive measures to conserve connectivity and genetic diversity in future pika populations.

Background

Global climate change is a threat to the persistence of many species. To develop conservation strategies for vulnerable species, we must first investigate how global climate change may affect them. Modeling these impacts can be challenging for species such as pika, which occur in diverse environmental conditions across a large geographic area. The **talus** slopes and **lava** flows utilized by pika are often widely scattered and separated by unsuitable habitat. Therefore, we must investigate potential changes in both suitable habitat distribution and the ability of pikas to move between habitat patches. The Pikas in Peril research team has assessed the current distribution and habitat requirements of pikas in 8 national parks (see Objective 1 brief; Jeffress et al. *in press*) and is currently studying the relationship between habitat type, landscape features, distance and **gene flow** (see Objective 2 brief). Using results from these studies, we will assess pika population vulnerability to climate change, in terms of connectivity, genetic diversity, metapopulation dynamics and extinction risk as related to the unique characteristics of each park.

Parks included in Objective 3

- Crater Lake National Park
- Craters of the Moon National Monument and Preserve
- Grand Teton National Park
- Great Sand Dunes National Park and Preserve
- Lassen Volcanic National Park
- Lava Beds National Park
- Rocky Mountain National Park
- Yellowstone National Park



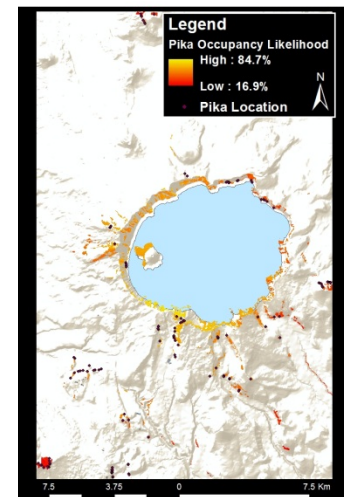
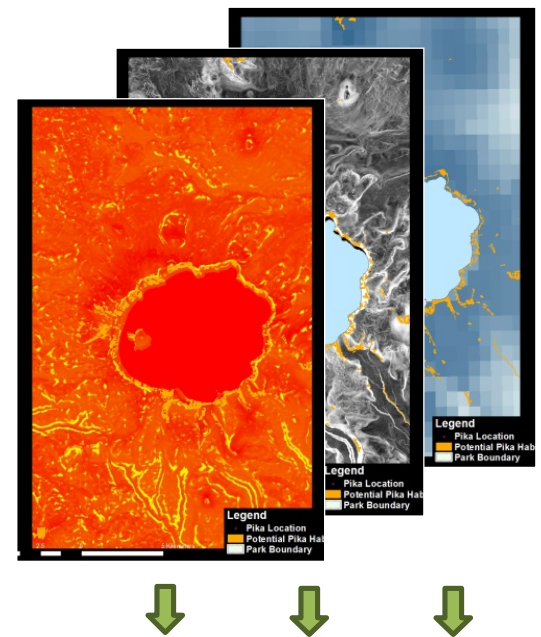
Pika occur in a variety of habitat types, including (but not limited to) densely vegetated talus, sparsely vegetated talus, and moderately vegetated Pahoehoe lava flow (from left to right). The unique characteristics of each habitat type may render it more or less suitable for pika occupancy under future climate change scenarios.

Study design and methods

During 2010-2012, trained field crews surveyed pika occurrence at over 600 sites across 8 parks. Pika droppings were collected during these surveys and during systematic searches of potential habitat. DNA extraction and analysis were conducted at the Epps population genetics laboratory at Oregon State University. We used these data to examine what factors (such as snow depth, ruggedness, elevation, and temperature) influence pika presence in potentially suitable areas and what factors (such as terrain, vegetation, distance) influence gene flow between patches. We next identified data sources which capture how and where these influential factors are expected to change on the landscape under future climate scenarios. Using these data as inputs, we will construct models which predict where pikas are likely to experience suitable conditions for persistence through the year 2100.

Modelling shifts in pika distribution and connectivity

Research completed during Objectives 1 and 2 provides insight into the unique relationship between pika populations and climate, topography, vegetation and habitat availability. Building from this knowledge, we will predict the expected distribution of pikas in each park at present and at two future time scales, using the most up-to-date **emissions scenarios**, **downscaled climate models** and, where appropriate, **dynamic vegetation models**. We will use the distribution and amount of predicted suitable habitat and our knowledge of pika genetic diversity and gene flow to assess expected changes in genetic diversity. Finally, we will model how pikas will persist in these national parks as the availability, location and amount of suitable pika habitat is altered by global climate change. These approaches go beyond predicting climatic suitability based on temperatures alone, and explore the potential for climate change to affect population dynamics and genetic diversity. Finally, we will identify areas that are potential strongholds for long-term pika persistence in each park, providing important information for resource conservation management.



We will use a combination of genetic, topographic and climate data to predict current and future pika occupancy and gene flow in each park.

Key references

Garrett, L., M. Jeffress, M. Britten, C. Epps, C. Ray, and S. Wolff. 2011. Pikas in Peril: multiregional vulnerability assessment of a climate-sensitive sentinel species. *Park Science* 28:9-13.

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Rodhouse, T. J., E. A. Beever, L. K. Garrett, K. M. Irvine, M. R. Jeffress, M. Munts, and C. Ray. 2010. Distribution of American pikas in a low-elevation lava landscape: conservation implications from the range periphery. *Journal of Mammalogy* 91:1287-1299.

These handouts were created to provide a brief description of the 3 objectives of the "Pikas in Peril" research project, funded by the National Park Service Climate Change Response Program. For more details regarding the project and why we are studying pikas, please refer to the overall project resource brief and/or the website listed at the bottom of the page. Terms in bold are also defined in a glossary (see link).

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