



# Pikas of Yellowstone National Park

## *Project Summary and Results*

### Pikas in Peril Project Background

The American Pika (*Ochotona princeps*) is a charismatic indicator species of the potential effects of climate change on mountain ecosystems. Pikas are sensitive to summer heat and rely on winter snowpack for insulation from harsh winter temperatures. The National Park Service stewards pika populations in more than a dozen parks and seeks to understand the vulnerability of pikas and other mountain species to climate change. Pikas in Peril, funded in 2010, is a collaborative research program directed by scientists from the National Park Service, Oregon State University, University of Idaho, and University of Colorado-Boulder. To help the National Park Service better prepare for the ecological changes anticipated in the coming decades, the team pursued three objectives in eight of these parks.



NPS/Waller

### Objectives

1. Identify the factors (e.g., temperature, precipitation, habitat connectivity, topography, etc.) that shape contemporary pika distributions.
2. Assess the connectivity and gene flow of pika populations, including how landscape features affect movement of pikas between patches of suitable talus and lava flow habitat.
3. Evaluate climate change vulnerability of pika populations in each park by integrating pika distribution and gene flow models with forecasted regional changes in temperature and precipitation.

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### Results

Yellowstone National Park (YELL) is warmer and drier than nearby parks like Grand Teton, and American pika distribution patterns there generally follow expectation that pika site occupancy probabilities increase at higher elevations. Currently, pika distribution in YELL occurs in many small and isolated talus habitat patches, and site occupancy probabilities are most influenced by warm season precipitation and temperature, implying that heat stress and also perhaps forage availability are driving factors for pika persistence. Under scenarios of projected climate change, the park is expected to become warmer and drier; these two factors will exert more and more stress on the species. Overall, pika distribution and site occupancy probabilities are expected to decline from current levels of close to 100% to about 20% over the coming decades (Figure 1). Based on model projections, the pika population at YELL appears to be vulnerable to extirpation. Interestingly, current genetic diversity in YELL is quite high, a likely reflection of favorable conditions during the recent past facilitating dispersal and gene flow (Figure 2). Based on projections of steep decline in patch occupancy in the coming decades, genetic diversity is also likely to decline. This provides a hypothesis that can be tested with data collected during future surveys.

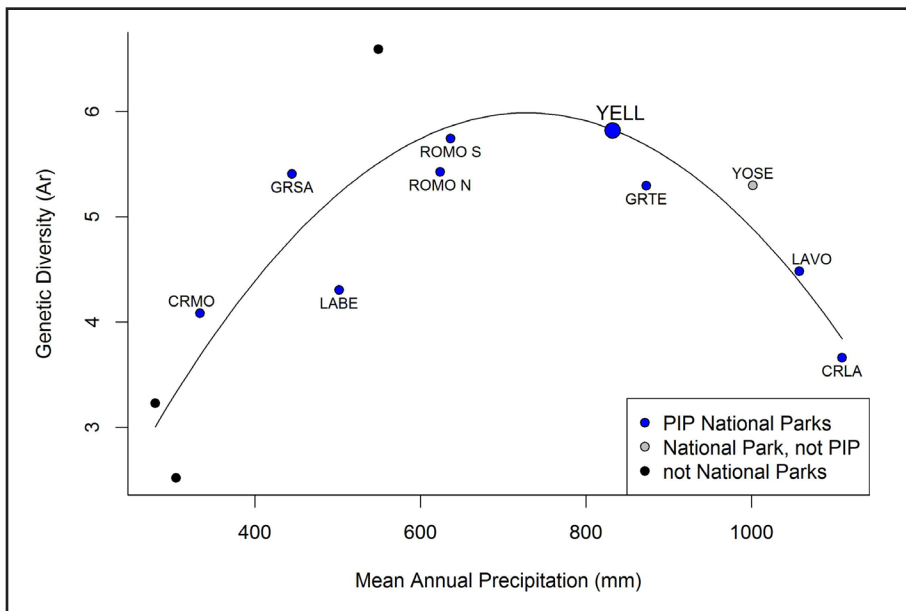


Figure 1. Genetic diversity, quantified as allelic richness corrected for sample size ( $A_r$ ), was strongly predicted by mean annual precipitation. Study sites with moderate precipitation had higher genetic diversity than those with extremely high or low precipitation. Genetic diversity of the pika population in YELL, as measured by  $A_r$ , was particularly high.

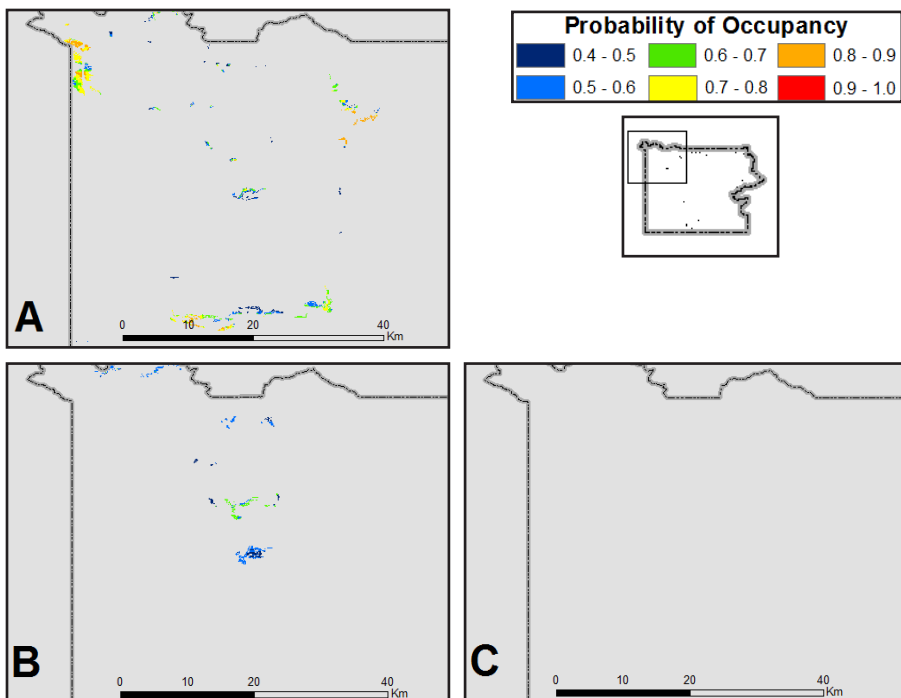


Figure 2. Current pika occupancy (A) and two future (2071-2099) occupancy scenarios (B, C) in Yellowstone National Park. For illustrative purposes, only the north-west corner of the park is shown. Future scenarios are based on two different models of potential human-driven carbon emissions. The pika population shows precipitous declines in both distribution and occupancy probability. By 2099, pika are predicted to be restricted to <20% of the current distribution (B) or extirpated (C).

## Conclusions

Climate change forecasts indicate that YELL will become warmer and drier in the coming decades. Pika populations are expected to decline steeply in the coming decades, and risk of extinction is high under a “business as usual” global carbon emissions scenario. Heat stress was not uniformly important across all the parks studied by the Pikas in Peril team, but it appears to be a fundamental driver of change for pika in YELL. Although landscape genetic connectivity was not closely examined in YELL, overall pika population genetic diversity was high. Declining patch occupancy and distribution under scenarios of climate change may jeopardize this diversity. Management activities that help mitigate loss of genetic diversity, including translocation and facilitated migration, could contribute to future pika conservation.

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### For more information, visit the UCBN pika monitoring webpages:

[http://science.nature.nps.gov/im/units/ucbn/monitor/pikas\\_in\\_peril.cfm](http://science.nature.nps.gov/im/units/ucbn/monitor/pikas_in_peril.cfm)  
<http://science.nature.nps.gov/im/units/ucbn/monitor/pika.cfm>