Pikas of Rocky Mountain 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/Chris Ray

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.

Results

Rocky Mountain National Park (ROMO) is a unique site because there are two different subspecies of pikas within the Park. The northern and southern Rocky Mountain lineages were once isolated from each other but currently coexist in the park and are likely interbreeding. Elevation is the main limitation to dispersal in the park, as pikas apear to avoid the lowest elevation areas because of heat stress. In the southern portion of the park, the warmer south and west facing slopes pose a significant barrier to animal movements and gene flow as well; both factors indicate that hotter temperatures may reduce pika dispersal. Genetic diversity at ROMO is high, indicating a large amount of well-connected habitat that supports a robust pika population (Figure 1).

Spatial configuration of habitat patches and habitat connectivity are important determinants of pika occupancy, as are temperature and precipitation during the cool season. In terms of the ROMO pika population's vulnerability to climate change, this indicates the potential importance of 1) sufficient snow cover providing thermal protection from cold temperatures for over-winter survival and 2) continued habitat connectivity. Climate models predict higher temperatures throughout the year at ROMO, declining habitat suitability and declining connectivity between patches. The combination of these factors is likely to lead to significant declines of pika populations within the park. Overall, the average likelihood that pikas will persist in a given area of habitat drops from >75% to <40%, while the overall amount of habitat occupied by pikas declines from >80% to <20%, with some models predicting complete extirpation by 2100 (Figure 2).

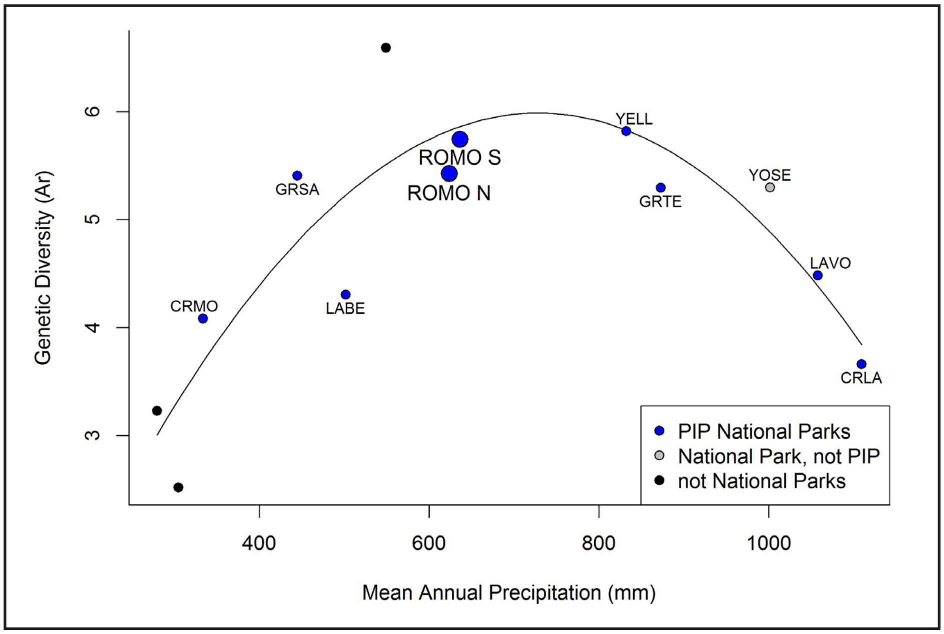

Figure 1. Genetic diversity, quantified as allelic richness corrected for sample size (Ar), was strongly predicted by mean annual precipitation. Study sites with moderate precipitation had higher genetic diversity than those with extremely high or low precipitation. ROMO had relatively high genetic diversity compared to the other Pikas in Peril sites.

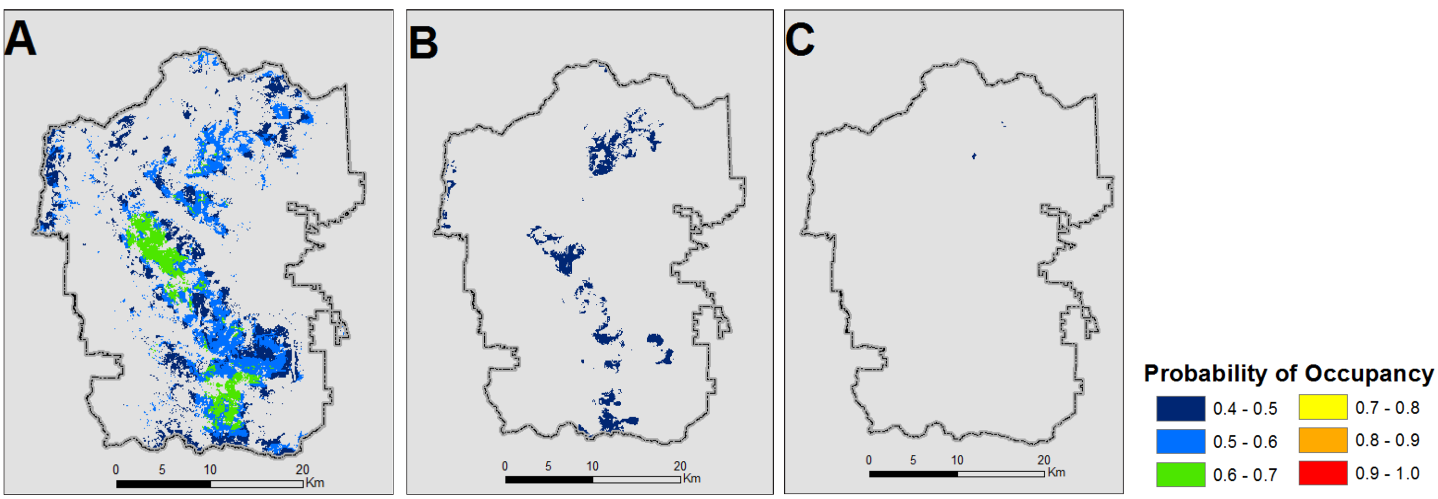

Figure 2. Current occupancy (A) and two future (2071-2099) occupancy scenarios (B, C) in Rocky Mountain National Park. Future scenarios are based on two different models of potential human-driven carbon emissions. The pika population shows precipitous declines in both distribution and occupancy probability. By 2099, pika are predicted to be restricted to less than 20% of their current distribution (B) or nearly extirpated (C).

Conclusions

Pikas at ROMO are vulnerable to extirpation due to climate change. This vulnerability appears driven by a break down in connectivity due to warming temperatures and the reduction of the amount of suitable habitat. Pika populations in this park may benefit from management actions which mediate connectivity losses as climate change progresses. Currently, genetic diversity, occupancy and distribution are relatively high in the park, offering potential for resilience with adequate management. Continued monitoring will be important for tracking climate change impacts on this population.

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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/pika.cfm