Pikas of Great Sand Dunes National Park and Preserve

Project Summary and Results

Pikas in Peril Project Background

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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.

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

Great Sand Dunes National Park and Preserve (GRSA) is one of the highest, driest, and coldest of the 8 studied parks. Pika site occupancy in GRSA increases with elevation, summer precipitation, and on cooler north-facing slopes. In addition, the connectivity and availability of talus habitat strongly influences contemporary pika distribution patterns in GRSA. Important barriers to pika dispersal include distance between habitat patches, open water, and exposed areas such as bare rock. Well connected talus patches in the central portion of the preserve are critical to maintaining gene flow (Figure 1). Habitat is more fragmented in the northern portion where pika movement among patches is limited. The southern portion of the preserve appears to be uninhabited by pikas (Figure 1).

Previous studies have predicted that pika distributions will shift to higher elevations in the coming decades. We also found that pikas will remain concentrated at higher elevations at GRSA. Hotter south facing slopes and lower elevation habitat patches are less likely to support pikas in the future. Our models also revealed that habitat patches that receive higher amounts of summer rainfall will be important to pika population persistence in the future. Overall, we found an approximate 20% net loss of pika distribution in GRSA, and a reduction in site occupancy probabilities in remaining habitat patches (Figure 2). However, these climate change impacts did not appear to greatly reduce habitat connectivity in the central and northern portions of the preserve.

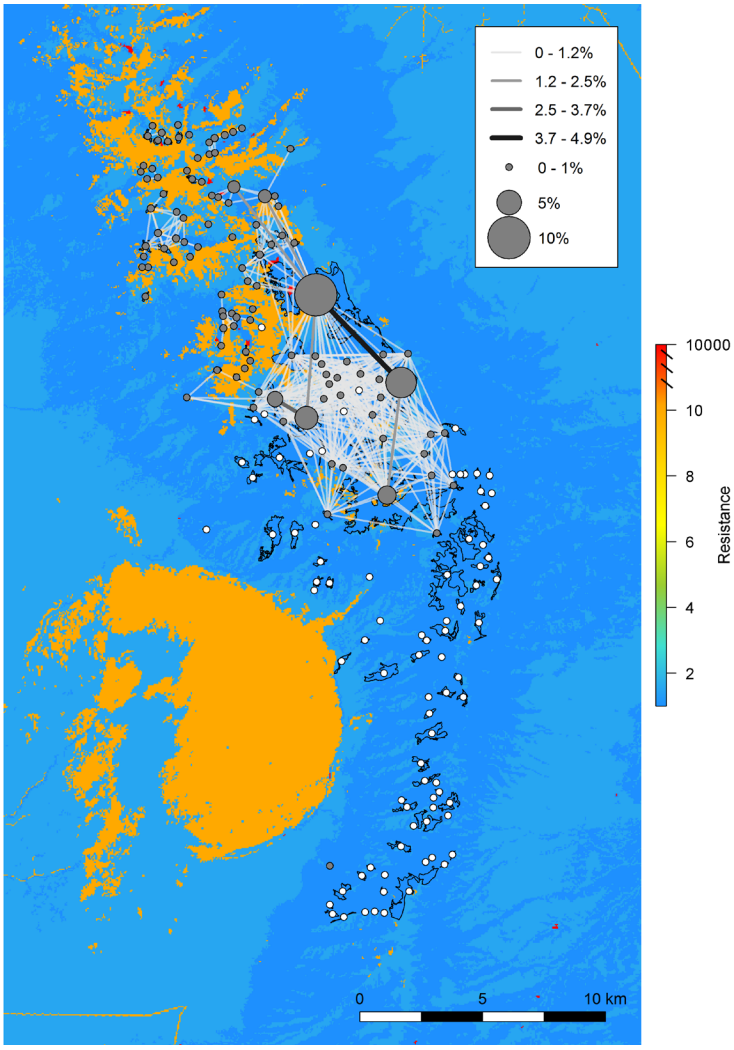

Figure 1. Map of GRSA showing relative resistance to pika dispersal in the background, with orange and red colors indicating high resistance. Each habitat patch is represented by a circle, or "node". White circles in the central and southern half of the park are predicted to be unoccupied. Gray circles in the northern half of the park are predicted to be occupied. Circle size indicates the relative importance of patches for maintaining overall connectedness. The park's charismatic sand dunes are highlighted as a large area of resistance in the southwestern portion of the map.

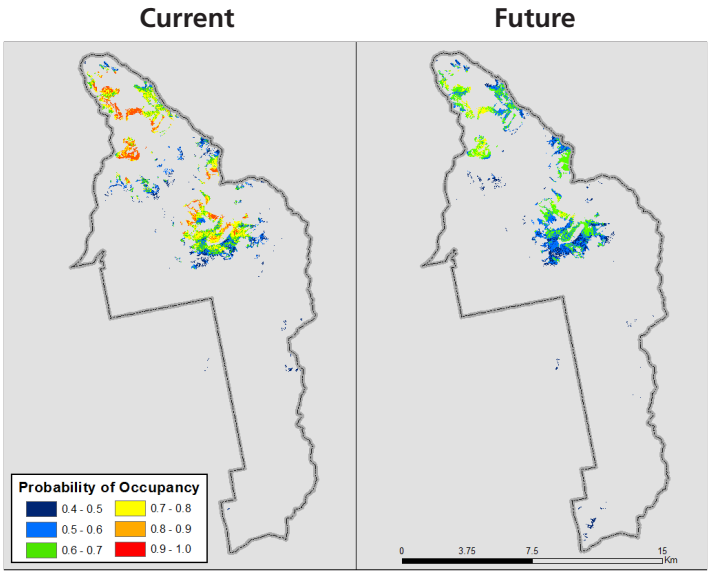

Figure 2. These maps show likelihood of current (left panel) and future (right panel) patch occupancy patterns. There is a modest predicted net decline in numbers of suitable habitat patches and in occupancy probabilities of remaining patches. Future patch occupancy probabilities become concentrated in the highest, wettest, and coolest (e.g., north slopes) patches.

Conclusions

Climate change forecasts indicate that GRSA is likely to remain one of the coolest of the 8 studied parks, even as temperatures increase. Although heat stress will contribute to future pika distribution patterns, changes in precipitation, particularly during summer, are likely to be more important in this arid park. Climate changes do not appear to induce substantial impacts on existing habitat connectivity, and there is encouraging evidence that the pika population can persist in the northern half of the park. Contemporary patterns of gene flow suggest that habitat connectivity is very high among patches in the central portion of the park. Maintaining connectivity in this region, for example by preventing landscape barriers such as roads, will be a key element to park conservation strategies.

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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