



In Focus

Impact of a cougar decline on Zion Canyon, Zion National Park

By Betsie Blumberg

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THE COUGARS OF ZION NATIONAL PARK, Utah, have withdrawn from Zion Canyon, and the cottonwood forest in the canyon has declined with their departure. Further changes in biodiversity and streambed characteristics in the canyon area of the park have also taken place. Researchers William J. Ripple and Robert L. Beschta of Oregon State University studied the trophic cascade that occurred with the decline in cougar (*Puma concolor*) population ([fig. 1](#)). Their research was supported by the Colorado Plateau Cooperative Ecosystem Studies Unit (CESU). Cooperators were Oregon State University and the National Park Service.

Zion Canyon was first settled by ranchers and homesteaders in 1862. Their activities left the canyon with destabilized creek channels, little of its natural vegetation, and a very small mule deer (*Odocoileus hemionus*) population. The settlers later abandoned the canyon and in 1918, Zion National Park was established. By the late 1920s, the vegetation and the deer were returning, and the number of visitors to the park was growing. By 1934, the decline of the cougar, attributed to human traffic and activity, was noted by park staff.

Researchers Ripple and Beschta were interested in assessing ecosystem changes where cougars had become rare. To do so, they compared the age of cottonwood trees (*Populus fremontii*) and selected riparian biota in the canyon with the same landscape features in an adjacent area of the park, the North Creek drainage, where human visits are infrequent and the cougar population is stable. (According to Utah Division of Wildlife files, the park has an estimated cougar population of 17–25 animals/1,000 km² [386 miles²].)

“Decline of the cougar had a profound long-term effect on terrestrial and aquatic ecosystems in Zion Canyon.”

At both sites, investigators measured the diameter of cottonwood trees and took cores from trees to establish age-diameter relationships. These results were used to develop historical trends in cottonwood recruitment (seedlings that matured to trees). They also surveyed streambank conditions, channel dimensions and width:depth ratio, and hydrophytic vegetation (i.e., plants that grow in water). To assess biodiversity, they inventoried the abundance of selected indicator species of wildflowers, amphibians, reptiles, and butterflies. They determined mule deer abundance by recording hoofprints along transects, and cougar abundance by quantifying scat per linear kilometer of foot trails.

In the North Creek study area, where cougar and deer continue to coexist, cottonwood trees showed continuous recruitment, with more young trees than old ones. Zion Canyon, in contrast, had few young trees and little recruitment since the 1940s, the apparent result of heavy browsing by deer after cougar were displaced from the canyon. The abundance of hydrophytic plants and wildflowers along streams was greater in the North Creek area than in the canyon, and there were more species and a greater abundance of lizards and butterflies. In Zion Canyon, where streambank erosion was 2.5 times more common than in North Creek, streambeds were wider and shallower. Fish surveys conducted since 1994 also indicated that mean

densities of native fish were three times higher in streams in areas where cougars were common (North Creek) than where cougars were rare (Zion Canyon).

These observations indicate that the decline of the cougar had a profound long-term effect on terrestrial and aquatic ecosystems in Zion Canyon. The loss of the large predator resulted in greatly increased mule deer density, which increased browsing on cottonwood seedlings and other vegetation, and the forest was diminished. Heavily browsed streamside vegetation caused declines in riparian fauna and allowed streambanks to erode. Overwidened channels and non-vegetated streambanks created shallow channels of degraded fish habitat.

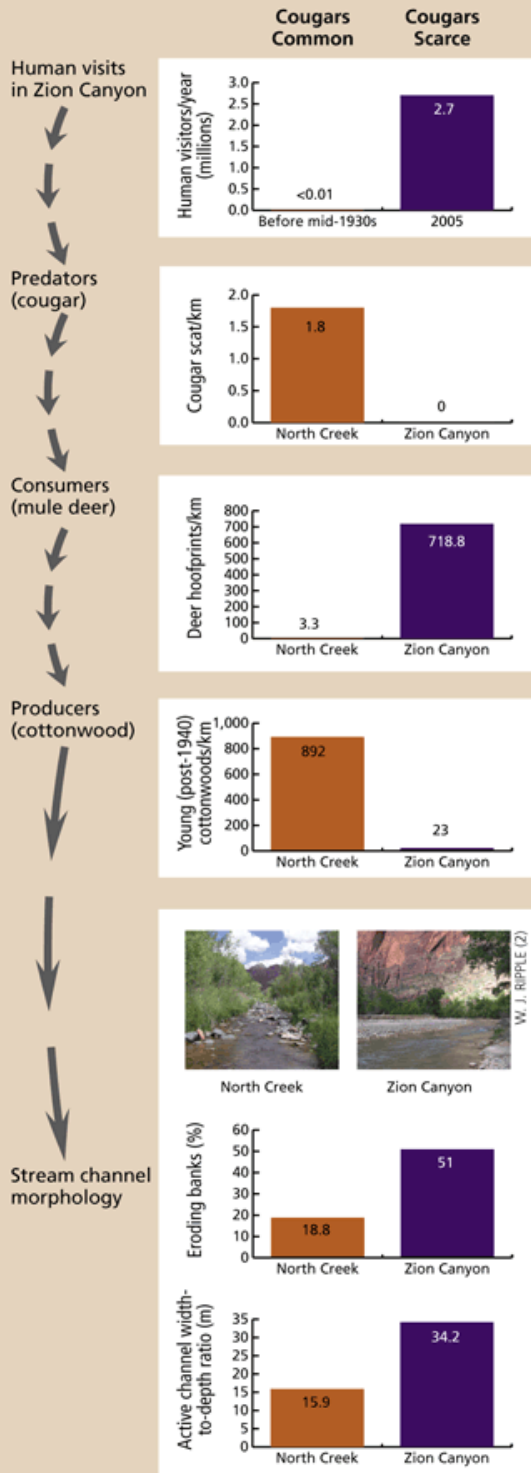
This study demonstrates the consequences that followed the departure of the cougars from Zion Canyon. Its findings are consistent with those assessing the impact of the removal of wolves and provide important insight to managers of parks and other natural areas where large predators have been extirpated or displaced.

For more information

Ripple, W. J., and R. L. Beschta. 2006. Linking a cougar decline, trophic cascade, and catastrophic regime shift in Zion National Park. *Biological Conservation* 133:397–408. Available online at http://www.cof.orst.edu/leopold/papers/cougar_cascades_ripple_beschta_2006.pdf.

[—Contact the author.](#)

a. Trophic Cascade



b. Species Abundance

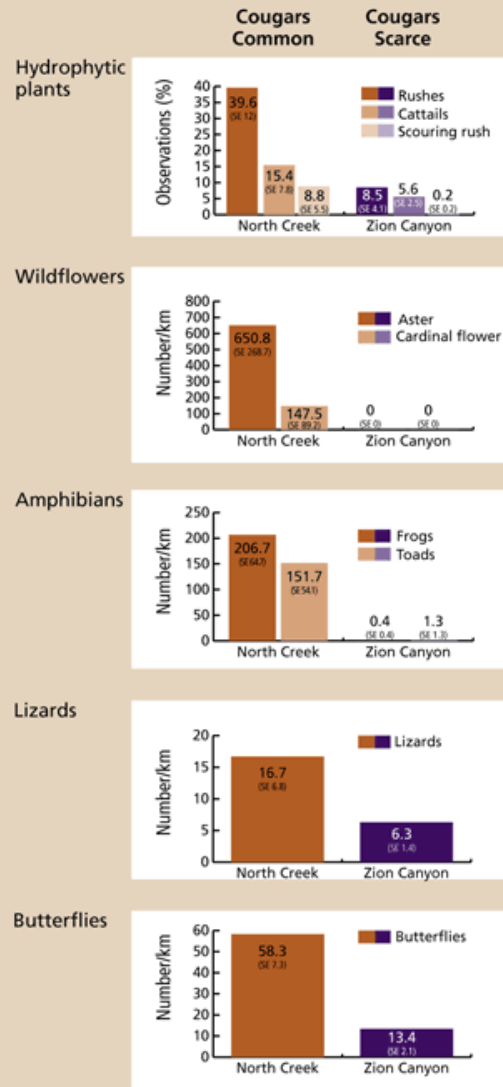


ILLUSTRATION ADAPTED FROM FIG. 5 OF RIPPLE AND BESCHTA 2006. PHOTOS (2): W. J. RIPPLE

Figure 1. Trophic cascade (a) is indicated by inverse patterns of indicator amplitude across trophic levels and (b) observed biodiversity indicators in 2005 for “cougars common” in North Creek, the control area, and “cougars rare” in Zion Canyon, the treatment area, of Zion National Park, Utah. Species include Fremont cottonwood (*Populus fremontii*) originating since 1940, rushes (*Juncus* spp.), cattails (*Typha* sp.), scouring rush (*Equisetum* sp.), Welsh aster (*Aster welshii*), cardinal flower (*Lobelia cardinalis*), canyon tree frogs (*Hyla arenicola*), and red spotted toads (*Bufo punctatus*). Lizards and butterflies observed are listed in Ripple and Beschta (2006). Error bars represent standard errors.

National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science
Office of Education and Outreach



Park Science, Volume 26, Number 2, Fall 2009, ISSN 1090-9966
National Park Service, U.S. Department of the Interior
Natural Resource Program Center, Office of Education and Outreach
Lakewood, Colorado