

# Genetic study clarifies evolutionary origin of elusive montane red fox

May 20 2011

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North American red foxes originated from two separate genetic lineages that were isolated from each other by glaciers some half a million years ago, according to a U.S. Forest Service Pacific Northwest Research Station study.

The research—featured in the April/May 2011 issue of *Science Findings*, a monthly publication of the station—can assist efforts aimed at conserving potentially imperiled montane populations of the species.

"When most people think of the red fox, they envision the ones that thrive in low-elevation, human-dominated landscapes," said Keith Aubry, a research wildlife biologist at the station who led the study. "But there are other extremely elusive and rarely seen populations that live only in isolated alpine and subalpine areas in the mountains of the Western United States."

The latter group—the montane [red foxes](#)—may be imperiled by climate change and other contemporary pressures and were the focus of Aubry's doctoral work in the early 1980s. Contrary to prevailing theory at the time, Aubry hypothesized that native North American red foxes were descended from two distinct lineages, not one, that were isolated from each other in both northern and southern ice-free areas during the most recent Ice Age. Such an evolutionary history would help explain the unique ecological adaptations of the montane foxes, and why native red foxes in southern British Columbia are so much bigger than the montane foxes that occupy nearly adjacent areas in Washington's Cascade Range.

"If all of North America's foxes originated from a single lineage that had expanded its distribution in a wave across the continent, you'd expect to see a more or less continuous gradient in size," Aubry said. "But there was an abrupt discontinuity in size in that area, suggesting that the montane red foxes had evolved in isolation from the northern populations," Aubry said.

Only recently were Aubry and his colleagues able to test this hypothesis through genetic analyses of 285 museum specimens and a close examination of fossil, archeological, historical, and ecological records. They found that North American red foxes did, indeed, stem from two distinct lineages that diverged from each other while they were isolated in both the southern and northern parts of the continent during the last Ice Age. Moreover, Aubry suspects that montane foxes' smaller size and high-elevation habitat preference is indicative of their being descendants of ancient foxes that had inhabited the southern part of the continent.

With knowledge of the evolutionary history and genetics of the North American red fox, managers can distinguish native from nonnative populations and can clarify genetic relationships among subspecies—knowledge that, in turn, can be used to target conservation efforts to the appropriate gene pool.

**More information:** To read the April/May 2011 issue of *Science Findings* online, visit [www.treearch.fs.fed.us/pubs/37702](http://www.treearch.fs.fed.us/pubs/37702)

Provided by USDA Forest Service

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