IS MERRIAM'S ELK REALLY EXTINCT?

While patrolling on a mesa between Black River and the higher plateau of the Blue Range about two years ago I discovered bedding signs of a small band of elk. I also found a pair of antlers which I placed in a tree for protection from damage by fire or otherwise. The exact place, near as I can remember, is on a little mesa facing a canyon known locally as Conklin's Draw, between Fish Creek and Bear Wallow, about a mile east of Black River.

— G. B. Chapin, Deputy Forest Ranger, May 25, 1906

In his letter to the District Office, Ranger Chapin probably did not realize that he was recording the last written record of the "Merriam's elk." It was about that time when the light for this mysterious elk blinked out. The mystery of Merriam's elk lies in the fact that they disappeared before we had the opportunity to learn much about them.

Merriam's elk were found in their greatest abundance throughout the White Mountains of Arizona, and the Mogollon and Sacramento mountains of New Mexico. Letters of correspondence from that time indicate that elk were plentiful in the White Mountains as late as the 1870s, but were rare just a decade later. Reports of Merriam's elk fizzle out earlier in New Mexico than in Arizona. The reasons for this rapid decline are not entirely known, but no doubt are related to the expansion of human settlement that was happening concurrently. Livestock numbers were much higher then, and the widespread subsistence and market hunting occurring at that time had no effective regulation.

Naturalist E. W. Nelson was in the Southwest collecting specimens in the 1880s when he heard about elk living in the higher, more remote parts of the White Mountains,

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One of only three known specimens of *Cervus merriami*, Merriam's elk, a species originally native to Arizona.

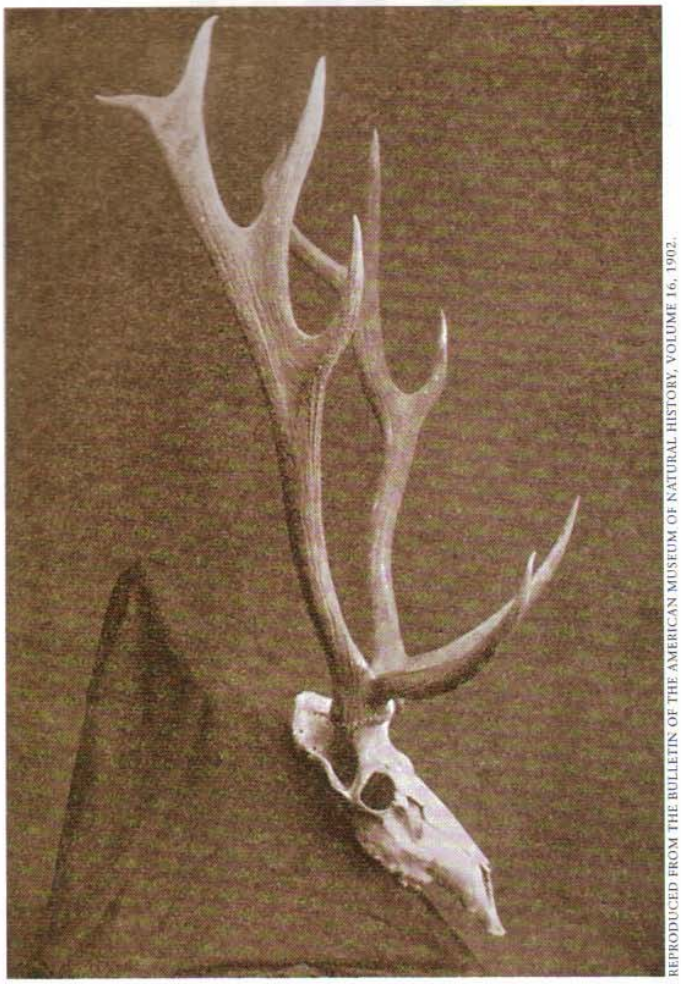
PHOTO COURTESY OF THE NATIONAL MUSEUM OF NATURAL HISTORY

along the border of the White Mountain Apache Indian Reservation near the head of the Black River. While living at his ranch outside of Springerville, he took frequent collecting trips to the Mt. Ord area and in 1886 was successful in collecting a Merriam's elk specimen for science. An old bull with large antlers, it was shipped to the National Museum of Natural History in Washington, D.C., to serve as the representative of a new species of elk, *Cervus merriami*. Underscoring the rapid disappearance of Merriam's elk is the fact that this specimen was found to have three bullets encysted in the thick hide of its neck and shoulders: one from a Springfield musket and two from .44 caliber Winchester rifles.

The following year, Nelson obtained a second specimen, another mature bull, and with these

two large males as reference points, he described the Merriam's elk as being larger than its northern cousins. Nelson's bulls would prove valuable, as these are the only two individuals collected specifically as specimens of Merriam's. These two and a third individual housed at the University of Arizona represent the only three Merriam's elk known to science. The third animal is known as the "Jesse Burke Rack" because Jesse Burke found it in the Springerville area when he was a teenager, sometime between 1908 and 1914.

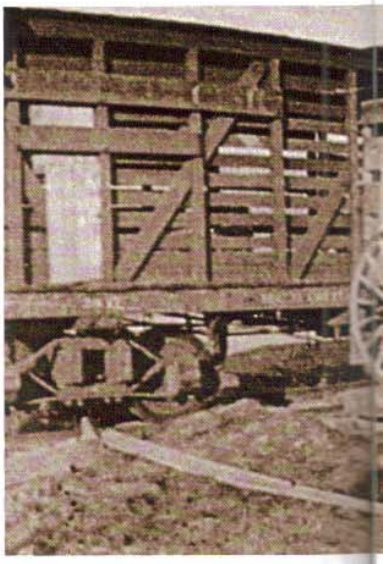
With reports of Merriam's elk subsiding by 1906, it did not take long for concerned citizens to take action to restore this important native animal. After reading an article on trapping and shipping elk in the August 1912 issue of *Outdoor Life* magazine, R. N. Looney, a young frontier doctor, contacted the Boone and Crockett Club, which advised him on the details of translocating animals. With the support of George Hunt, Arizona's first governor, Looney secured a permit to transport 80 head of elk from Yellowstone National Park and release them in Arizona. During this period, the Benevolent Protective Order of Elks asked to take on the logistics of the effort as their project. The Elks Club provided assistance in every step from capture to release.



REPRODUCED FROM THE BULLETIN OF THE AMERICAN MUSEUM OF NATURAL HISTORY, VOLUME 16, 1902.

Naturalist E. W. Nelson collected this specimen of Merriam's elk near Springerville in 1887. It now resides in the American Museum of Natural History in New York City.

The Yellowstone elk were captured in February 1913 out of the northern Yellowstone herd near Gardiner, Montana, and shipped by railroad to Winslow, Arizona. The National Archive records show that the permit was for 80 head of elk; however, when they arrived in Winslow, 86 elk mysteriously appeared from the railcars—14 bulls, 4 adult cows, and 68 heifer yearlings. The local Elks Club transported the elk to their release site at Cabin Draw in 12 wooden horse-drawn wagons that had been modified to contain the elk.



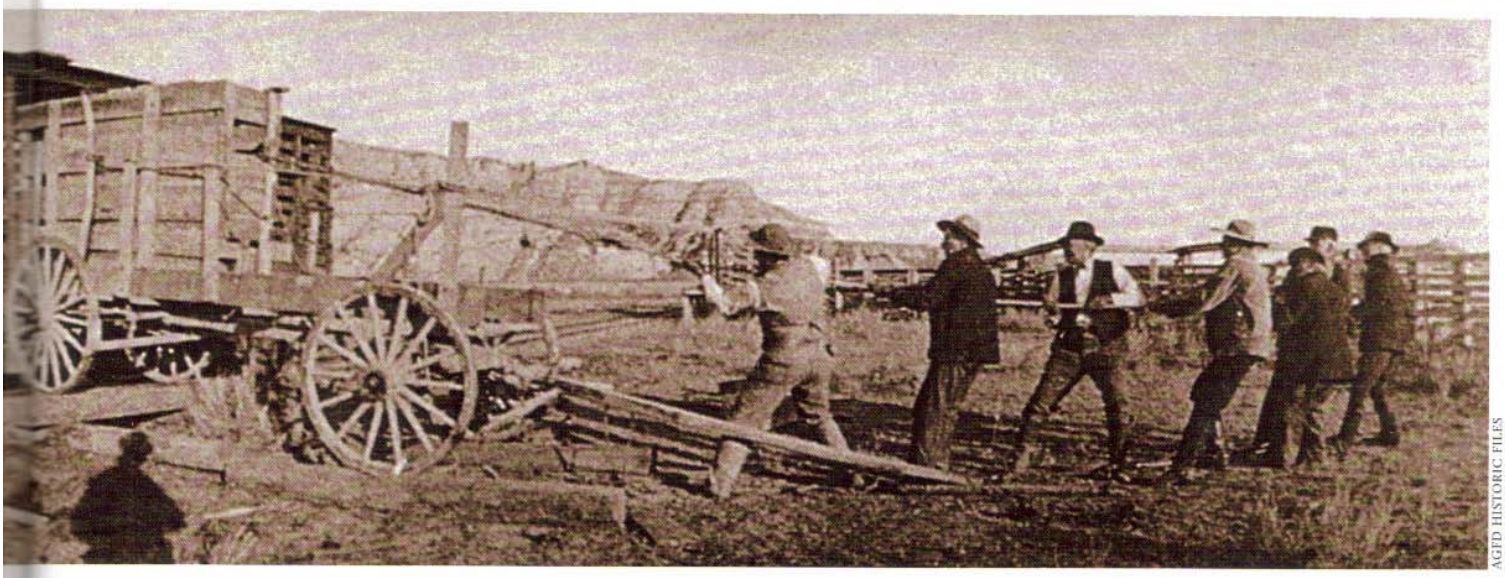
Above: In February 1913, 86 elk arrived in Arizona, transported by train from Yellowstone National Park to repopulate the state. **Right:** These elk, which were released near Clear Creek, are the forebears of today's herds.

This first introduction was followed by several more in the next decade, but fewer than 300 elk are believed to have been released, and all from the northern Yellowstone herd. These efforts have resulted in more elk in Arizona than Dr. Looney could possibly have imagined. We now have elk in areas where early Arizona settlers never recorded them.

Not only do we have quantity, we have quality as well. Arizona is known for its ability to produce big bulls and trophy cows. What accounts for our large-antlered elk in Arizona? For years many have speculated that it is the influence of Merriam's elk that survived the period from 1906 to the first release in 1913 to interbreed with Yellowstone elk. This genetic influence, they say, is the reason for the large antlers that crown Arizona's *wapiti*. Although many have speculated about whether Merriam's elk is really extinct, it seemed little could be done to settle the matter.

That is, until recently. Genetic analysis methods are developing at an unbelievable rate, and we now have at our disposal tools that no one could have dreamed of just 15 years ago. If some Merriam's elk did survive to interbreed with Yellowstone elk, genetic analysis might detect evidence of Merriam's elk in Arizona's present herd. To solve this mystery, we decided to compare the two to see if today's Arizona elk have any genetic variations that do not occur in Yellowstone elk. If some Arizona elk have a genetic variant that did not come from Yellowstone, that would be good evidence that Merriam's elk contributed to the building of Arizona's elk herds.

The Rocky Mountain Elk Foundation saw the value of



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this effort and funded the entire project. We started by collecting tissue samples from both Arizona and Yellowstone elk. During the hunts, wildlife managers and other Arizona Game and Fish Department personnel collected 82 Arizona elk tissue samples from throughout current elk range. Special emphasis was placed on collecting samples from the White Mountains where Merriam's elk were said to have made their last stand. The last of the Merriam's were reported near Mt. Ord, close to the border of the White Mountain Apache Indian Reservation. Because samples from tribal lands were not made available to us, we sampled those elk as they wintered at lower elevations off tribal lands. Department research shows that elk from Mt. Ord winter east and north of the tribal boundary, so we sampled these areas during the December hunts when those elk were accessible to us. Tom Lemke of Montana Wildlife, Fish, and Parks, as well as Barbara Lundrigan (Michigan) and Dee Dee Hawks (Wyoming) provided 66 samples from Yellowstone National Park.

Arizona and Yellowstone elk were compared to each other using a genetic analysis called SSCP, short for Single Strand Conformation Polymorphism (which is why we linguistically challenged people call it "SSCP"). This analysis divided the elk samples into several categories, called "haplotypes," based on the genetic code of the mitochondrial DNA. The haplotypes could then be evaluated to see if any were unique to Arizona or if our elk are simply a sample of Yellowstone elk with no additional genetic input from native Merriam's elk.

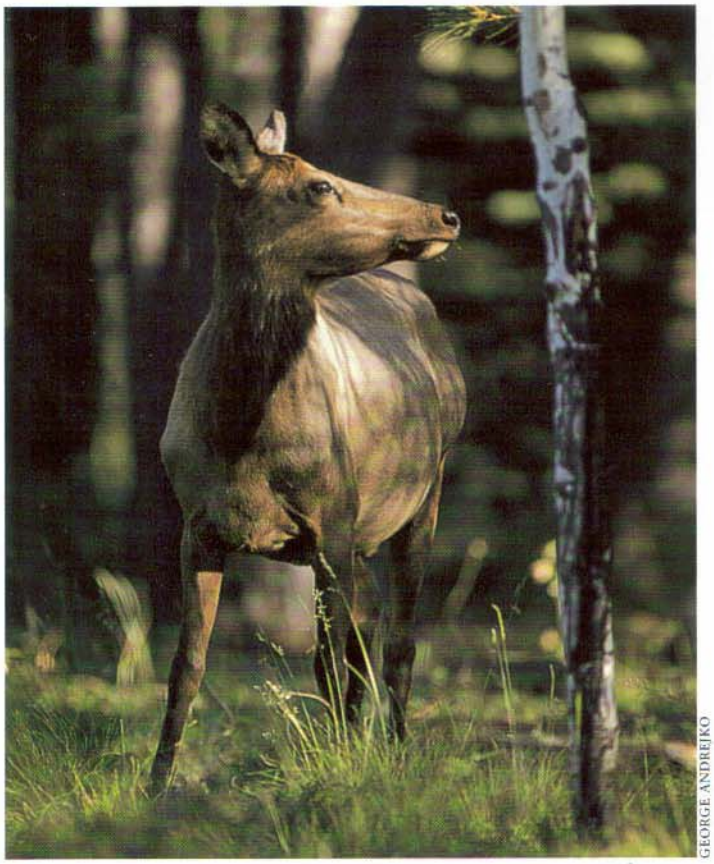
We found seven different haplotypes, but none were unique to Arizona. Two haplotypes were found in the Yellowstone samples and not in Arizona. Both of these occurred in very low percentages in Yellowstone and may not have transferred to Arizona with the small number of elk moved here. The SSCP analysis showed that all the Arizona haplotypes are exactly what one would expect from a sample of Yellowstone elk. In other words, there is no evidence to suggest that elk from Arizona are anything but a subsample of Yellowstone elk.

It appears, then, that Merriam's elk was indeed extinct before the reintroductions. Or does it? How do we know Merriam's elk was any different to begin with? Maybe our native elk were simply a southern extension of Rocky Mountain elk. Recent genetic studies for other presumed elk subspecies in the Rocky Mountain region have shown that some elk subspecies are not different from each other as previously believed.

So why was the Merriam's believed to be different? For Arizona's native elk to be different, there would have had to be separation between them and those elk to the north. A look at the juxtaposition of higher elevation habitat in the Southwest shows that, although there was undoubtedly interchange, Arizona elk may have been

somewhat separated from other populations to the north.

The original description says that Merriam's elk were larger, the nose was darker, the head and legs more reddish, skull more massive, nasal bones wider, tooth row longer, and their antlers had straighter tips. Merriam's elk were described as having compact or "lyre" shaped antlers. Because the original specimen was temporarily misplaced at the National Museum, Nelson used the second bull he collected to describe Merriam's elk as a new species. In later evaluations, it was demoted to the rank of subspecies because its differences certainly were not enough to justify a species-level designation. The diagnostic characteristics related to the larger size might be attributed to the age of the specimen being described. The bull Nelson described was not only very large, but very old with teeth worn to the gum line and some missing. Its age is probably the reason for its regressed lyre-shaped antlers, which were erroneously considered to be a characteristic of the subspecies. Antler size and shape is notoriously variable in members of the deer family. None of the other specimens or photos show Merriam's elk with an antler shape like that old bull. This older bull would also be expected to have darker coloration than that of younger specimens representing other subspecies. Also, the skull measurements of Merriam's elk fall within the range of normal variation of other elk subspecies. In short, there has not been (and cannot be) an adequate evaluation of how different the Merriam's elk was physically, because only two specimens were collected and examined by scientists.



GEORGE ANDREIKO

Arizona is known for its ability to produce big elk—could this be due to Merriam's elk genes?

This is where we can turn to genetics for further inquiries. We gained permission to obtain a DNA sample from the three known Merriam's elk in existence. One is housed in New York, the other in Washington, D.C., and the third (Jesse Burke's Rack) in Tucson. We started with the Burke specimen and extracted DNA from bone dust ground off the inside of the 95+ year-old skull. By sequencing a segment of the DNA, we determined the actual genetic code (ATGCGGTACGT) for 111 positions of the DNA molecule.

We then found results from other genetics studies where researchers had sequenced these same 111 positions in other elk. We found that 20 different variations of this 111-position segment have been found; these 20 variations represent elk from every other living subspecies. We first compared those 20 segments to each other to see how much variation there was in the other recognized subspecies. They differed from each other by anywhere from 0 to four positions along that 111-position segment (most differed by 0 or 1). Then, as a test for how different the Burke specimen was, we compared it one by one to those 20 other variants. What we found was surprising—the Burke specimen differed from the other living elk by three to six positions (more than they differed from each other). We must keep in mind that this is only a short segment of DNA and from only one individual, but this may be an indication that Merriam's elk were, in fact, different from other elk in the Rocky Mountains.

DNA from the remaining two specimens will be collected this winter to see if they, too, show more divergence from other living elk. If these samples show an apparent difference between Merriam's and other elk, the next step will be to obtain additional funding and look at a larger portion of the DNA to provide more support for these conclusions.

Stories of big bulls running around with "Merriam's Genes" make for great campfire tales, but it appears at this point that we have Yellowstone bulls that are glad to be in the warmer climate of sunny Arizona. The abundance of big bulls here is more likely the result of harvest management that allows many of them to reach their full genetic potential. We are now beginning to understand the origin of that genetic potential.

Jim Heffelfinger is the Department's Regional Game Specialist in Tucson and an adjunct professor at the University of Arizona. His interests in big game include applying genetic tools to learn more about intraspecific phylogeographic entities (and other cool stuff). Dr. James R. Purdue is the Curator of Zoology at Illinois State Museum. His work brings together old tech (archeology) and high tec (genetics). Dr. Ken E. Nicolls has conducted cutting-edge research on the physiology of antler development and is recently retired from Northern Arizona University.