

Research documents domestic cattle genetics in modern bison herds

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A new study published in the journal *Scientific Reports* has revealed the strongest evidence to date that all bison in North America carry multiple small, but clearly identifiable, regions of DNA that originated from

domestic cattle.

In the study, Texas A&M University College of Veterinary Medicine & Biomedical Sciences (CVMBS) researchers, led by James Derr and Brian Davis, compared genome sequences among the major historical lineages of bison to 1,842 [domestic cattle](#), establishing that all analyzed bison genomes contained evidence of [cattle](#) introgression.

"This comparative study clearly documents that the people responsible for saving the bison from extinction in the late 1800s are also responsible for introducing cattle genetics into this species," Derr said.

This study updates findings from a series of studies published 20 years ago in which Derr's team revealed that only a few bison herds existed that appeared to be free of domestic cattle introgression. Now, with better [genetic technology](#), these researchers have shown that even those herds are not free from hybridization.

"Today, it appears that all major public, private, tribal, and non-governmental organization bison herds have low levels of cattle genomic introgression," said Sam Stroupe, a Ph.D. student in Derr's lab and first author of the study. "This includes Yellowstone National Park, as well as Elk Island National Park in Canada, which were thought to be free of cattle introgression based on previous genetic studies."

Derr said that these new findings will also have ramifications for bison conservation efforts; in this case, their findings could actually make conservation efforts easier, since certain herds will no longer need to be isolated.

Legacy of crossbreeding

This shared genetic ancestry is the result of multiple hybridization events

between North American bison and cattle over the last 200 years, which followed the well-documented bison population crash of the 1800s.

Those hybridization events were mostly human-made, as cattle ranchers in the late 1800s intentionally bred domestic cattle with bison in an effort to create a better beef-producing animal. While the crossbreeding was successful, they failed to achieve their main purpose, and the effort was largely abandoned.

At the same time, William Hornaday and the American Bison Society were beginning national conservation efforts, sounding the alarm that North American bison were being driven to extinction. As a result, a national movement began to establish new bison conservation populations and preserve existing bison populations.

However, the only bison available to establish these new conservation herds were almost exclusively animals from the cattlemen's private herds.

"As a result, these well-intentioned hybridization efforts leave a complicated genetic legacy," Davis said. "Without these private herds, it is possible bison would have become extinct. At the same time, this intentional introduction of interspecies DNA resulted in remnant cattle footprints in the genomes of the entire contemporary species.

"We now have the computational and molecular tools to compare bison genomic sequences to thousands of cattle and conclusively determine the level and distribution of domestic cattle genetics in bison that represent each of these historical bison lineages," he said.

According to Derr, it is important to recognize that although hybridization between closely related wildlife species has occurred naturally over time—well-known examples include coyotes and eastern

wolves, grizzlies and polar bears, and bobcats and Canadian lynx—the bison-cattle hybridization is almost entirely a purposeful, human-made event that happened to coincide with the tremendous population bottleneck of the late 1800s.

"Two primary events, an extremely small bison population size and widespread interest in developing hybrid animals, changed and shaped the genomes of this species in ways we are just now starting to understand," Derr said. "Nevertheless, this species did survive and now they are thriving across the plains of North America."

Reactions from the bison conservation community

As one of the world's most iconic animals, bison play a number of important, and sometimes conflicting, roles in society.

While some consider them a [wildlife species](#) that shouldn't be domesticated, others consider them an important economic livestock animal; although bison are raised as wildlife in state and federal parks and wildlife refuges, most bison alive today are owned by private ranchers and are raised for meat and fiber production.

To others, they hold religious and spiritual roles, as well as being icons of continental pride. In 2016, bison were even named the U.S. national mammal.

"Though viewed in different ways, bison conservation is a priority to many different groups, and it is imperative that we agree to use the best available scientific information to make decisions moving forward," Stroupe said. "These findings clearly show that, using modern genomic biotechnology, we can uncover many historical details regarding the past histories of a species and use this information to provide informed stewardship in establishing conservation policies into the future."

While many of these livestock herds are rather small with 100 animals or less, there are some exceptions. Turner Enterprises in Bozeman, Mont., is the largest private producer of bison, with over 45,000 animals spread across multiple states.

According to Mark Kossler, vice president of ranch operations, Turner Enterprises will use this new information to further improve its conservation efforts.

"Turner Enterprises has used the bison genetic work of Texas A&M University for the last 20 years to structure genetic management of our maternal herds concerning cattle mitochondrial DNA introgression," he said. "We were fully aware that advancing technology and mapping of the entire bison genome could reveal that all bison nuclear DNA could have cattle introgression as well.

"Knowing that the North American Bison herd has widespread introgression of cattle DNA, though in small amounts, will allow our operations to structure future genetic management between our herds to maintain broad genetic diversity without the worry of cross contaminating herds that were perceived to be 'clean' of introgression," he said. "This is helpful information for the bison community. We are appreciative of Texas A&M University's research and diligence in providing the bison community the final answer on this question of bison genetic purity."

Les Kroeger, president of the Canadian Bison Association, which helped fund Derr's research, agreed that better information is always a positive step for their sustainability and [conservation efforts](#).

"As research tools improve, we gain a better understanding of the complex history of bison," he said. "With this information we can continue to lead the way to grow healthy populations of this iconic

animal for future generations to enjoy. The commercial bison industry continues to support research and conservation initiatives while continuing to sustainably produce a high-quality protein for consumers to enjoy."

Chad Kremer, president of the National Bison Association, added that the information will give bison producers across the country better information to manage their herds.

"The National Bison Association welcomes these research findings as we continue to unravel the long and complicated history of the American bison's genetic lineage," he said. "Research projects such as this continue to assist producers in their ability to maintain healthy and diverse genetics in bison herds today. Genetics are a cornerstone of modern-day [herd](#) management, and something the National Bison Association promotes heavily in its outreach and education to producers across the continent through our North American Bison Registry. It is our hope that bison producers will utilize this data and technology to continue to improve their own herds' genetics while continuing to restore [bison](#) to their native landscape."

More information: Sam Stroupe et al, Genomic evaluation of hybridization in historic and modern North American Bison (Bison bison), *Scientific Reports* (2022). [DOI: 10.1038/s41598-022-09828-z](https://doi.org/10.1038/s41598-022-09828-z)

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