

Letter from the Desk of David Challinor
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Despite being the largest national park in the lower 48 states, Yellowstone suffers from having more visitors than it can properly handle. Crowding has become so unmanageable that park authorities have initiated steps to control the numbers. A major attraction luring visitors to Yellowstone is the easily visible herds of bison and elk. Less seen but even more sought are the two principal predators: grizzlies and wolves. If only two big ungulates and a hoped-for glimpse of a large predator can attract such crowds to a U.S. national park, it is understandable why East Africa's varied megafauna is such a tourist lure and, further, why maintaining the presence of such large mammals is so crucial for the health of the local economy.

About 10,000 years ago (an instant in the world's history), the number and variety of North America's megafauna, based on the fossil record, easily rivaled that of East Africa today. What emerges from studies of past climates and flora is that the North American plains were similar to those of present East Africa: each has or had a large and varied ungulate fauna and their predators. The African fauna has survived, albeit in relatively small pockets compared to the vast domain it once occupied. This letter will speculate on some of the reasons why one habitat retained its diversity while the other (North America) has only a small portion of its former variety

The browsers and grazers that once dominated North America's grasslands were mammoths, mastodons, llamas, horses, prong-horned antelopes, ground sloths and bison. The ancient forms of all are now extinct. Fierce predators preyed on these herds, whose composition we know only from their fossils. Horses were a major feature of the New World landscape where they evolved. Their evolutionary heyday ended about 8 million years ago; by the Pliocene (3 million years ago), horses had crossed the Bering land bridge to the Old World and traversed the newly arisen isthmus into South America. By the beginning of the Pleistocene (one million years ago), only a few species of the single genus *Equus* survived in the northern hemisphere; all other genera were extinct. Horses that eventually reached Africa were the foundation for that continent's two zebra genera. In Asia, *Equus* developed into the forest-dwelling tarpan depicted on the walls of Stone Age caves and the plains-living Przewalski's horse from which the domestic horse was bred only about 5,000 years ago.

Bison, on the other hand, originated in the Old World and those that traveled to North America during the Pleistocene era (within the last million years) evolved into enormous animals, almost double the size of today's, with massive horns. These giants also died out, or perhaps were hunted to extinction by the human newcomers.

Scientists can only speculate on the causes for the decline and extinction of all these large ungulates. They do know that there were numerous large predators then. Among the most lethal were the long-legged, fast-running, short-faced bears. Valerius Geist, a distinguished mammalogist, believes that this bear, along with the American lion

(almost twice the size of the present African one), two species of saber-toothed cats and packs of dire wolves were such a threat to early human hunters, who competed for the same prey, that the humans were unable to occupy the North American hunting fields until the bears and other predators died out about 12,000 years ago for reasons still unknown. Paleontological evidence shows a surprising increase in large browsers and grazers following the demise of the short-faced bears, lions and sabertooth cats. Fifty-six species larger than a peccary (a small wild pig) flourished in North America until about 10,000 years ago, compared to only eleven such species existing today.

The disappearance of the big predators coincides with the development of the Folsom stone points, which are generally considered the first indisputable evidence of human hunters in North America. These stone spear points, first discovered near Folsom, New Mexico, have characteristic fluting that makes them easily recognizable to archaeologists. How much these hunters contributed to the extinction of North America's megafauna is unknown.

Predator fossils from the LaBrea tar pits in southern California show an abnormal number of broken teeth and fractured bones compared to contemporary counterparts such as lions and hyenas. Among the fossil carnivores, the percentage of broken teeth was 3 to 5 times that found in today's predators, including hyenas. Furthermore, tooth breakage among carnivores that were 30,000 years older than the tar pit sample had a much lower breakage percentage, one comparable to today's African lions, or about one in four adults with a broken tooth. Something unusual must have happened to cause this anomaly. The large incidence of broken teeth implies that competition among predators was greater than it had been and that carnivores had to consume more of their prey to survive, costing them more broken teeth. The evidence that North America's megafauna rapidly declined about 10 or 11,000 years ago is incontrovertible, but the reasons for this decline still elude us.

Unlike in North America, large African mammals evolved alongside humans and were thus exposed to human hunting pressure for hundreds of thousands of years. Initially, human predation on ungulates probably had an insignificant effect on the prey population because the relatively few humans were scattered and they had inefficient hunting skills. However, man soon learned to exploit his hunting skills by coordinating hunts with visual and oral signals. Even though armed with only sticks or throwing stones, early hunters could have wounded fleeing prey sufficiently to slow them down and thereby reduce the risk of endangering themselves when making the kill.

Humans can run down many quadrupeds; we are probably the only mammal that can run 26 consecutive five-minute marathon miles, albeit on smooth ground. As man developed the art of hurling projectiles more lethal than mere stones, such as throwing stick-assisted spears and eventually bow-propelled arrows, he could kill larger prey. If we assume these improved hunting techniques emerged gradually in Africa, the prey species may have had time to develop various avoidance strategies. For example, hunters today recognize the increased wariness of geese and deer once the hunting season has begun.

In addition to having been exposed to humans for far longer than their counterparts in North America, African megafauna, scientists believe, enjoyed a more stable climate than that of North America and Europe, where vast areas were encumbered with a series of massive glaciations during the Pleistocene. We can only speculate on the effect of glaciation on mammal adaptability, but it must have caused large populations of grazers and browsers to move north or south in synchrony with glacial movement. Mammals are more mobile than plants and a lack of flexibility in their diet may have contributed to their demise. For example, bears, wolves and coyotes have survived in North America since the Pleistocene because they are more omnivorous than the cat family. The American lion and two sabertooth cats became extinct perhaps because their teeth, like those of all cats, are specialized for meat eating; only cats' teeth are designed to slice meat so that chunks are swallowed whole with little digestion occurring in the mouth. Dogs and bears, in contrast, use their molars for chewing, thereby mixing food with saliva to begin the digestion process. As a result, dogs, wolves and coyotes can process a variety of food such as bone, sinew and even invertebrates and fruit. Such flexibility is helpful to their long-term survival, as exemplified by the current range expansion of such omnivores as coyotes, foxes, raccoons and even black bears.

Human omnivory undoubtedly contributed to our rapid spread to all parts of the globe. In doing so we have displaced many of our mammalian competitors. The Pleistocene overkill by the early human invaders of the new World has been advanced as a theory for the rapid extinction of such animals as mammoths, camels, horses and ground sloths. Although perhaps an important component of this extinction, I believe there must have been other factors as well, such as climate and disease. Just how these other causes affected the megafauna is frustratingly obscure. The search for the reasons behind the sudden extinctions continues, however, and I am confident my grandchildren will eventually learn the causes. Hopefully, they will apply their knowledge wisely to slow or at best avoid future extinctions, although in the long run, no species is likely to be immune from this fate.