Land of the Lost

Paul L. Koch

In *The Twilight of the Mammoths: Ice Age Extinctions and the Rewilding of America*, paleoecologist Paul Martin describes his career-spanning efforts to understand the extinction of most large animals from around the globe near the close of the last ice age. Just 50,000 years ago, terrestrial communities were dominated by unfamiliar species: mammoths, mastodons, giant ground sloths, car-sized glyptodonts, rhino-sized marsupials, giant kangaroos, gorilla-sized lemurs, and many, many others. For millions of years, continental mammals had a bimodal body size distribution, with many species of rodent-to-rabbit-sized (small) mammals and a second mode of deer-to-elephant-sized (large) animals. Everywhere except Africa, this larger mode has almost entirely vanished.

As Martin recounts in the book—which is part memoir, part detective story, and part a call to environmental activism—a convincing explanation for these extinctions proved elusive into the 1950s, though climate change was thought a likely culprit. But as radiocarbon analyses began to clarify the timing of extinctions, Martin and others noted two startling patterns that pointed to humans as the causative agent. Whereas earlier extinctions affecting mammals always took out a greater proportion of smaller species, the late Quaternary extinctions were unusually fatal for large, slow-breeding animals. Furthermore, “when viewed globally, near-time extinctions took place episodically, in a pattern not correlating with climatic change or any known factor other than the spread of our species. Extinctions followed prehistoric human colonizations in a ‘deadly synecphony.’” Martin became the most forceful advocate of the overkill hypothesis, offering sophisticated models to explain how human predation could drive extinctions while authoring studies on environmental change and the diets of extinct species that cast doubt on climatic explanations.

Here, writing for a general audience, Martin doesn’t dive into overkill models in rigorous detail. But he broadly advocates “blitzkrieg,” an idea he first advanced in the 1970s. Under blitzkrieg, immediately after arriving in unpopulated country, human range expansion and population growth are fueled by intense predation on large game. High kill rates are possible because naïve prey don’t respond to an unfamiliar threat—armed humans. Extinction occurs rapidly, within decades at a regional scale. Blitzkrieg offers solutions to two perceived problems with overkill. Prey naïveté explains why the magnitude of extinction was high in the Americas and Australia but low in Africa, the region of human origins. And because the extinction was so rapid, blitzkrieg explains why archaeological sites containing extinct animals are rare in the Americas and Australia.

Overkill has been debated for decades. Some archaeologists remain troubled by the lack of kill sites and have questions about when humans arrived in the Americas and Australia. Animals on continents full of voracious predators may not have been so naïve to a new predator. On the other hand, detailed studies of the selectivity of extinction and predator-prey simulations support overkill. And despite spectacular increases in knowledge of near-time environmental change, no climatic hypothesis has ever explained the timing or selectivity of extinction. Some details of the extinction may have been modulated by environmental change, but the vast weight of evidence indicates that without human impacts, there would have been no late Quaternary mass extinction. That said, blitzkrieg as applied to extinctions on continents has always been a bit of a Rube Goldberg device, and it has become increasingly frayed in recent years. My view is that the extinction looks like the work of an omnivorous hunter (not a large-game specialist). As human populations slowly grew (fueled by small, faster-breeding game that could be harvested without causing extinction), tasty, large prey would be hunted whenever encountered and ultimately eliminated.

Martin’s prose is folksy and engaging. It is a treat to learn the personal and historical story behind his studies of overkill. Chapters on his work in the American Southwest offer a glimpse of the twists and turns of field-based research and show how much is gained by taking a holistic multidisciplinary approach. The author spent a good deal of time literally studying crap, but this dirty business paid off with a nuanced understanding of animal diets. Equally fascinating is his discussion of animal figurines found with fossils in some caves. The figurines were placed in the caves in the last few thousand years, long after the extinctions. They hint that “for whatever reason—a focus on the hunt, or simple fascination—our ancestors were strongly drawn not only to living large animals, but also to the remains of extinct ones.” The book has some editorial flaws, but they are minor and don’t detract from the broad arc of Martin’s narrative.

Amazingly, overkill is not the most controversial topic discussed in the book. In the final chapters, Martin explores the implications of the late Quaternary extinction for understanding the modern world. He recounts evolutionary “ghost stories,” tales of species (such as the California condor) whose ecology makes no sense until one recognizes that they had co-evolved with now-extinct partners. And what should be the target of restoration ecology? The impoverished ecosystems that Europeans found when they arrived in the Americas and Australia, or the communities rich in large animals that lived there for millions of years? If history is any guide, North America without wild horses is completely “unnatural,” yet ecologists and conservation managers continue to treat horses as an invasive species. Martin’s most daring proposal is “rewilding.” He proposes establishment of Quaternary parks in North America and Eurasia, with horses, camels, elephants, and recently lost carnivores (lions and cheetahs). The idea has provoked a range of responses, from disbelief, to calls for more study, to test cases.

Paul Martin has made a career of challenging orthodoxy and in the process has revolutionized the way we understand our history as a species and the world that we have shaped. It’s fitting that he ends the excellent *Twilight of the Mammoths* with another bold idea that may let the sun shine again on the lost world of large animals.

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