
Goodbye Eternal Frontier*

By Connie Barlow

Native or alien? The distinction is crucial for conservation. An understanding of deep time, however, can scramble the categories. For example, most of us are aware that the Old West's image of a Lakota warrior riding bareback on a horse is a blend of native and alien. The Lakota traveled afoot until horses sailed across the Atlantic with the Spanish and went feral in the New World. The deep time twist is that it is the *horse* that is native, the man a recent immigrant to the Americas.

Tim Flannery, in his book *The Eternal Frontier*, explains that horse ancestors originated in North America 45 or 50 million years ago; humans have been here a mere 13,000 years. Horses spent their first 30 million years evolving on this continent and nowhere else. Only during the Miocene, when North America sprouted a dozen kinds of three-toed horses (some grazers, some browsers), did equids begin to colonize the eastern hemisphere. Those early emigrants did not persist in the East, however. The Asian and African horses alive today (including the zebras) all came from ancestors who were confined to North America until just three million years ago. Were it not for those persistent descendants of vagrant North American stock, horses would have gone globally extinct when they vanished from North America 13,000 years ago—at the same moment that the Lakota warrior's ancestors arrived from Asia.

This is deep time history, deep ecology history. This kind of education not only alters one's outlook, but invites a new relationship to the land. The EuroAmerican culture that dominates North America today still treats the continent as a frontier—a collection of resources to be exploited by an ever-expanding population. Can Americans learn a key lesson from the roll-call of lost life forms over the long span of ecological time and begin to understand that people cannot persist on a landscape viewed as a limitless frontier—only on one they come to know and love as *home*?

Taking the Long View

Tim Flannery, director of the South Australia Museum, is officially a vertebrate paleontologist. Yet *Eternal Frontier* is a cross-disciplinary opus that draws from botany, geology, ecology, geography, archeology, anthropology, and American history as well as paleon-

tology and zoology in constructing the first deeply ecological story of this continent grounded in deep time.

Flannery begins his tale with the asteroid impact off the coast of Mexico that ended the Mesozoic Era 65 million years ago by extinguishing the ammonites, the great marine reptiles, and the dinosaurs, while severely diminishing the diversity of animal taxa from foraminifera to mammals. Plants took a hit, too, but mostly here in



North America and eastern Asia, where the shock and firestorms of the impact were most intense. (Plants can wait out horrific conditions as root, seed, or spore.) The end-Cretaceous impact event is described by Flannery in gruesome detail, leaving the reader aghast at how truly empty of life this charred continent had become in the aftermath, and how open it was, therefore, to the extravagances of “ecological release” and “evolutionary radiation” for those lucky lineages who first wafted in by spore or seed, or poked their heads out of the mud after a long, impact-winter sleep. In short, North America was an ecological vacuum, a frontier available for easy colonization.

Flannery thus introduces the North American Story with the violent birth of the Cenozoic and, coincidentally, the birth of the North American continent itself. During the Mesozoic, the eastern and western halves of what would become North America had been separated by shallow water, the Bearpaw Sea, which flooded the continental midsection all the way from the Arctic

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Ocean to the Gulf of Mexico. Within five million years following the asteroid impact, tectonic uplift associated with the rise of the Laramide Mountains in the West had displaced the sea. One grand continent was born.

Toward a Mythic Story of North America

Zoologist David Burney, ecologist Stuart Pimm, conservation biologist John Terborgh, and Pleistocene ecologist Paul Martin have all written laudatory reviews of *The Eternal Frontier*, published in major journals.¹ The science is top-notch, they agree, and the style of delivery is engaging.

Here I'd like to suggest that this book gives us far more than excellent and readable science. It gave me the idea that, by golly, there *is* a unified story of the North American continent. There are mythic themes that connect the abundant bare facts, and there are lessons to be learned from 65 million years of continental experience.

Oh, what a mythic story it is! Before reading Flannery's book, I assumed that a common Native American name for this continent—Turtle Island—had no basis in fact. Now I know that soon after it was born (upon the retreat of the Bearpaw Sea), this continent hosted the Golden Age of Turtles. Never before and never since, and never anywhere else, has the turtle been such a prominent and speciose member of animal guilds. Pond turtles, soft-shelled turtles, river turtles, and snapping turtles all survived the meteor impact. When the firestorm had passed, and the turtles could safely poke their heads out of the mud, the landscape and pondscape they looked out on was nearly barren of vertebrate life. Crocodylians and (now extinct) champsosaurs also survived in the sediments, and offered the turtles just enough predatory challenge to keep them from reproducing their way to oblivion.

Turtles are more the exception than the rule. This continent has, for sixty-five million years, mostly been a land of immigrants. "No other continent," writes Flannery, "exhibits such different origins for the constituent parts of its fauna." North America has been a magnet for newcomers, who may overeat or out-compete the natives when they first arrive. If they are to persist, however, they do eventually settle into adaptive harmony as natives themselves—with whatever life community remains. A deep time perspective teaches that, on the one hand, North America will surely be rich in naturalized and endemic diversity within five or ten million years after humans are gone. On the other hand, deep time teaches that the scale of ecological disruption caused by human hegemony over habitat, our unloosing of myriad exotics, our tampering with the very chemistry of the biosphere, as well as our long-standing role in overkill, is unmatched in 65 million years. Is that the legacy we wish to leave in the geological record?

It seems that whenever climate and sea level conspired to give four-leggeds the opportunity to move around, the vast continent of Eurasia sent us proficient beasts, via Greenland and the Canadian Archipelago or by way of Beringia, the now-submerged continental shelf that, when sea level is lower, connects Alaska with Siberia. Elephants (mastodons) found their way into the New World perhaps 17 million years ago, beavers less than ten million. Much earlier, rhinolike brontotheres arrived, radiated into multiple species, and vanished. True rhinos, too, ventured into North America early in the Eocene, and they thrived here until just three million years ago.

Global trade has been much less successful in the opposite direction. There are, however, four big success stories among the mammals. North America gave birth to the dog family (*Canidae*), the camel family (*Camelidae*), the horse family (*Equidae*), and the squirrel family (*Sciuridae*), all of whom now have a presence in much of the world. The squirrel story begins in the Oligocene some 30 million years ago, when angiosperm plants in North America had to cope with extreme seasonality for the first time: hot summers, frigid winters. North American nut trees appeared at this time too, suggesting a co-evolutionary dance of seed and seed disperser.

The only truly and completely American large mammal alive today is the pronghorn. Not a deer, not an antelope, not a goat, the pronghorn family *Antilocapridae* originated right here and stayed put for 19 million years. All sorts of pronghorns, some sprouting four, even six antler-like horns, thrived during the Miocene, Pliocene, and Pleistocene. The only one that survived the end-Pleistocene extinctions 13,000 years ago still retains a vestige of a by-gone era. *Antilocapra americana* is ready should a long-legged hyena, a swift *Arctodus* bear, or a cheetah be lurking over the grassy horizon: pronghorns can sprint five miles per hour faster than cars are supposed to travel on the Pennsylvania turnpike. The animal is thus way overbuilt for its current predators, coyote and the all-too-rare gray wolf. Pronghorns are running from the ghosts of predators past. Their speed is an ecological anachronism.

To keep the pronghorn fit and facile, perhaps cheetah restoration efforts should be considered. Flannery's research suggests that the cheetah (*Acinomyx*) is possibly the only genus of living cat that originated in North America. The particular species that chased pronghorn until 13,000 years ago was the spitting image of the one that is now having such troubles with humans, lions, and hyenas in Africa. Bring back the cheetah!

Unaware that Paul Martin and David Burney had published a "bring back" manifesto in *Wild Earth* a year before his own book was published,² Tim Flannery

independently and forcefully argues that Americans should repatriate not only the cheetah but also the lion. America's Pleistocene lion was nearly identical to the living African lion, although it was probably maneless and certainly bigger, with footprints the size of dinner plates. Flannery also joins Martin and Burney in proposing repatriation of the biggest land mammal alive today: the elephant. This convergence of ideas suggests that perhaps the time has come to seriously consider repatriation of extirpated megafauna as part of rewilding North America.³

Convergence (or "parallel evolution") is indeed another theme that stands out in the Cenozoic story of 65 million years. It seems that there are forms and life-ways that time and time again are called forth by ecological opportunities, and in more than one place. Descended from rails, the six-foot tall terror bird (*Diatryma*) stalked North America like a miniature *Tyrannosaurus rex* in the early Cenozoic. In South America, independently evolved bird lineages held onto the niche of top carnivore for 50 million years. The last of the breed was the ten-foot-tall *Titanis*, who survived until late in the Pliocene, after it had ventured into North America.



Similarly, true cats (family *Felidae*) originated in the eastern hemisphere and then spread to Turtle Island, but not until an older and unrelated form of "cat"—the nimravids—went extinct 23 million years ago. Even canids have periodically generated catlike forms (our living gray fox, a nimble tree climber, is arguably as much catlike as doglike). And, of course, there were the remarkable saber-toothed "cats" of South America. These were pouched marsupials, yet their body and teeth look uncannily like the placental *Smilodon* (a true cat) of the north. The closest common ancestor of *Smilodon* and its South American equivalent was far more like a

shrew than a cat, and that ancestor coexisted with the dinosaurs.

An important chapter in the Story of the North American Continent recounts the amazing exchange of life forms between North and South America. For tens of millions of years, the only terrestrial vertebrates that came into or left South America were those that could fly (bats and birds), float (turtles and tortoises), or hunker down on storm-launched plant debris for a long sea voyage (frogs, lizards, snakes, and toads).

For example, Turtle Island welcomed tree frogs (*Hyla*) into its life community some 35 million years ago. These frogs all came from South America. Toads journeyed north a few million years later. Since then, both kinds of amphibians have speciated grandly, becoming North American natives. Whiptail and race runner lizards (family *Teiidae*) lived in both of the Americas during the Cretaceous. The asteroid extirpated all of those native to the north. Teiids of Turtle Island today thus all hail from South American ancestors who rafted north during the Cenozoic. But South American mammals other than bats came north only when the continents drifted close enough to one another for an extended swim (about five million years ago for the smaller ground sloths) or a dryland odyssey after the Isthmus of Panama emerged about three million years ago. South American ground sloths, glyptodonts, and toxodons did well in the north until humans arrived 13,000 years ago. Only the small ambassadors from the south—possums, porcupines, and armadillos—remain.

Meanwhile, Turtle Island sent southward its vertebrates in droves. There is no canid, cat, deer, mouse, rat, coati, skunk, squirrel, rabbit, tapir, peccary, camel (llama), cat, bear, or weasel native to South America whose ancestors have been there for more than five million years—and most scampered or slunk across the isthmus only two or three million years ago.

A Golden Age Ends

Following this "Great American Interchange," the story of the North American continent shifts from deep time to deep history. And this is where the bad news begins. The overkill theory for why the horses, camels, elephants, sloths, glyptodonts, tapirs, peccaries, long-horned bison, and giant tortoises disappeared at the end of the Pleistocene is now widely accepted. The ripple effects of overkill—extinction by starvation, exacerbated by hunting—is the majority explanation for the simultaneous or somewhat later extinctions of the continent's great native carnivores: dire wolf, sabertooth cats, American lion, cheetah, and the biggest mammalian land carnivore of all time, *Arctodus*, the short-faced bear. Overkill theory is bad news because overkill is us. We did it. Thirteen thousand years ago is the time we may

come to look upon as the beginning of the end of the Cenozoic Era⁴—when spear-wielding humans entered North America and over-hunted to extinction most of the continent’s large mammals, which had evolved without predation from intelligent, socially organized hominids.

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Within the past five years, discoveries in New Zealand, Australia, Madagascar, Hawaii, and Polynesian islands all validate overkill theory. Everywhere, it seems, the last appearances of Pleistocene mammals, reptiles, and flightless birds correlate astonishingly well with first appearances of artifacts and charcoal attributable to *Homo sapiens*.

Correlation is not, of course, proof of cause, but correlation en masse is persuasive. Proponents of climate change have struggled to explain why continental ice waxed and waned sixteen times in the past two million years, yet only on the seventeenth melt-back did the change force North America into an “extinction of the massive.” Now, with fine-tuned dating of extinction events in hand, a dwindling team of climate proponents is pressed to explain the non-simultaneity of extinctions around the world. How was climate shifting 50,000 years ago in Australia—and only in Australia? Why did that shift take place before the putative change in North America 13,000 years ago? And how did Cuba manage to avoid the zoological effects of North American climate change until 6,000 years ago, when its six species of ground sloth suddenly vanished? Even more astonishing, one island a dozen miles off the coast of Siberia held onto its mammoths for 8,000 years longer than mammoths survived anywhere else in the world.

And then there are the more recent extinctions on islands distant from any mainland (and more difficult to colonize by raft or canoe). Hawaii began to lose its flightless and other vulnerable birds around 1,500 years ago. Madagascar lost its gorilla-size lemurs, its elephant birds, and its giant tortoises just 1,200 years ago. Even more isolated, New Zealand lost its moa birds just 600 years ago.

It seems that westernized industrial peoples are not the only ones to wreak havoc on lands newly colonized.

Perhaps no human culture can be expected to walk lightly upon an unfamiliar landscape, not because we are inherently evil, but because our technology, even at the level of chipped stone, turns us into formidable predators of wildlife that did not co-evolve with us. Animals too big to hide, too naïve to run, and unable to give birth to replacements as quickly as we can slaughter them are the most vulnerable. In the lean times of winter or extended droughts, even bio-regionally attuned humans may be driven to kill and kill again, harvesting fatty tongues, while leaving behind the kidney-straining excesses of bare protein, starved flesh. Only after the plundering by the pioneers is complete do the peoples begin a new dance with the landscape. Limits of the land may then shape humans into indigenes who live more or less sustainably with the community of life that remains.

It is surprising to realize, too, that, within the context of the 65 million year Cenozoic Era, our symbol of the western wilderness, the grizzly bear, is a recent arrival. The bear who crossed Beringia after the first humans led the way was a human-savvy species that could find a niche in the New World only when a far heftier, faster, and indigenous “short-faced” bear (*Arctodus*) lost its prey base to overkill, and perhaps made the mistake of assuming that it need not run from anything. Our griz, *Ursus arctos*, is so recent an arrival



that it has not yet had time to speciate from the ancestral Eurasian populations of brown bear. The same is true of the animal we call elk and that Europeans call red deer (*Cervus elephas*). Ditto the moose: *Alces alces*. The gray wolf, too, is a recent arrival. Although the dog family, *Canidae*, originated right here, the gray wolf took form in Eurasia, returning home maybe 100,000 years ago, but only becoming prolific on this continent after our native dire wolf disappeared.

Deep time awareness compels us to accept, as well, that the symbol of the Great Plains is a newcomer to North America. Bison entered this continent 400,000 years ago. The long-horned behemoths then evolved several distinctive species native to place. But those first American bison all vanished with the mammoths and sloths—presumably because they were not only naive of projectiles but hadn't evolved a strong herding instinct. Into the empty niche came the smaller, short-horned bison that still survives in Europe. *Bison bison*, commonly known as buffalo here, goes by the name wisent in its land of origin. These bison didn't need horns to convince would-be predators to stay away from their young. They ran. And the females and young kept to open grasslands, where predators were easily detected at a distance, running was unimpeded, and many muzzles could work together to detect the approach of danger. Alas, even these bison nearly succumbed in North America to guns and railroads.

Frontier or Home?

Tim Flannery makes clear that humans per se are not lethal to megafauna (witness pre-colonial Africa). Rather, the problem is with humans who find themselves in an Edenic frontier of populous and easily killed large animals. It is the way our species invades exploitable habitat—the purple loosestrife phenomenon—that makes a continent quake.

Even after humans adapt to place as indigenes, the danger to wildlife is not over. Native cultures may effectively revert to an alien relationship with their habitat if the technology available to them suddenly changes—notably, if a new technology enters the landscape from abroad and the local peoples indiscriminately make it their own. The sign of an alien is that it is too successful. The body carrying the gun may be native, but the human-gun amalgam is a novelty in the land community.

In the case of North America, the newest waves of human colonists haven't given themselves a fair chance to become indigenous. Technological ingenuity keeps breaching natural limits. For example, Flannery recounts how EuroAmericans passed right by the deserts of the Great Basin on their first westward drive. The limits of the land bested the available technology. But once deep drilling and pumping became possible, the frontier re-opened; lands that had been “wastes” became wheat fields.

Each time that technological innovation gets us out of a resource-limit pickle, there are populations, species, and even whole biomes who suffer. Cornucopians are dangerous not because they are wrong. The real danger

for the community of life is that the cornucopians may be right for some time to come. Perhaps technological advances will continue to save us from materials shortages, energy shortages, maybe even water shortages for some time, especially now that globalization has effectively made a frontier of the entire globe. At some point, of course, one limit or another will prove unbreachable (perhaps the limit of human sanity in an increasingly crowded and artificial world), but by then we may have wiped out more forms of life than a Manhattan-size meteor was able to accomplish 65 million years ago.

Coming Home

The good news is that we can wake up. *The Eternal Frontier* offers, in breathtakingly beautiful prose, a bracing dose of deep time perspective. Now it is up to us to *choose* a new relationship to North America, to Earth. The landscape cannot be counted on to force the choice

upon us, at least not anytime soon. So how will we, of all humans—this prideful, frontier-addicted culture—be motivated to go native, and with all the skill and grace that our sciences and technologies (appropriate technologies) might afford us? What will make us willing to say goodbye to the convenience of a frontier relationship with the land and re-inhabit North America as *home*?

One tool in the necessary transformation of spirit will surely be the teaching and preaching of the mythic story of the North American continent. Tim Flannery has given us the storyline, the themes, and a wealth of stunning examples. It is now up to the educators and dramatists and firebrands within the conservation movement to communicate the rich and engaging history of this place: its geological and ecological diversity, its beauty and integrity. Knowing this story, telling and retelling it, is one step on the ethical journey to becoming truly, fully indigenous.

¹ The major reviews of *The Eternal Frontier* are: David A. Burney, “A Down-Under Look at North America,” *Natural History* 7(01):76-78 (2001); Paul Martin, “Paleobiogeographer from Down Under,” *Bioscience* 51:687-688 (2002); Stuart Pimm “Cenozoic Dramas,” *Science* 292: 1842-42 (2001). John Terborgh, “The Age of Giants,” *New York Review of Books*, September 20, 2001.

² Paul S. Martin and David A. Burney, “Bring Back the Elephants!” *Wild Earth* 9(1):57-64 (1999).

³ Connie Barlow, 1999, “Rewilding for Evolution” *Wild Earth* 9(1):53-56.

⁴ Christopher Manes, “Whatever Happened to the Cenozoic?” *Wild Earth* 1(2):73-74 (1991).

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