Chapter Three

ACROSS THE SEAS OF GRASS

"Do you think we need another can of gas?"

My friend Shannon was expertly arranging and rearranging tubs full of supplies. Water. First aid kit. Survival kit. Tent and gear. Spare car parts. Bug spray. More bug spray (the woman had traveled with me before). The living room looked as if we were mounting a major expedition, and in a way, we were; 3,000 kilometers north on a research trip to some of Canada's most remote and beautiful landscapes. We would also be traveling back in time, to a world before farming, to the world of grasslands, tundra and, most importantly, megafauna. If I wanted to understand the mammoth and the culinary extinctions that allow the existence of the modern cow, I needed a landscape grand enough to put the cow in perspective. I also had a few standing invitations in the Yukon to sample northern cuisine.

Canada's North isn't forgiving, and this wasn't the sort of trip I would do alone. Fortunately, I had a friend insane enough to drive north with me, a friend who was comfortable in the

wilderness and would ensure I didn't end up as a pile of bleached bones on the tundra because I forgot the insect repellent. Lawyer by day, Shannon was a serious wilderness buff. We had two spare tires, road flares, fire starters, emergency blankets. Axes, knives, folding shovels. Jude, Shannon's active little black cat, hopped from container to container, looking concerned.

"Another can of gas," Shannon remarked to herself. "You just never know. And maybe an extra axe. And more snacks."

"Yes. More snacks. I approve of snacks."

I fished Jude out of the supply tub and turned my thoughts to the North. I wanted to see the world before farming. I wanted to lose myself between the sky and the waving seas of grass.

The North is the living shadow of the Paleocene, a world without farms or fences. Driving north took several days of winding highways and sprawling forests. Before each town, I would get rather hopeful about the possibility of lunch, only to encounter an empty crossroads with a few weathered houses and perhaps a gas station. I had hours to ponder strange food trivia. The northernmost Denny's in British Columbia is in Terrace, roughly 300 kilometers north of the Peace Arch at the Canada-U.S. border. I was out of the range of even the possibility of twenty-four-hour pancakes. How odd.

By the time we reached Dawson City, the sun barely bothered to dip behind the horizon. It was July, and midnight was as bright as a lazy summer evening back home. We feasted on sourdough bread spread thick with fireweed jelly, sampled pickled spruce tips and sipped Labrador tea. One morning, a really lovely chef served me a steaming stack of sourdough pancakes studded with wild blueberries. I slept long, ate well, and breathed crystal air. Most days, the horizons were free of human presence and the world boiled with wildlife. Ravens squawked and chortled at us. Black bears gave our car menacing

glances, and one evening all of the hair rose on my neck as a grizzly did exactly what it pleased as it passed our picnic site. The sky was the deepest of blues, and the air smelled of herbs, sunlight and ice. I found a really friendly pizza joint in Mayo, Yukon. It had a sign on the wall listing the coldest recorded temperature at that spot as minus eighty degrees Fahrenheit. Outside, the endless summer sun shimmered on the river, a tease.

There were, shall we say, a few insects. Even with the repellent, mosquitos would settle on me like a blood-sucking blanket. They hung over the landscape like buzzing smoke. Shannon, who was quirkily immune to all insect life, would watch in interested horror as my neck swelled rapidly. I tried to be brave.

"Did you know there is a type of mosquito that feeds on tea plants?" I asked.

Shannon, serene in the knowledge that every insect in the North was feeding on me, had bared her arms to the sun. "Let me guess, the tea from those plants is more expensive."

"Yes, it tastes different because the plant has an immune response to the bites. The leaves develop an enzyme."

"You might want to try that. An immune response. Maybe if you drink that tea, they will leave you alone."

I slapped ineffectually at a new wave of mosquitos.

A few days later, after marveling at shivering green lakes, wind-ruffled hillsides and escaping an angry beaver,[9] I found what I was looking for. We rounded a corner as we dropped back into the province of British Columbia and were surrounded by wood bison. They meandered along the road, blocking our path. Shannon and I stared at the massive creatures as they walked to and fro in front of the car. There were dozens of them. They

9 Canada's national symbol, these industrious creatures are generally well tempered. Except this one, who used his tail to toss rocks at us.

were beautiful and wild, their great coats full and shining. The males watched us warily, and the females nudged along the calves, who were a much lighter shade of brown. They were surrounded by thick clouds of flies that didn't seem to bother them particularly, though one of the half-inch-long bulldog horseflies found my arm and carried off a large bite of flesh. I watched a few more flies navigate around Shannon to reach my exposed skin. The grand animals shuffled past us, munching on the grass. They probably were no heavier than dairy cows, but they felt bigger. Maybe it was the landscape. Maybe I just felt smaller. A soft brown stream of plush muscle, they stopped us in our tracks, and I had the overwhelming urge to get out of the car and sink my fingers into the thick shoulder fur. They looked like they were wearing the world's most luxurious shawl. I felt for a moment what it was like to stare into the Pleistocene, that golden age where we find the beginning of the anthropological culinary extinction.

The bison are a living reminder of the age when megafauna ruled the planet. Mammals are opportunists, and when the skies cleared and the earth warmed after the Cretaceous extinction sixty-six million years ago, the age of reptiles was over and the age of mammals had begun. It was a lush time. Herbs and grasses carpeted the continents. Mammals diversified across the earth's land masses, and the jungles of the dinosaurs gave way to gentle savannas. Mammals began to grow larger, and as glaciers advanced and retreated in the epoch we call the Pleistocene, gentle and not so gentle monsters ruled the grasslands. This period, roughly two million years long, gave us mammoths, mastodons, dire wolves, saber-toothed cats, giant beavers as large as small cars, American camels and cheetahs, giant flightless birds, deer with antlers ten feet across, aurochs and, of course, wood bison. The vast landscapes were littered with massive animals of

two general kinds: herbivores who traveled in herds and carnivores who lived more solitary lives, picking off the weak and old from the protective clusters of plant eaters. For millennia, these species ruled an endless sea of rich scrub.

But then a dying began. In a rapid wave of extinction, the world's megafauna began to vanish. In the last 50,000 years, the world lost half of its large mammals in a burst, beginning in Africa and spreading to Europe, Asia, the Americas and finally to Oceania. In North America, the wave of death peaked around 12,000 years ago, when ninety genera of animals weighing over forty-four pounds went extinct. This included giant sloths, several species of bears, tapirs, the American lion, giant tortoises, sabre-toothed cats, giant llamas and the two largest species of bison. Several musk ox species vanished, along with the giant beavers and giant armadillos. The very landscape changed; megafauna turn plants (or plant-eaters) into energy, and without this constant grazing, forests spread and vegetation shifted. This pattern, this wave, mirrored our expansion as a species. It proceeded at walking speed; and many of these extinctions can be blamed on our appetite.

Imagine the human of the Pleistocene. We call this period of human development the Paleolithic period, and it was a long age of nomadic wandering. Humans began to use tools in the Paleolithic and coalesced into small bands. We gathered plants and berries, fished, scavenged the kills of larger predators and began to hunt animals. As we began to develop art, language and storytelling, our bodies evolved into what we see in the mirror: *Homo sapiens*. We used fire, and we began building boats. By foot and by paddle we spread. About 50,000 years ago, our toolmaking made a leap forward in complexity, including the appearance of projectile weapons such as the spear. This allowed us to hunt

animals from a safer distance.[10] The loss of megafauna near the end of the Pleistocene is called the quaternary extinction event, and it closely mirrors the spread of humans during the transition from the Pleistocene to the Holocene epoch. As the earth warmed, humans prospered. The quaternary extinction continued right into modern times, with the extinction of the giant birds of New Zealand shortly after the arrival of the Polynesians. As we moved, we hunted; when one area's large animals became scarce, we moved on.

How do we know these are human influenced extinctions? Before our species appeared, the rate of extinction among large mammals mirrored the background rate. As large land mammal extinction rates rose in region after region following the timeline of human arrival, the large marine mammals and smaller mammals saw little change to their own rate of extinction (small animals gave us too little return on the effort of a complex hunt, and we hadn't yet learned to hunt at sea). Human hunter-gatherers caused what has been called an ecological shock. Larger animals tend to breed more slowly than smaller animals, and the megafauna couldn't reproduce fast enough to offset losses from human hunting. Their greatest asset, their extreme size, protected them from most predators, but made them an easier target for us.

The largest and slowest vanished first. Climate change was likely also a factor, but the overwhelming evidence suggests these were culinary-assisted extinctions. As time passed, we honed our skills, developing better weapons and more skilled use of fire to distract and panic large animals. Wild creatures couldn't

10 Comparatively. Standing a few yards back from a beast as big as a small car likely felt more comfortable than sneaking right up to it, armed only with a stone knife.

evolve fast enough to counter our development. Humans learn, and they pass that knowledge to their young. The outcome of our increasing efficiency in hunting is well illustrated by one of the better-known lost animals, one that Cuvier knew well, and the one that I most want to talk about: the mammoth.

Like the dodo, the mammoth is an extinct species. In popular culture, a mammoth is depicted as a fuzzy elephant with curled tusks who lived among early humans during the last ice age, but the reality is more diverse. There were many mammoth species, from the huge to the tiny, living in the warm climates to the coldest. The term mammoth covers the various species of the genus *Mammuthus*; they are known for their tusks, large prehensile trunks, and, for many of them, woolly hair. Like the bison I admired on the Alaska Highway, the northern mammoths were shaggy beasts, built for cool climates. They appeared roughly five million years ago, and the last mammoths lingered into the age of written record, vanishing for good roughly 3,500 to 5,000 years ago. They are cousins to the two living kinds of elephants and populated all of the continents save for Australia and Antarctica. They vanished first in Africa, then in Europe and China, lasting the longest in North America and on the remote islands of the Arctic. We hunted and ate mammoths. We used their coats for clothing and their bones and tusks for tools and shelter.

We know rather a lot about mammoths, as a great number of well-preserved specimens have been found over the centuries. They were large, some species reaching up to four meters tall and weighing up to ten tons. Most of the species, however, were about the size of elephants. Both sexes had tusks and, judging from cave paintings, they likely lived in matriarchal herds similar to those of elephants. And like elephants, their weakness was their long gestation, which, combined with the large areas

of grassland needed to support them, resulted in a low overall population. From their frozen remains, we know that they had huge fat reserves, allowing them to survive harsh conditions for long periods of time. This might explain their survival in the far North long after their southern populations were gone. They vanished from region after region once we walked into town but survived where humans couldn't easily follow.

The mammoth was a shambling department store of fat and protein, wrapped in warm fur and sporting long ivory tusks we could carve into tools, weapons, jewelry and art. Mammoth ivory remains valuable and is excavated on the margins of the permafrost as climate change exposes new sets of remains. Hunter-gatherers subsisted primarily on plants, but the 20 percent or so of their diet that came from animal protein was important. As humans moved north into regions where the plant life was sparse, the percentage of animals consumed in their diet rose. Small bands of humans likely followed the mammoths and other megafauna, killing them as needed. Megafauna provided critical nutrients that allowed humans to have more and healthier children. Their existence was central to human development.

Mammoths grazed on trees, shrubs and grasses. They could also eat moss in lean times and favored the aromatic herbs of the grasslands when times were good. They likely lived about as long as humans if they could avoid disease and injury, elders surviving until their formidable molars wore out. From the habits of elephants, we can reason that mammoths ranged widely to avoid destroying their environment. Until they encountered humans, they proved extremely adaptable. This is one reason why the extinction of the mammoth was primarily a culinary extinction. It was once believed that mammoths vanished because of climate change, but that didn't make a lot of sense given their wide range. As humanity increased its own range, the mammoth

disappeared, a strong piece of circumstantial evidence. But we also have found mammoth kill sites, including ones where stone spear points are embedded in the mammoth remains. At one site in Lehringen, Germany, a mammoth was killed 120,000 years ago with a fire-hardened wooden spear. Some of these sites were likely created by our extinct cousins, the Neanderthal. From the many human camps filled with mammoth bones, we can safely assume that the animal was a prized menu item.

We can't entirely know how quickly early humans eliminated mammoths once they entered an area, but we can glean clues from what we know of the mammoth's habits and breeding. Studies of tusk show that when humans entered a herd's territory, sexual maturity of female mammoths began happening earlier, a sign of predation we see today in stressed animal populations. (Climate change, on the other hand, would have had the opposite effect.) In some areas, we have found shelters built with mammoth tusks and bones, suggesting mass killing over a sustained period. Mammoths might seem fierce but were likely easy to sneak up on. A quick blow with a poisoned arrow or spear would do the rest, as they had weak points on their belly and neck. Such a bounty likely spurred the invention of an entirely new technology. As no group of humans could consume so much meat while it was fresh, there would have been a need to preserve some of the kill for a later time. Archeological evidence suggests humans weighted mammoth meat and submerged it in cool ponds, where it would stay somewhat fresh. Later, the earliest food technologies — smoking, drying and salting — emerged to protect similar meaty bounties. From such hunting, we developed the first really critical culinary skill after fire: leftovers.

We also know about mammoths from ancient cave art. Some ancient cave complexes were both shelters and the first places of

worship. Rouffignac cave in France, known as the cave of the hundred mammoths, is a good example. To get to the farthest decorated chamber is a forty-five-minute walk underground. Oxygen levels are low and ancient artists would have been working by the flickering light of wicks floating in burning oil. Paintings of mammoths, woolly rhinoceroses, horses, bison and other animals adorn the ceiling. Its location deep underground has protected the cave from light and the elements, giving us a good idea of the look and color of the live animals. Some are depicted at a run, galloping across the walls. The artists engraved lines into the rock and filled areas with pigment. Mammoths dominate the art, suggesting their great importance.

It is hard to say with certainty how we cooked mammoth, but archeologists can give us a rough idea. We had controlled fires a million years ago, though cooking pots didn't develop until 20,000 years ago, and our mammoth snacking days fall somewhat in between. We had sharp stone knives and probably cut meat into chunks or strips to roast over or alongside the fire. The people of the Pacific coast of North America roasted salmon in thin strips by wrapping them around wooden sticks and planks and propping the planks near a fire, a technique that would work for mammoth as well. The fat would run over the meat and could be collected in shells at the bottom of the sticks. It is unlikely our mammoth chefs had much salt, but from dental plaque studies, we know the mammoth hunters ate herbs, and so perhaps they prepared a crushed herbal rub to massage into the meat. Today's barbeque techniques have a very long pedigree.

An early human site in the Ukraine revealed a diet rich in plants and mammoth and signs of frequent cooking. Cooking causes meat to lose calories as the fat melts out, but it is easier to digest, reducing the caloric cost of digestion by as much as 15 percent and giving humans another critical edge. Early

humans didn't know that, of course, but they did know that cooked meat tasted better. One reason for this is known as the Maillard reaction, in which sugars and amino acids react to produce compounds that make seared foods tasty. Once early humans got a taste of caramelized mammoth with wild thyme, they were likely hooked.

The last species of the genus was the woolly mammoth, and these animals began to die off as humans followed the retreat of the glaciers. By 10,000 years ago, they were gone from the continents. On the remote Wrangel Island north of Alaska, a site that humans never colonized, the final pygmy mammoths vanished about 1650 BCE. These mammoths were never hunted but encountered a different problem: climate change. As the sea level rose, their habitat shrank until, eventually, the environment couldn't support them.

The loss of the mammoth and similar animals left us with a problem: without megafauna, humans were hungrier and weaker. Our numbers contracted and our territories shrank. We needed a new way of interacting with the environment. Mammoth was off the menu.

"What happened to your neck?"

Dan and I were catching up after my time in the North. I'd managed to snap some impressive "city raven" photos in and around Dawson City. The big scruffy birds just sort of hang around town, like bored teenagers. Dan admired the images and then returned to worrying about my neck. I was still looking a little weathered, sporting a sunburn and an impressive array of swollen bites. That morning, I'd found a small stick tangled in my hair. It would take a few more hot baths and a couple loads of laundry to get me back to urban respectability.

"I contributed to the local ecosystem by donating blood. And flesh."

"So, about our first extinction dinner. I wish we could serve preserved mammoth. Do we know anyone who could get us mammoth? Like at the Explorers Club?"

I sighed. From the gleam in Dan's eyes, I knew that he was taken with the romance of the strange stories of people eating carrion mammoth meat found preserved in the permafrost. Tales have circulated since the first few frozen corpses were found, and one of the grandest of these stories involved the Explorers Club, founded in 1905 by a group of adventurers. On January 13, 1951, as they sat down for their annual dinner in the ballroom of New York's Roosevelt Hotel, to a lavish repast of spider crab, green turtle soup, bison steaks (at the time much more unusual than they are today), cheese straws and, as legend has it, stewed mammoth. This last dish had been widely advertised to club members, and the dinner as a whole began a tradition of serving unusual meals that continues to this day. The story was so established in club lore that the tusk of the mammoth allegedly committed to the stew pot can be found in the club's lush, curio-crammed quarters on East 70th Street, where it hangs over a rather handsome stuffed penguin. Certainly, many club members lived, bragged and died believing they had eaten mammoth meat. Well, no. The club definitely intended to serve mammoth, and they presented the meal as mammoth, but we now know that it was counterfeit.

The mammoth hoax would have been the perfect crime (after all the evidence was consumed at the dinner) except a member of the club, taxidermist Paul Howes, was absent that night and asked if the club might send him his share of the mammoth in a sample jar as a trophy. The dinner committee complied, and the meat was dispatched along with its story of origin. According to the club, the mammoth meat had been

sourced in the Aleutian Islands by Bernard Hubbard, a glaciologist, especially for the club.

Howe never ate his sliver of meat and it ended up in the Peabody Museum, a curious little institution on the outskirts of Boston. There it sat, forgotten in a back room. In 2014, Yale student Matt Davis, who was a member of the club, began to wonder if the mammoth meal could really have taken place. He knew ancient meat decays quickly upon exposure to air. One of his professors had mentioned the museum sample, and Davis sought the institution's permission to test the meat. This wasn't easy, as DNA degrades over time, and the meat was stewed, mixing in with whatever else the chef had fancied. The results, once they were carefully teased out, bore no mammoth DNA. It was, rather, green sea turtle. Likely part of the same turtle that found its way into the soup. Whatever happened to Hubbard's mammoth, it hadn't made its way to New York.

The Explorers Club was likely inspired to eat mammoth by a story borne out of one of the first excavations of an intact mammoth. In Victorian times, there was a frenzy of interest in mammoths and a rush to get an excellent specimen. When, in 1901, a hunter and his dog stumbled upon a great gray corpse frozen into the banks of the Berezovka River in Siberia, the governor of Yakutsk alerted the St. Petersburg Academy of Sciences. A team led by entomologist Otto Herz was dispatched immediately to claim the prize, and paleontologist Eugen Pfizenmayer kept a careful diary as the expedition moved east. At first, the trip was idyllic. They traveled by luxury train, bringing along a saloon car, dining car, church car, piano and bathtub. Otto suspected the existence of the remains would be a false alarm, and so he reasoned they might as well at least travel in style. In Irkutsk, they transferred to steamer, then swapped to horses and then later to a reindeer team. Leaving luxury behind, they smelled

the mammoth before they saw it, still frozen into the crevice where it had died. A few wild animals (and the dog) had chewed on the head, but otherwise it was perfect. The team built a small cabin around the animal and began frantically working to thaw the ground enough to remove it.

For decades afterward, stories circulated that the expedition had stretched its insufficient supplies by eating the excess flesh of the great beast. Alas, this too was a myth. Pfizenmayer notes in his diary that the meat, when first exposed, was pretty tempting. It was red and healthy-looking, filled with ribbons of fat. Once thawed, however, it turned deathly gray and quickly congealed into a putrid mush that gave off a horrid stench. It was 35,000 years old and was not going to land in any stew pot. Instead, they cut the beast up, stowed it in cowhide and rushed it to Irkutsk and a refrigerator car. Reassembled in St. Petersburg, the beast drew rave reviews, though it retained its horrid smell. The tsarina, stunned by the stench, asked politely if she might tour another part of the museum, preferably one quite far away.

Mammoth flesh. Maybe we don't want to eat it, but it does still exist. These freezer-burnt remains lie in various museums and, with our boundless optimism over the power of technology, an interesting question emerges: could we bring the mammoth back? This idea, which emerged right after the first discoveries of preserved animal remains, was largely science fiction until the rise of bioengineering, but now, the potential to bring back the extinct elicits optimism from people with a mild understanding of the topic as well as scientists with decades of training. It turns out that there are a lot of people out there who dream of living forever in a perfect future full of resurrected mammoths and dodos. In a world where nature is in rapid retreat and countless species face extinction, it is tempting to think this might be possible, but it would be wise to check our optimism slightly.

Consider the mammoth. The use of preserved genetic material has long been discussed as a pathway to restoring vanished animals, a process known as de-extinction. Thanks to advances in genetic technology, this possibility has begun to move out of the realm of science fiction. These revived animals are known as necrofauna, and there are dozens of projects to reverse extinctions around the world, usually through cloning or back breeding. There are three major projects to restore the mammoth alone, one in Japan, one in South Korea and one in the United States. The complete genome of the mammoth has been sequenced and was published in 2015 by Swedish scientists. A Harvard team has inserted some mammoth genes into elephant stem cells. By using elephants as host mothers for mammoth-elephant hybrids, it is possible that we could slowly bring individuals with high percentages of mammoth DNA into the world, though currently our technology is still insufficient. Beth Shapiro's book *How to Clone a Mammoth* outlines the technology in detail, including the difficulty of extracting DNA from frozen remains. (DNA fragments upon death, which created a puzzle for the scientists attempting resurrection.) Inserting crafted sections of DNA into elephant DNA and growing hybrid cells in culture is a laborious process. The issue of an elephant's ability to carry a mammoth to term is also thorny and beyond our current technology; miscarriage is almost certain. Shapiro also asks the critical question, "What would happen if we were successful?" It's a vital question to ask if we want the species to be more than a zoo curiosity. Is there enough room for them in their home ecosystems? Would they outcompete other species? Could they reintegrate into the food chain?

Let's return to my trip north and to one of the few megafauna that is not extinct and can be found in the wild, living a life fairly similar to the one it lived in the Pleistocene: the

bison. The two existing species of North American bison didn't go extinct, but they came close. Their collapse ended nomadic living on the American plains and made possible mass colonization and farming. The North American industrial cow would not exist if the buffalo still roamed. I kept thinking about the wood bison. Why were they there, grazing peacefully by the road? Did they spend most of their time standing on the Alaska Highway, or were we just lucky to cross their paths? The herd Shannon and I visited turned out to have a name, the Nordquist herd, and they are a hopeful symbol of the survival of the iconic species. They also represent how difficult it is to maintain endangered megafauna, even in areas of the continent where there is almost no human presence. In the face of the effort to maintain the Nordquist herd, de-extinctionists start to sound a little naïve.

The Nordquist herd contains somewhere between 120–150 individuals, introduced by the Canadian Ministry of the Environment in 1995. Before that, the last wood bison in British Columbia had grazed in the early 1900s, hunted to local extinction. They were generally thought to be extinct after that, but in 1957, a wildlife patrol flight spotted several hundred animals browsing deep in Wood Buffalo National Park, where they had gone unnoticed for decades. This herd provided needed genetic diversity for a herd of plains bison on Elk Island near Edmonton, Alberta, that had been purchased from the United States. Elk Island now hosts both subspecies, and the Nordquist herd was established from these animals as part of a British Columbia strategy to reintroduce the species. The restoration is part of a larger Canadian wood bison recovery strategy, which aims to release free roaming animals throughout their range. They began with forty-nine animals, and the herd has slowly grown from there. It is one of three such herds in British Columbia.

But the wood bison still face real challenges. For starters, they really do like standing on the highway. The forest no longer burns as often or as completely as it once did, so the bison clump together on the one clear spot available: the highway. Ten to fifteen animals a year are killed in car accidents, and the population expansion is limited by the narrow forage band. Expensive habitat enhancement is needed, including the reintroduction of fire into the landscape, which clears the forest and allows forage to grow. This process is underway, and the bison will hopefully spread throughout Muncho Lake Provincial Park, which is 88,000 hectares in size and is surrounded on all sides by wilderness — no roads, no human activity. The area free of roads surrounding the bison would swallow Belgium; Germany would fit into British Columbia three times over. And still, preserving a few herds of bison is difficult and expensive.

The terrible truth is that as long as humans exist in our current and growing number, and as long as farming requires large swathes of land, maintaining existing herds of megafauna is difficult and expensive work. Restoring them is even more difficult, besides being morally debatable and impractical. We can learn a few things from the loss of the megafauna, including the mammoths. Large animals that breed slowly and require huge ranges for survival are fragile and quickly fall prey to human technology and intrusion. Our remaining megafauna, such as bison, moose and elephants will survive only if we don't hunt them and if we give them adequate room. We can't eat wild megafauna widely and expect them to exist, and if we try to farm them, we will find it an inefficient and environmentally intensive experience. This brings me to the one place we can apply our lessons from the quaternary extinction, for in our food system, one surviving example of megafauna remains: the cow.