



# Reinterpreting the 1882 Bison Population Collapse

By Sierra Dawn Stoneberg Holt

## On the Ground

- Many people believe grazing management is vital to ecosystem health. Others feel ecosystems are only healthy when nature takes its course. The Great Plains bison population of the early 1800s supposedly supports the superiority of goal-free grazing management.
- By 1883, bison were virtually extinct, and hunting is usually blamed. However, records indicate that hunters killed less than the annual increase each year. Evidence implicates disease and habitat degradation instead.
- Comparing Allan Savory's observations in Africa, Lewis and Clark's observations in eastern Montana, and Blackfoot history, indications are the bison disappearance was perhaps triggered by the loss of intelligent human management.

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## The Dr Jekyll and Mr Hyde of Range Management

I love data. I love counting and measuring and estimating and transects. But sometimes, in resource management, we need to take three steps back from the data and take a hard, new look at the instincts, emotions, biases, intuitions, myths, folklore, and common sense that play such a critical role in how resource management is practiced and perceived.

Range management suffers a Dr Jekyll/Mr Hyde dichotomy. On one hand, society is deeply invested in the idea that range management is positive. How many government agencies have how many people spending how much money year after year instituting and disseminating range management practices? How many universities have how many instructors with how many research projects and how many tax dollars teaching range management to class after class and developing newer and better ways to manage range?

Everything from soil erosion to noxious weeds to sage-grouse welfare is believed to hinge on range management.

And at the same time, society is just as strongly invested in the opposite viewpoint, that the finest management is that of Mother Nature, unsullied by human involvement. From this perspective, every single one of those hours and dollars and educations and careers is a waste of time and resources and directly harmful to the environment.

Where I live, this perspective is represented by the Charles M. Russell National Wildlife Refuge, which changed from rotated to continuous grazing because water developments and fences are unnatural. It is represented by the American Prairie Reserve, which is petitioning the Bureau of Land Management to let it remove interior fences and abandon its grazing plan. It is represented by Yellowstone National Park, whose bison herd ballooned to over an order of magnitude above official carrying capacity when “natural herd management” was instituted.

In *Gardeners of Eden: Rediscovering our Importance to Nature*, Dan Dagget<sup>1</sup> labeled this perspective the Leave-It-Alone assumption. He characterized it by a comment he heard an Earth First!er make to a rancher, “There’s only one thing you can do to make this place better. You can leave. Because if you stay, no matter what you do to the land, no matter how good you make it look, it will be unnatural and therefore bad. And if you leave, whatever happens to this place, even if it becomes as bare as a parking lot, it will be natural and therefore good” (p.18). Later, Dagget states, “The Great Plains of North America with their huge herds of bison are offered as... proof of the effectiveness of the Leave-It-Alone approach. As the story goes, the wild and free bison were hunted by Indians who were too few to keep the Great Plains from becoming one of the most biologically productive habitats the earth has ever produced and one of the greatest successes of the Leave-It-Alone approach” (p. 22).

Dagget’s thesis<sup>1</sup> that Leave-It-Alone’s opinion of Original Americans is, “when it comes to how they managed the environment, the thing most of us value about those peoples is the perception that there were so few of them they couldn’t really mess things up. In other words, we value them for being a failure, because that’s what most of us assume they were” (p. 135) may seem unnecessarily harsh. However, in his encyclopedic, 602-page indictment of management, *Waste of*

*the West: Public Lands Ranching*, Lynn Jacobs<sup>2</sup> (p. 9) states, “Although (Native Americans) exerted many influences on their environment, as a whole they had an incomparably less destructive impact than those who would follow. Perhaps this was largely because they had lesser means to exploit and destroy.”

Now biology is big and messy and mysterious. It is possible both viewpoints are simultaneously true, that good range management is absolutely critical to the health of rangelands and that, at the exact same time, good range management is entirely superfluous and the best range manager is the one that stays as far from the range as possible and never influences it in any way.

But if that is not the case, then a lack of managers should have either catastrophic or exceptional results, and we should hopefully be able to tell the difference.

Now it’s time to take a closer look at that “most biologically productive [of] habitats the earth has ever produced,” and it’s time to look at some data.<sup>1</sup>

### **The Question: A Mathematical Curiosity**

American bison nearly went extinct. On 1 January 1889, there were 456 known to exist (p. 464).<sup>3</sup> They are believed to have descended from approximately 171 separate individuals (calculated from Hornaday<sup>3</sup> and Stermitz Ricketts<sup>4</sup>).

What caused that near-extinction? Everyone knows: hunting. According to *Ocean of Grass: A Conservation Assessment for the Northern Great Plains*, by the World Wildlife Fund (p. 11–13),<sup>5</sup> “[Bison] numbers... totaled some 30 million or more. Others have placed the number much higher, generally around 65 million. A recent estimate based on forage productivity estimated historic bison carrying capacity at between 21–88 million... By the mid-19th century... [t]he railroads brought... the means to transport the hundreds of thousands of hides taken annually... By the mid 1880s, the North American bison was virtually extinct.” What is wrong with this statement? There were tens of millions of bison. Every year hundreds of thousands were harvested. If they were fossils or statues and you took hundreds of thousands from 21 to 88 million every year, then in 21 to 440 years, you would get rid of them all. But what do tens of millions of bison have every year? They have millions of calves. And if not, they have problems that are much more serious than hundreds of thousands of bullets!

Being snide about the World Wildlife Fund’s scholarship would be unfair. The quote accurately presents the conclusion of the seminal paper on the bison disappearance by Dr William T. Hornaday.<sup>3</sup> Page 466 states, “Notwithstanding the merciless war that had been waged against the buffalo for over a century... and the steady decrease of its numbers... there were several million [two million increase by about 400,000 a year]... [before] 1870... [hunters] took annually less than one hundred thousand...” This mathematical curiosity, paraphrased, “Hunters yearly killed less than the annual increase until bison had been exterminated by hunting,” appears throughout the paper, illustrated by various years, ranges, herd sizes, and kill rates.

Hornaday<sup>3</sup> (p. 498–501), using actual records plus a generous 705% factor to cover unrecorded kills, estimated that

just over 1.2 million bison were killed annually during the 3 years that bison slaughter was at its peak (1872–1874). Otherwise, the total annual kill was definitively in the hundreds of thousands.

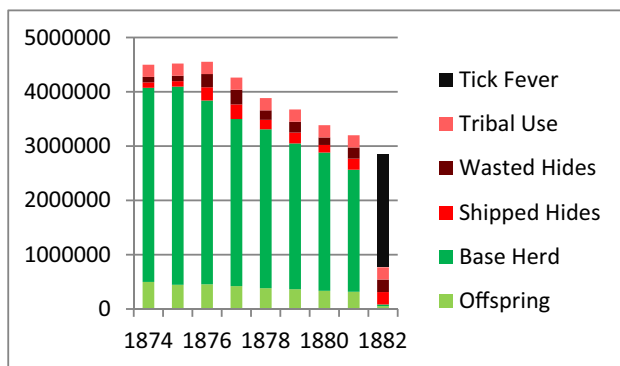
When considered critically, the numbers are clear. Bison were not exterminated, wantonly slaughtered, or overhunted. They were sustainably harvested. According to the United States Department of Agriculture,<sup>6</sup> there were 92 million cattle in the United States in 2016 (which is approximately 1–3 times the common bison herd estimates) and in 2015, 28.8 million head were slaughtered (24 times the recorded bison slaughter over the 3 years it was at its peak). Cattle are in no danger of disappearing from the continent. According to VerCauteren,<sup>7</sup> whitetail deer populations exceed 30 million (the low end of bison herd projections). The Quality Deer Management Association<sup>8</sup> compiled records from 37 state wildlife agencies and came up with almost 5.6 million legally harvested whitetails in the 2014 to 2015 season (over four and a half times the highest annual bison harvest). The harvest was low that season, and the numbers do not include any animals poached, killed by vehicles, or killed in the 13 states that did not provide data. According to VerCauteren,<sup>7</sup> whitetail numbers are increasing. Looked at from the other end, I started with the bison known to exist after near-extinction, then worked backward using the most extreme yearly slaughter estimates (calculated from Hornaday,<sup>3</sup> Koucky,<sup>9</sup> and Lepley and Lepley<sup>10</sup>) and a very conservative herd increase factor. I determined that for those slaughter rates to wipe out bison, the total bison herd of North America never, ever reached 7 million animals. I have never seen anyone claim that the North American bison herd was that small. If our ecological philosophy grants any value at all to predation, the slaughter of the North American bison was not harmful to the bison, it was helpful. So what happened?

### **The First Hypothesis: Epidemic Makes the Numbers Make Sense**

I stumbled upon the discrepancy between accepted bison numbers and bison kills when my father asked rhetorically how people could shoot 60 million animals. The question intrigued me. While collecting articles and data, I found a brilliant paper by Dr Rudolph Koucky<sup>9</sup> that did a careful, scholarly analysis of the disappearance of the Northern bison herd, the final remaining large herd of bison, between 1874 and 1883. He concluded that extermination by hunters “is a myth initiated and maintained by bad journalism and poor scholarship” (p. 23). He posited death by epidemic and provided some convincing arguments.

My veterinarian mother and I studied Koucky’s<sup>9</sup> article and found two disease candidates, anthrax in the Nebraska area and Texas tick fever in the Montana area. They are sufficiently deadly to wipe out tens of millions of animals,<sup>11</sup> seem native to the hemisphere,<sup>12</sup> match the snippets of historic observations reported by Koucky,<sup>9</sup> and have convincing narratives of infection and spread.<sup>11</sup>

Koucky<sup>9</sup> estimated bison at four million in 1874, based on available sources. His very conservative annual increase



**Figure 1.** The graph shows estimates of bison numbers, kills, and tick fever mortality. Kill estimates are extreme maximums. Using moderate kill numbers from the ranges in the sources has the herd increasing slightly before 1882. Shipped hides combine early estimates and historical records; wasted hides and tribal use are from early estimates.<sup>3,9,10,13</sup>

estimate was 500,000. Careful review indicates the total annual kill never reached 840,000 (calculated from Hornaday,<sup>3</sup> Koucky,<sup>9</sup> and Lepley and Lepley<sup>10</sup>). In 1883, bison were nearly extinct; fewer than 25,177 animals remained (calculated from Hornaday,<sup>3</sup> Stermitz Ricketts,<sup>4</sup> and Koucky<sup>9</sup>). Removing 840,000 animals from 4.5 million leaves them a good 3 million short of extinct. But Texas tick fever has an 81% death rate.<sup>11</sup> Removing 81% from 4.5 million leaves just 855,000. Shooting < 840,000 of them leaves > 15,000, which is a lot like < 25,177 (Fig. 1). The closeness of the fit is especially impressive given that many of the numbers come from rough estimates from varied sources.

### Evidence of epidemics

Can millions of animals have dropped dead without anyone noticing they had not been killed? How easy is it to overlook the cause of a carcass?

E.C. “Teddy Blue” Abbott<sup>14</sup> (p. 101) said, “That buffalo slaughter was a dirty business... next spring they would just lie there on the prairie and rot, hides and all. Riding the range, you would find lots of skeletons with pieces of hide still sticking to them. It was all waste.”

Contrastingly, Dr Sam Fadala<sup>15</sup> wrote, “Beaver trapper Yellowstone Kelly wrote an interesting account circa 1867. ‘... on all sides as far as the eye could reach was dotted with bodies of dead buffaloes. These animals were in good condition and bore no mark of bullet or arrow wounds. The cause of their death was a mystery to us... [S]o many carcasses scattered around made a strong impression on my mind, perhaps because they were the first buffaloes I had ever seen.’”

Koucky<sup>9</sup> (p. 28) reported, “In 1926, while hunting on the former northern buffalo range, I saw a cluster of buffalo skeletons arranged much like a herd of cows lying on a meadow. I examined the skeletons and, with my training as a pathologist, could find no suggestion that the animals had been killed. They had simply laid down and died.”

Buffalo skulls weather out of our creek banks. My veterinarian mother sees middle-aged animals undisturbed by predators or scavengers, that is, evidence of epidemic,

an extreme winter, or drought-caused starvation. I see heavy, crumbling skulls with big horns. The obvious is not always obvious.

In his 1841 journal, trapper Osborne Russell<sup>16</sup> (p. 121) wrote, “[25 February–27 March] The Buffalo have long since left the shores of these [Utah and Great Salt] Lakes” and, “In the year 1836 large bands of Buffalo [his personal observation] could be seen in almost every little Valley on the small branches of this Stream [near Snake River, Idaho] at this time [5–15 November] the only traces which could be seen of them were the scattered bones of those that had been killed. Their trails which had been made in former years deeply indented in the earth were over grown with grass and weeds” (p. 123). Russell himself says the buffalo were “killed”, but this was 1841! Before 1865, Hornaday<sup>3</sup> (p. 492) says, “buffalo hunting as a business was almost wholly in the hands of the Indians.” Francis Haines<sup>17</sup> and David Dary<sup>13</sup> agree there was no serious bison hide market before 1870 and no professional white hide hunters. Haines<sup>17</sup> (p. 188) says, “[t] here is no indication that the traders at that time made any special effort to buy [buffalo] skins, but seemed to buy from the various tribes only to keep the Indians happy and to ensure that the Indians would sell them their better furs.” It would be easy to see Russell’s quote as evidence of the extremes of the hide trade and never notice it was written almost 30 years before that trade began.

### Tick fever

Texas tick fever is caused by a protozoan and spread by a tick native to southern Texas. The protozoa destroy blood cells. When the animal’s blood can no longer carry oxygen, it suffocates. The few emaciated survivors are easy prey for a harsh winter or predators. Some survivors achieve limited immunity. They can carry ticks to infect healthy herds. If a herd loses contact with the disease for a time, it loses its immunity and is again subject to the high death rate. Tick fever’s causes were discovered in 1906, long after the bison were gone.<sup>11</sup> In 1882, the fact that passing Texas cattle meant “native cattle died in vast numbers” was still being attributed to crawling devils, an ancient Spanish curse, poison leaking from their feet, and/or noxiously bad breath (p. 49).<sup>18</sup>

Tick fever grants new dimensions to an observation by Charles Goodnight. “[T]he summer of 1867 was very dry in the Texas Panhandle, and bison herds had gathered on the Little Colorado River in such numbers that ‘They had remained until the grass was gone, and had died from starvation by thousands and thousands. The dead buffaloes, which extended for a hundred miles or more, were so thick they resembled a pumpkin field.’ Goodnight also stated that although there was still good grass on the Rio Concho, 30 miles across a divide to the southwest, the buffalo had stayed on the Little Colorado” (p. 85).<sup>19</sup> Charles Goodnight had been driving herds of Texas cattle north since the spring of 1866.<sup>20</sup> If they were carrying infected ticks, and if the bison on the Little Colorado had had no recent contact with southern bison or cattle and had lost any immunity they may once have had... then within 3 weeks of meeting Goodnight’s



herd, they would indeed have died like pumpkins. They would not have been noticeably sick, just too anemic to walk 30 miles to fresh grass until they dropped dead.

Goodnight eventually settled in the Texas panhandle. His cattle lost contact with the fever-carrying tick and their immunity and died like pumpkins when herds of South Texas cattle passed through. His frustrated anguish is clear from a letter published in the *Fort Griffin Echo*, 18 November 1881.

*[Y]ourselves and I have always been good friends, but even friendship will not protect you in the drive through here... if you have any feeling for me as a friend or acquaintance, you will not put me to any desperate actions... My cattle are now dying of the fever contracted from cattle driven from Forth Worth; therefore do not have any hope that you can convince me that your cattle will not give mine the fever... I simply say to you that you will never pass through here in good health (p. 80–81).<sup>18</sup>*

## The Second Hypothesis: Catastrophic Loss of Management Makes Epidemic Make Sense

So epidemic was The Answer. Yet something was missing. As I read texts and studies related to my home range, the bison question stayed in the back of my mind.

The Pikuni (of the Nitsitapii or Blackfoot Confederation) had ranged my part of the Great Plains since at least the 14th century. Nomadic bands had inhabited the Plains and hunted bison since the terminal Pleistocene (14,000 years ago), using the impoundment method for at least 2,000 years.<sup>21</sup>

Then one day I was reading Allan Savory's<sup>22</sup> *Holistic Management: A New Framework for Decision Making*,

*When [Robert Paine] removed the main predator, a certain species of starfish, from a population of fifteen observable species, things quickly changed. Within a year, the area was occupied by only eight of the original fifteen species. Numbers within the prey species boomed... species that could move left the area; those that could not simply died out. Paine speculated that in time even more species would be lost. His control area, which still contained the predatory starfish, over the same time remained a complex community where all species thrived... I witnessed a similar disruption in two much larger communities in Africa. For a period in the 1950s I worked as a game department biologist in the Luangwa Valley in Northern Rhodesia (today Zambia) and the lower Zambezi Valley of Southern Rhodesia (today Zimbabwe). Both areas contained large wildlife populations—elephant, buffalo, zebra, more than a dozen antelope species, hippo, crocodiles and numerous other predators... Yet despite these numbers, the river banks were stable and well vegetated [Fig. 2]. People had lived in these areas since time immemorial... But the governments of both countries wanted to make these areas national parks. It would not do to have all this hunting going on, and all the drum beating, singing, and general disturbance, so the government removed the people. Like Paine, we, in effect, removed the starfish. But in our case we put a different type of starfish back in. We replaced drum beating, gun firing, gardening, and farming people with ecologists, naturalists, and tourists, under strict control to ensure they did not disturb the animals or vegetation. Just as in Paine's study, the results were quick and dramatic. Within a few decades miles of riverbank in both valleys were devoid of reeds, fig thickets, and most other vegetation. With nothing but the change in behavior of one species these areas became terribly impoverished and are still deteriorating seriously... (p. 20–21)*



**Figure 2.** In the 1950s the banks of the Zambezi River were stable and well vegetated, despite the high numbers of game and the presence of hunting, gardening humans (p. 21). Photo courtesy of Allan Savory.<sup>22</sup>

When I looked at Photo 3-2 (Fig. 2) of a well-vegetated Zambezi River in the 1950s and Photo 3-3 (Fig. 3) of a deteriorated Zambezi River in the 1980s, two other papers crashed together in my mind. Luckily, I had read both only a few days before. Because of contemporary culture's innate bias against the value of active human management, I'd read those pages of Savory many times before and never realized that they applied to anything beyond elephants.

Looking at Photo 3-3 (Fig. 3), I realized I'd seen it described by Captain Merriweather Lewis, written Saturday 11 May 1805,

*[T]he banks are falling in very fast; I sometimes wonder that some of our canoes or perogues are not swallowed up by means of these immense masses of earth which are eternally precipitating themselves into the river; we have had many hair breadth escapes from them (p. 139–140).<sup>23</sup>*

But what took my breath away was noticing Savory's pictures were about 30 years apart, and just 25 years before Captain Lewis wrote that entry, a smallpox epidemic had devastated the Pikuni.<sup>21</sup>



**Figure 3.** By the 1980s the banks of the Zambezi River within the national park were nearly devoid of vegetation, even though game populations had been culled heavily and the hunting, gardening humans removed (p. 22). Photo courtesy of Allan Savory.<sup>22</sup>

So what if the Pikuni were range managers? What if they had not just spent 14,000 years being irrelevant, according to the Leave-It-Alone assumption, but, like Savory's drum-beating Africans, had been learning, since "time immemorial," to be a critical component of a complex ecosystem?

Nitsitapii bands had approximately five buffalo hunts a year and at each would impound, kill, and process 24 to 200 animals, drying surplus meat, all without the aid of horses.<sup>21,24</sup> Fur trader Charles Larpenteur<sup>25</sup> witnessed such hunts and reported up to 300 bison could be harvested. Imagine 80 to 160 people, about half of them vigorous adults,<sup>24</sup> harvesting and processing up to 300 buffalo at a time, 1,000 or more a year. That's a lot of meat, but "from Hopewell times (beginning of the first millennium AD), surpluses (probably pemmican) were produced and traded downriver into the Midwest region, and overland to the Southwest" (p. 37),<sup>21</sup> since "meat represents plant carbohydrates processed into a highly cost-efficient form in terms of transportation costs" (pp. 96-98).<sup>24</sup>

Were the Nitsitapii managers? There seems to be no question in the mind of anthropologist Alice Kehoe. She referred to life on the Great Plains as a "human's planned economy" and called it, "a livestock production strategy minimizing labor input... Great skill in managing herds was developed" (p. 88).<sup>24</sup>

So why am I convinced there was a loss of management? The bison went nearly extinct. We can all agree upon that. They seem to have been nearly wiped out by overgrazing and by diseases at least some of which were native to the continent. And this was after roughly 14,000 years sharing North America with people and not going extinct. Something important apparently changed. The near-extinction seems to have occurred following the arrival of Europeans, so it is easy to suspect they were somehow involved. That is why the simple explanation, "Europeans just shot them all," has always been so popular. If the diseases had been European diseases, that would also have been a simple obvious narrative. European arrival did have tremendous impact on human and animal movements, so it is possible to attribute the epidemics to that—changes in movement made disease transmission possible in ways it never had been before. That is one explanation, but I do not find it the most plausible one. Seeing Savory's description, with photographs, of personally witnessing damage to the Zambezi River and its elephant population caused by removing humans, and seeing that Lewis and Clark described similar riverbank effects following the same length of time after smallpox had removed Pikuni from the Upper Missouri opened my mind to the idea that the European diseases most deadly (ultimately) to bison were those that killed the humans. It convinced me that humans had been providing a "something" that the bison were unable to survive without. What was it? Well, in the starfish example, the missing "something" was predation. I do not believe the starfish were managers. And the idea that removing a key predator can destabilize and damage an ecosystem is fairly universally accepted. But in the elephant example, the most important thing the humans were supplying was not predation. They kept the river and elephants healthy by impacting the behavior of the elephants. Indeed, once the

elephant behavior had changed and the ecosystem had begun to deteriorate, Savory<sup>22</sup> tells us the new managers tried to replace the old management they had removed with predation, to no avail. No matter how many elephants were killed, the ecosystem remained degraded. In addition, the Europeans definitely supplied the bison with predation. There are two possible interpretations for this. One is that the critical "something" supplied by Original Americans was predation. The supply failed when they were decimated by disease, and subsequent European predation came too late to save the bison as the herds were already in a death spiral. This answer, like the epidemic-caused-by-movement-changes answer, is plausible. Yet I think still more plausible is the answer that the lost "something" was more than just predation. It was management. Whether or not we consider Original Americans capable of management depends in part on our definition of management. If we define it as using modern technology and Western scientific method, it is clearly a recent innovation. My personal definition, however, requires intelligent intent, observation, foresight, goals, the ability to remember and learn from the past, the ability to predict the future, and the ability to communicate with others. That is something that I believe starfish are not capable of and something I cannot imagine original American peoples not doing. As with the elephants, it seems that replacing centuries-old management with mere predation was doomed to failure. According to Gary Nabhan<sup>26</sup> the sequence that I proposed for the Pikuni (intensive management, abandonment of managed lands following severe epidemic, "discovery" of those lands as "virgin wilderness" by subsequent Europeans) happened all across North America. In *Cultural Parallax in Viewing North American Habitats*, he refers to habitats of pre-Columbian North America as both "intensively managed" (p. 92) and "actively managed" (p. 93). I am certain that my interpretation is influenced by my experiences on a family ranch in the Great Plains. My great grandparents were supplying their cattle herd with predation 100 years ago, but my family's management methods have grown and adapted over time, thanks to the management criteria listed previously. Watching how sensitive and responsive the landscape is to our management methods and imagining what would happen if we replaced them with mere predation, convinces me that the skills and understandings my family has developed over 100 years were most certainly possessed by people that had 10,000 years to study this ecosystem. And I can't imagine anything more devastating to a management system with no written record, one that was based solely on trained individuals and oral transmission, than a major outbreak of fatal disease.

### *The clues*

What if the Pikuni and their management were the starfish, whose loss triggered the collapse? Would "numbers within the prey species boom" followed by extinctions as reported by Paine? Savory<sup>22</sup> predicted the following clues to recognize a "lost-starfish" collapse: collapsing river banks, "the change in human behavior changed the behavior of the animals that had naturally feared them, which in turn led to the damage to soils and

vegetation” (p. 21), “our droughts were becoming more frequent *because* the land was deteriorating” (p. 43), and “droughts occur more frequently and are much more severe” (p. 111). Savory<sup>22</sup> describes large, herding animals in the presence of their predators as “concentrated and moving” (p. 40). Without their predators, do they remain in one place? According to Montana Fish, Wildlife, and Parks, hunted bison are “very wary of humans, with most tending to flee at the sound of a stopping vehicle or the smell of approaching hikers” (p. 87).<sup>27</sup> Are un hunted bison gentle? These were the clues. Would I find them?

I leafed through a month of journal entries by Lewis and Clark when they were closest to my home. Over 31 days, I found 28 mentions of unhealthy vegetation (compared with today), 14 mentions of extremely large herds of game animals, 13 mentions of unseasonably dry stream beds (compared with today), 5 mentions of collapsing river banks, 4 mentions of high levels of water erosion, 4 mentions of extreme wind erosion (compared with today), and 2 mentions of oddly gentle buffalo<sup>23</sup> (p. 117–259; see Appendix 1).

### *Extremely high bison numbers*

Many sources indicate large bison numbers. Lewis and Clark are popular<sup>23</sup>; others include J. Bradbury in 1810, Edwin James in 1820, Jacob Fowler in 1822,<sup>19</sup> James A. Fisk in 1862, Captain Grant Marsh, Captain William T. Twining in 1874, and Lt. G. C. Doane.<sup>9</sup> For example Clark wrote on 29 August 1806, “I must have Seen near 20,000 feeding on this plain [near Dry Island, South Dakota]” (p. 328).<sup>28</sup> In addition, James wrote on 2 June 1820, “immense herds of bisons... at least ten thousand here burst on our sight in the instant” (p. 91),<sup>19</sup> Furthermore, “The James A. Fisk expedition in 1862 encountered so many buffalo in northwestern Dakota that one member claimed they saw ‘one million’ in a single day” (p. 23).<sup>9</sup>

People in the late 1800s believed the bison numbers to be normal and sustainable. If this was a “lost-starfish” collapse, the stable Great Plains ecosystem had not existed since 1780. It had never been witnessed by Europeans (except De Soto in about 1540, far to the south and writing in Spanish). “The disappearance of the buffalo was so sudden that, in 1883, the local people did not realize that the buffalo were gone. The hunters assumed that the buffalo had wandered to some other area and would return” (p. 27).<sup>9</sup> “And yet nobody believed, even then, that the white man could kill *all* the buffalo. Since the beginning of things there had always been so many!” (p. 250).<sup>29</sup>

*Buffalo roamed the plains in vast herds. I could not calculate their numbers—no man could... and the only regret I have of the life which I have led is that I thoughtlessly slaughtered many hundreds of these animals when I could have easily refrained from doing so. I wish now that my aim hadn't been so good* (p. 233–234)<sup>30</sup>

*“I was born in the buffalo trade and I expected to die in it... The buffalo are gone, I don't know what to do” Joseph Kipp, 1882* (p. 69).<sup>10</sup>

### *Population crashes*

Great Plains species did have population crashes in the late 1800s and early 1900s following the population booms. The testimony of the scientist is telling. (The K ecological strategy

is pursued by large animals with few young, long lives, slow increases, and relative stability. The r strategy is pursued by small animals like rabbits and mice with short lives, many young, and boom and bust population curves.) The following quotes are from scientists trying to reconcile the idea that in the early 1800s bison herds represented the long-term, sustainable situation with the incompatible fact that they seemed too numerous for their forage base and were prone to massive die-offs. “McDonald makes the point that, *comparing Bison species*, the historic Plains *Bison bison* had a *relatively r strategy*” (p. 90).<sup>24</sup> “A few species are notorious for their unrestricted growth potential... The bison of North America... are some of the best known... [their] numbers grew so high that *their survival depended on die-offs and high accident rates*” (p. 441).<sup>22</sup> Was it the mystery of the situation that caused each author to invest in italics, otherwise used fairly sparingly in her and his writings?

### *Environmental damage*

Are there records of damage to riverbanks, soils, or vegetation? Richard Hart<sup>19</sup> extensively documents period sources attributing vegetation damage to bison. Henry of the Red River of the North wrote in 1800, “They [bison] have ravaged this small Island... Nothing remains ... Brushwood and Grass are not to be seen in this little wood” (p. 98). Larocque wrote in 1805, “It is amazing how very barren the ground is between this [Powder River] and the lesser Missouri. Nothing can hardly be seen but those *Cornin de Raquetts* [prickly pears]. Our horses were nearly starved” (p. 90). Fremont, who was located on the Platte River, wrote in 1842, “[Bison] had left scarcely a blade of grass standing” (p. 94). Palliser, who was near the Swift Current of Saskatchewan, Canada, wrote in 1857, “The grass of this arid soil, always so scanty was now actually swept away by the buffalo” (p. 86). Palliser, in 1858 near Unity, Saskatchewan, Canada wrote, “miserable herbage which had been cropped bare by the buffalos” (p. 86).

In addition, “[7 February–25 March 1838] the buffaloe had consumed everything in the shape of grass along the [Powder] river [Wyoming]” (p. 81).<sup>16</sup> “Buffalo were so plentiful here [Fort Stewart, Poplar River, Montana] last summer [1861] that they ate up all the grass; it looked as though fire had burned the prairies” (p. 286).<sup>25</sup> “May 11, 1880... The myriads of buffalo have eaten out what little grass there is [Musselshell River, Montana]... May 12... very little grass and ten thousand buffalo busily engaged in eating up what little there is” (p. 124–125).<sup>31</sup>

Conditions for anthrax epidemics include, “close grazing of tough scratchy feed in dry times, which results in abrasions of the oral mucosa, and confined grazing on heavily contaminated areas around water holes” (p. 315).<sup>11</sup> The above quotes fit this description, as does Hart’s<sup>19</sup> (p. 95) quote of James from 16 August 1819 or 1820, “Bisons became astonishingly numerous... countless thousands of them were seen coming in from every quarter to the stagnant pools [in the Canadian River].”

### *Evidence of predation (or Lack thereof)*

Did bison show evidence of predation? Were they shy? Or did they congregate without moving? Lewis wrote, [9 May 1805, Big Dry Creek, Montana] “Buffaloe... so gentle that



the men frequently throw sticks and stones at them in order to drive them out of the way” (pp. 131–132).<sup>23</sup> Granville Stuart<sup>31</sup> (p. 125) recorded, “May 11, 1880... Had to run out and shake our blankets to frighten the buffalo away from camp... May 12... Antelope and buffalo are very tame here. Will hardly run from us.”

The primary thesis of Hart’s<sup>19</sup> “Where the Buffalo Roamed—or Did They?” is that “[o]ften bison were found continuously in the same location for weeks or months” (p. 99), and he supports his conclusion with period documents, particularly from 1800 to 1808. That is, none come from before 1780.

### Conclusion: There is No Get Out of Jail Free

So which was it? Were the bison plains an example of how productive Nature can be without human interference, an unspoiled Garden of Eden that collapsed with the entry of man? Or were they an example of how loss of range management can trigger a cascade of environmental damage spiraling toward extinctions? When I look at the evidence, I see the latter.

I worry I may have subconsciously viewed the Leave-It-Alone assumption pervading our culture’s foundations as my “get out of jail free” card. Yes, I am dedicated to the science and art of range management. Yes, I want to learn as much as I can and apply it for the good of the resource. But deep inside a little voice whispers, “If you really mess up and don’t understand anything, step away and all-knowing Nature can heal it.” Surely it is this same voice that encourages some federal managers and environmentalists to abandon management without research. After all, how much knowledge does it take to not interact with something? But if “one of the greatest successes of the Leave-It-Alone approach” is actually its opposite, if it actually demonstrates the tragedies that lack of management can cause, then there is no “get out of jail free card”. If we fail to understand, to study, to interact with, to teach... then we can bring our own world crashing down.

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### Appendix A. (Moulton,<sup>23</sup> 1987)

**Lewis, 6 May 1805** (p. 117): “passed three streames today which discharged themselves on the Lard. side; the first of these we call little dry creek it contained some water in standing pools but discharged none, the 2ed 50 yards wide no Water, we called it Big dry Creek, the 3rd is bed of a conspicuous river 200 yards wide which we called little dry river”

**Clark, 6 May 1805** (pp. 119–120): “passed two Creeks & a River to day on the Lard. Side, neither of them discharged any water into the Missouri, they were wide and Continued their width for Some distance”

**Lewis, 7 May 1805** (p. 121): “the water of the river is so terbid that no bird wich feeds exclusively on fish can subsist on it”

**Lewis, 8 May 1805** (pp. 124–126): “large herds of Buffaloe... a little distance from the river there is no timber to be seen on either side; the bottom lands are not more than one fifth covered with timber; the timber as below is confined to the borders of the river... there is no timber of any discription on the upland unless particularly mentioned; and also that one fifth of the bottom lands being covered with timber is considered a large proportion... a great number buffaloe, Elk, common and Black taled deer, goats”

**Clark, 1805** (p. 128): “Saw great numbers of Buffalow, Elk, antelope & Deer”

**Lewis, 9 May 1805** (pp. 130–132): “the timber has also in some measure declined in quantity. today we passed the bed of the most extraordinary river that I ever beheld. it is as wide as the Missouri is at this place or ½ a mile wide and not containing a single drop of running water; some small standing pools being all the water... it did not appear that it had been more than 2 feet deep at it’s greatest hight... a great quantity of game today particularly of Elk and Buffaloe, the latter are now so gentle that the men frequently throw sticks and stones at them in order to drive them out of the way”

**Lewis, 11 May 1805** (p. 140): “it is a light colored poor sterile sandy soil, the base usually a yellow or white clay; it produces scarcely any grass, some scattering tufts of sedge constitutes the greater part of it’s grass”

**Clark, 1805** (p. 143): “in every derection Buffalow, Elk, Antelopes & Mule deer innumerable and So jintle that we Could approach near them with great ease”

**Lewis, 12 May 1805** (p. 146): “we saw great quantities of game as usual”

**Clark, 15 May 1805** (p. 156): “We see Buffalow on the banks dead, other floating down dead, and other mired every day, those buffalo either drown in Swimming the river or brake thro’ the ice”

**Lewis, 17 May 1805** (p. 159): “few scattering cottonwood trees are the only timber near the river... The great number of large beds of streams perfectly dry which we daily pass indicate a country but badly watered”

**Clark, 1805** (p. 161): “a few Cotton trees is the only timber which is Scattered in the bottoms & the hills contain a

fiew Pine & Cedar, which is Scattered...We passed 2 large Creeks to day one on the Starbd Side and the other just below our camp on the Lard. Side each of those creeks has a little running water near their mouthes which has a brackish taste”

**Lewis, 18 May 1805** (p. 163): “timber consists of a few cottonwood trees along the verge of the river; the willow has in a great measure disappeared... creek on the Stard. side about three oclock, which afforded no water”

**Lewis, 20 May 1805** (p. 170): “immence number of prickley pears in the plains and on the hills”

**Lewis, 21 May 1805** (p. 176): “the soil is fertile, produces a fine turf of low grass and some herbs, also immence quantities of the Prickley pear, without a stick of timber of any description... we found ourselves so invellped with clouds of dust and sand that we could neither cook, eat, nor sleep”

**Clark, 1805** (p. 178): “the dust & Sand blew in clouds”

**Lewis, 22 May 1805** (p. 179): “the lands fertile or apparently so tho’ the short grass and the scantey proportion of it on the hills would indicate no great fertility”

**Clark, 1805** (p. 181): “verry rich Stickey Soil produceing but little vegetation of any kind except the prickley-piar, but little grass & that verry low”

**Lewis, 23 May 1805** (pp. 183–184): “two small creeks on Lard. and two others on Stard. all inconsiderable and dry at their entrances... great number of Elk”

**Lewis, 24 May 1805** (p. 189): “the first of these is a large Creek or small river... it is 30 yards wide and contains some water... the next streams in order is a creek which falls in on Lard. 2 ½ miles higher; this is 15 yds. wide no water... 2 Small creek fall in on the Stard. side, no water... the banks high and country broken it’s bottom narrow and no timber...the soil poor and sterile, sandy near the tops of the hills, the whole producing but little grass; the narrow bottoms of the Missouri producing little else but Hysop or southern wood [sagebrush?] and the pulpy leafed thorn [greasewood?]”

**Lewis, 25 May 1805** (p. 195): “last evening we passed a Creek 20 yard wide affording no runing water... the river bottoms are narrow and afford scarcely any timber... but little pine on the hills”

**Clark, 1805** (p. 198): “the bottoms between hills and river are narrow and Contain Scercely any timber”

**Lewis, 26 May 1805** (pp. 201–202): “scarcely any timber to be seen except the few scattering pine and spruce which crown the high hills... This is truly a desert barren country”

**Clark, 1805** (p. 205): “the Countrey may with propriety I think be termed the Deserts of America, as I do not conceive any part can ever be Settled, as it is deficient in water”

**Lewis, 27 May 1805** (p. 208): “once perhaps in the course of several miles there will be a few acres of tolerably level land in which two or thre impoverished cottonwood trees will be seen. Great quantities of stone also lye in the river and garnish it’s borders, which appears to have tumbled from the bluffs where the <water> rains had washed away the sand and clay in which they were imbeded... the country more broken and barren than yesterday if possible”

**Clark, 1805** (p. 209): “no timber except Some Scattering pine on the hills & hill Sides... Stones are loosened by the earths washing from them into the river and ultimately role down into the river, which appears to be Crowded with them”

**Lewis, 28 May 1805** (p. 211): “the drairy country through which we had been passing”

**Lewis, 30 May 1805** (p. 222): “the earth and stone also falling from these immence high bluffs render it dangerous to pass under them”

**Lewis, 1 June 1805** (p. 238): “Capt C. who walked on shore today informed me... he observed large banks of pure sand which appeared to have been d[r]iven by the S.W. winds from the river bluffs and there deposited... prickley pear which are numerous in these plains”

**Clark, 1805** (p. 240): “I observed maney [k]noles of fine Sand which appeared to have blown from the river bluffs and collected at these points”

**Lewis, 3 June 1805** (pp. 247, 250): “the country in every derection around us was one vast plain in which innumerable herds of Buffalow were seen... there are a great number of prickley pears in these plains... they saw a great number of Elk”

**Lewis, 4 June 1805** (pp. 253–256): “soil appears dark rich and fertile yet the grass is by no means as high nor dose it look so luxuriant as I should have expected, it is short just sufficient to conceal the ground. Great abundance of prickly pears... they are so numerous that it requires one half of the traveler’s attention to avoid them... the part of the river we have passed is from 40 to 60 yds. wide, is deep, has falling banks, the courant strong, the water terbid... dry ravines so steep and numerous... a great number of Buffaloe, Elk, wolves and foxes today”

**Clark, 1805** (p. 256): “this plain is covered with low grass & prickley pear... Saw Several Gangues of Buffalow”

**Lewis, 5 June 1805** (p. 258): “great quanties of Buffaloe... near the river the plain is cut by deep ravines”

**Clark, 1805** (p. 259): “I saw great numbers of Elk & white tale deer”

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*Author is PhD, Horse Ranch, Hinsdale, MT, USA. sierra@nemont.net. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.*