

Iowa's Bison: Ancient Animals in an Industrial Landscape

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Independent Major Senior Thesis

February 8, 2012

Acknowledgements

I'd first like to acknowledge my advisers, Professor Jon Andelson and Professor Kathy Jacobson, who not only guided me through each step of this project, but who have also mentored me through my four years at Grinnell College, investing in my visions of an independent major in International Agriculture and Rural Development. I am also deeply indebted to the many kind and interesting individuals who shared their perspectives and showed me their bison for the sake of this project. I only hope that they enjoyed the interview process as much as I. Thanks goes out to my parents, Greg and Kathy Koether, for their support, and especially to my dad for helping me create this project and find a calling in the land. I'd like to thank the Center for Prairie Studies at Grinnell College for providing an intellectual and physical space for this line of place-based academic exploration. Finally, I must thank Landon Corlett and many other friends for their intellectual and moral support as I completed this project.

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Introduction

Less than two centuries ago—a blink of an eye on the scale of evolutionary and human history—the bison of the North American Great Plains were nearly wiped out by European-American pioneers pushing west. Scholars estimate that prior to their near extinction, the North American bison herd numbered somewhere between 30 million and 75 million animals (Arthun and Holechek 1982). Bison were a keystone herbivore on the prairie; through grazing, wallowing and depositing nutrients, they acted as an important source of disturbance, contributing to habitat and species heterogeneity (Knapp et al. 1999). Bison were not only an important part of the prairie ecosystem, but were also crucial to the Native cultures that relied on them for food, shelter and materials. But, during the 19th century, the U.S. government actively promoted the slaughter of bison in a policy intended to exterminate Native Americans and their way of life. The eventual demise of the bison was a result not only of over-hunting, but also drought, habitat destruction, competition from exotic species, and introduced diseases (McDonald 2001).

As Isenberg (1997) writes, by the time preservationists focused their attention on the buffalo, little remained of the species or their habitat, and bison “had become an imprisoned, domesticated species maintained only by the constant intervention of human keepers” (180). By 1914, the American Bison Society noted in its minutes that 3,788 bison were known in existence, a 300% increase from the previous decade (Anonymous 1914). The prairie was plowed under, becoming the so-called breadbasket of the world, and bison were left in the hands of private owners and government preserves. Today, the bison population has recovered even more, with an estimated 500,000 bison living in North America. Most today are raised by private owners for meat production (many have been crossbred with cattle), less than 30,000 are in public herds, and of those less than 5000 are free-roaming, unimpeded by fences

(Anonymous 2011c). Like the prairie itself, bison exist in mismatched patchworks, tended by a diverse array of human managers. Most bison in the United States now occupy the western plains; of the bison in private herds, over half are concentrated in South Dakota, Montana, and North Dakota. There, in the short-grass steppe, the less-fertile land remained unplowed and was instead grazed by introduced domestics.

Yet, bison can also be found in the fertile agricultural state of Iowa, a landscape now altered beyond recognition. Prior to settlement, Iowa was covered by 28.6 million acres of tall-grass prairie (Smith 1998). Today, 26.8 million acres are covered by cropland, a category that does not include pastureland or timberland (Anonymous 2010). Additionally, 3.9 million cattle, 19.3 million pigs, and 53.8 million laying hens call the state home (Anonymous 2011a). Production agriculture is so prevalent in Iowa that some consider the state to be one of the most industrialized agricultural places in the world. Thus, bison's return to Iowa has juxtaposed two incongruent landscapes. The industrial farmscape, on one hand, is replete with towering modern machinery, rows of corn and soybeans, and land carved into neat squares. Bison, on the other, are an ancient animal- one that evokes visions of a wild ecosystem inhabited by predators and unimpeded by fences. From this incongruity arise questions: In Iowa, who raises bison and why? How do contemporary bison and their managers fit into the agro-industrial landscape of Iowa?

While I knew I'd find bison on refuges and on private land, I didn't know who I'd encounter managing them. Perhaps managers would be farmers who altered their operations or prairie enthusiasts who'd planted some native species and bought a few head of bison. I imagined that bison-managers might be young, environmentalist hippie- types, or old, no-nonsense businessmen. They might be nostalgic, romantic, pragmatic, or some combination thereof. I wondered whether, for these managers, bison were a means to an end (like prairie restoration or profit), or if they were an end in themselves.

Further, I questioned how managers in Iowa chose to raise bison. Was their management different from, or similar to the norms of industrial agriculture models? Did managers see themselves as part of the dominant agricultural landscape, or as an alternative to that model? Finally, by pursuing these questions, I hoped to understand what the return of the bison meant for the species itself as well as the Iowa landscape.

Methods

I conducted 10 interviews with 15 bison managers within the state of Iowa. (A short profile of each management operation is provided in Appendix A to help the reader distinguish among the managers). Where private herds were managed by families or couples, I often interviewed multiple people at once, though interviews usually focused on the primary manager. Interviewees included 10 men and 5 women, whose ages ranged from 40-85. All of the primary managers had either grown up on farms or had lived on a farm. Some of the managers were known to me beforehand; others were located via the Iowa Bison Association website, and even more contacts were gathered through interviews. I did not select the managers I interviewed based on any characteristics of the manager or the herd, but when I could I attempted to add diversity to my analysis by contacting managers who functioned in different settings (public or private), and whose management styles or perspectives seemed potentially different from other interviewees. For example, some managers that I interviewed gave me contact information for other growers and roughly described their management styles, while others suggested that I interview specific individuals based on their extensive knowledge or unique viewpoints. There was some level of self-selection, because some people that I contacted either did not have time for an interview or did not return my initial calls. Contacts that I chose to pursue were also limited by time and distance, since I interviewed managers on site where they managed, and thus gave preference to sites that were easier for me to access. In the end, I completed one interview with a herd

manager at a federal refuge, one interview with a herd manager at a tribal refuge (who was not a member of the tribe), and eight interviews with private managers.

Interviews were pre-arranged via telephone, and upon my arrival I asked interviewees to sign a consent form that allowed me to make observations and audio record the interview (see Appendix B). I drafted a long list of questions with which to conduct interviews (see Appendix C), but more often than not, the interview did not follow the prepared format, and I condensed my questions (see Appendix D). Questions were based on my original hypothesis, which is not the main thrust of this paper, but is included (Appendix E). The free form allowed bison managers to discuss ideas about bison that they found most important before I prompted them to address other topics related to my questions and my hypothesis. While this format certainly made analysis more difficult, it was a conscious decision to prevent a rigid format from priming peoples' responses and my subsequent analysis. Recorded interviews ranged in length from 1- 2.5 hours, but usually were accompanied by a tour of the actual landscape and observation of the bison herd. Thus, the time I actually spent with managers varied in length from 2- 6 hours as time and graciousness permitted. Audio recordings were subsequently transcribed, using time-stamps. I coded the transcriptions and my other notes, categorizing the themes managers discussed and finding reemerging patterns. I also took photos of the herd and facilities to provide a visual record of the landscape. In designing and analyzing my interviews, I was aided by my knowledge of livestock. Having grown up on a certified organic, rotational grazing farm in Northeast Iowa, I was well acquainted with both conventional production models and alternative agricultural movements. I was able to understand agricultural jargon and ask questions pertinent to those who manage land and animals.

Results

Bison's characteristics make them unique and distinct from other domestics, and bison managers are different from other land managers. Consequently, the resulting system of bison management radically departs from conventional Iowa agriculture.

Bison: A Different Animal

So many people that have buffalo have a cow mentality. They still think they're dealing with cattle, and buffalo are not cattle in no sense of the word. They are entirely different (Lee).

When it comes to being different, the bison as an animal is an obvious departure from other land management regimes that invoke row-cropping or traditional domestic animals. But this difference is not one to be simply glossed over, because the specific characteristics of bison prevent them from being managed like other livestock and wildlife species. In fact, those unique characteristics pose both advantages and disadvantages for managers. Some of their traits, like their diet, hardiness, mothering, and disease resistance, make them lower-maintenance, especially for private owners. Yet other traits, like their susceptibility to parasites, their slow maturation rates, and their strength, speed and aggression, can create significant challenges. Not only do bison's characteristics make aspects of management either easier or more difficult, they also influence how managers interact with, and ultimately appreciate, their bison.

While people ultimately make decisions about the specifics of management, the idiosyncrasies of bison behavior are important determinants in those decisions. Bison are particularly striking for their strength and speed. Yet, they truly are wild, and at times their agility coupled with instinctual aggression make bison extremely dangerous to human handlers. As Will said, "You can't trust them at all." Tim agreed, "People should be more scared of them than they are. They're not an animal that really instills fear in you, because they seem so quiet and docile, but they're not." Managers take significant risks

when handling bison; many told stories about narrow escapes from aggressive bison. A bison cow once chased Will, who was driving a four-wheeler at 45 miles an hour, around the pasture until he got so desperate that he bailed off and dove under the fence (Will). Lon said his nephew “took a ride on a cow’s horns,” with so much force that she pushed him through the fence and broke part of a barn wall. Lee tried to outrun a distressed cow on foot, and escaped only because she made a detour into the herd to look for her calf. He rolled under the fence in the nick of time, but noted “You can’t outrun one” and “She’d have got me if she could have.” Doug retells his son’s experience with a stressed-out bison cow when they were sorting the bison:

One time...we got down to the last couple of cows... we had them too worked up. And...my son, he went in with the fourwheeler, because he wasn't feeling comfortable even, and that one cow hooked the front of his fourwheeler...she hit that and just roughed him all up and bent the front of his fourwheeler up.

In the open pasture, I'm comfortable on the fourwheeler, but I won't get off and walk to the other end. No, I won't do that, because ... there always seems to be one cranky cow in the bunch. I don't want to chance it (Doug).

As Will’s case shows, bison can be aggressive in the open. Yet, they are more likely to be aggressive when they are confined and thus feel threatened. Not only can these situations be dangerous for people, but they can also be quite dangerous for the bison, which can gore each other with their horns.

Buffalo, when they get in confinement, when they start getting irritated, they start taking it out on each other, and they can kill each other in confinement, or they'll beat the hell out of each other, just because they're pissed. (Mark)

I guess when I came here I was expecting it to be kind of like cattle, that they're just big livestock out there because they're in this fence. But the more time I spend with them, they're really not like cattle... one looks you in the eye- it's not like a dumb cow. You think there's something there, and it could really hurt me if it wanted to...But then during the round up it gets pretty exciting and you see how powerful they are and that they are really not like cattle, because once you get them confined they fight, and they are really wild animals. (Diane)

The trouble is if you start crowding them... they start to spook (Deb). It's natural instinct for them to fight or flee, and they either want to run or they're gonna get aggressive if they feel threatened, and they start to feel threatened if you start getting them in a corner (Frank). So we just try to avoid handling them that much, just [for] safety, just so they don't get hurt (Deb).

People adopt many tactics for dealing with wild and aggressive bison; in most cases they simply find ways to handle them less. Will explained how their treatment of bison and beef cattle differed: “Beef cattle, we’re usually working them every year and tagging and stuff like that, well we started doing that with the buffalo, and we kind of got away from it, being it was pretty traumatic every time we caught them.” Will and Tim originally had their bison certified organic, but they dropped the certification after the organic inspector wanted them to continue tagging the bison. The premium wasn’t worth handling the animals, even though they continue to feed their bison more expensive organic fodder and follow organic protocols (with the exception of occasional chemical wormer¹ usage). As Will said, he didn’t want to stress the bison, but it was also “a whole lot easier on our nerves” to refrain from handling them. Therefore, he and his brother’s bison are “pretty much a hands-off animal.” They only handle them when they load them on a trailer to take them to the locker; otherwise the bison stay in the pasture. Though other managers handle their bison to varying degrees, most likewise avoid working with them, gathering them in a yearly round-up if necessary.

Like other managers, when Will and Tim do have to handle their bison, they play on their psychology and trick them. “We don’t have fancy facilities, or really too much for facilities, although they’re a curious animal, so you open a gate, they’ll come check it out” (Will). Opening gates and letting bison wander in is one tactic to get them into confinement. Others bait them with food; at the refuge, Diane related that in preparation for the yearly round-up, they deprive the bison of salt and mineral, which they usually keep in the enclosure used for the round-up. During the round-up, they put the salt and mineral along with alfalfa pellets inside the enclosure. The bison know what to expect, so they’ll follow a truck to the enclosure, and the rest are herded with tractors and trucks. For many managers, however, there’s a limit to how much bison can be physically manipulated, especially in comparison to

¹ Wormer- colloquial term for anti-parasite medication. Chemical wormers do not meet organic certification standards.

domestic animals. “Sheep and dairy cows, you can kind of make them go where you want them to go, but on buffalo, you let them go where they think they want to go. It’s like, easier to pull a log chain than it is to push a log chain” (Doug).

You don’t handle buffalo like cattle...It’s a lot slower process. You can’t push buffalo. You can’t herd buffalo either. Buffalo will only be herded so far and then they’ll draw the line, they’ll turn and the game’s over. You’ve got to lead buffalo. You either train them with grain, or like we do in the winter you wait till it’s cold and start feeding them in confinement and you basically trick them... buffalo it’s on their terms...Not every day is a day to work buffalo. If buffalo don’t want to work that’s not the day to work buffalo (Mark).

Once bison managers do trick bison into smaller confines where they can treat them for diseases, sort them, or otherwise ‘work’ them, they need to do so carefully to ensure their safety and the safety of their animals. Mark said, “Buffalo out on their own, out in the open, are extremely content, but once you put them in confinement, that’s where the problems start, and there’s not a whole lot that will hold Buffalo back” (Mark). Mark said that bridge-plank and guardrail are both heavy enough to use in bison corrals; his facilities are built with guardrail. Will and Tim set up an alley, then use a skid loader to push their bison down the alley and into the trailer to go to slaughter (Will and Tim). Doug sorts his bison on foot and has some “gates we can get behind hopefully before we get hooked.”

Others have elaborate working facilities with high walls so that the bison can’t jump out. These are often eight to nine feet high, as bison are notorious for jumping in excess of six to seven feet. Lee said that one bull even attempted to jump his eight-foot-high fence. To work the bison in such facilities, people stand outside the high pens on elevated cat walks and operate gates from above. At the refuge, one such enclosure leads bison through a series of narrower pens until one bison remains to put into the headgate². Dave, a private owner, built a homemade chute with catwalks, and based the design on information he’d read about Native American herding and his own theories of bison psychology. First the bison first run down an alley; once at the end they turn around, wanting to return to the majority of

² A headgate is a narrow chute, with an opening at the end which encloses on an animal’s neck, holding it in place

the herd that they left. They start back up the same alley, yet this time the gates have been switched, so they take a different route in the same direction, and walk freely into the chute.

Some owners prevent bison from hurting their human handlers and each other by dehorning their bison. Lon started dehorning after his nephew's incident, as did Doug after his son's encounter. Lee has dehorned some as well. He says, "They're so much easier to handle. I like the looks of them with horns, you know, they *look* like a buffalo. But, they're so much easier on each other when you're working them. They're vicious. Oh! They're vicious. That's just their nature. Something gets close to them, they're gonna put it to 'em!"

Most private owners will slaughter or sell animals that are repeatedly confrontational. Lee recalled especially aggressive bison cows he'd bought from another herd, "They'd paw the ground and come after you like crazy. So they didn't live too long either. I won't keep those kind." When I asked if Lee thought bison were becoming domesticated, he said, "Well yes and no. You never domesticate one. Never let your guard down. They can change, just the snap of your finger. So I never try to give them a chance to get me." The aggressive and wild nature of bison does not preclude handling; some managers choose to wean calves, medicate animals, or do yearly round-ups. Yet, when managers do decide that handling bison is necessary for whatever reason, they have to remain constantly conscious of the challenges and risks involved. Managers have to take significant precautions to keep themselves and their animals safe. Those risks may be one of the reasons that many private bison managers say they take a "hands-off" approach to their bison.

Managers are able to take such a "hands-off" approach because they report that bison are lower-maintenance than other forms of livestock; this is especially true of their diet. Some managers say they are simply more efficient, and maintain their body condition with less feed, or with 'lower-quality'

forage. While many livestock are fed more expensive hay made with alfalfa, a high-protein legume, during the winter, bison don't require such a high-protein diet.

They do not require the land base that a stock cow does. Buffalo eat probably 1/3 less than a stock cow will, and they survive on extremely marginal ground. In fact, in the winter, it's not highly recommended to feed buffalo...high protein hay. We supplement with good alfalfa but most of the time the buffalo are maintained through the winter on slow grass...Buffalo maintain themselves on lower quality hay... just mature grass. That's what they lived on in the plains all the time...I mean we keep body condition just as good in the winter as they are on good green grass with lower quality hay, because they just maintain themselves that much better (Mark).

Doug explained that even when he makes hay and leaves it at the edge of the field his bison will continue to "eat that grass through the snow as much as they can" and only "nibble on the hay." Not only can bison make do with what is considered "lower-quality" forage, but as Frank and Deb explained, their metabolism slows in the depths of winter.

It's still like heredity that's taking place. They pack on the pounds right now [in the fall] and we think we're never gonna make it through the winter with the hay we have... but once Christmas gets here, they back off and they just maintain. It's like they're preparing for winter... By Christmas they slow down... we're not putting out as much hay (Deb).

For producers, feeding less hay or lower quality hay means a substantial reduction in the amount of input costs. At the federal refuge costs are not the concern, but bison are expected to survive naturally. Diane explained that they don't give the bison supplemental winter feed. "We just let them eat on their own and they do okay. They always get thinner during the winter, so around February-March...people [start] calling, saying 'your bison are too skinny.' It's normal for them to be skinny....they're pretty tough." On the tribal refuge, Darci explains that since their bison are treated "like wildlife," they don't give them supplemental feed "unless their health is being threatened." When they do, they give them alfalfa mixture hay; she says they like it, but they can't digest it properly. Furthermore, she said "if you supplemental feed them with corn and grain, they won't eat it.... They'll eat it if that's all they have to eat... their system's just not set up for it."

This is particularly helpful for private bison-managers; they can maintain their bison cow herd on less-expensive hay and other roughage like cornstalks. Furthermore, those managers who do choose to finish their bison on grain (as cattle are conventionally finished) find bison easier to care for because bison “won’t overeat” (Lee).

But, if they got the grass and that, they won’t, they won’t stand at a feed bunk and eat ‘til they drop. They’ll come in and eat what they want and then they go back to the pasture...What I hear, they got to get their beef on full feed a little bit at a time to get them up there or else they’ll bloat. Where a buffalo, I can take him right out of a grassfed pasture and give him as much feed as he wants to eat, and he’s only going to eat what he wants to eat, and I’ve never ever had anything bloat (Doug).

You can put them on a self-feeder the first day you put them in the lot... and they’ll walk up and eat what they want and walk away, where a cow will stand there [eating]’till she dies... They like rough feed, they like cornstalks (Lee).

For beef cattle, gorging themselves on grain (or even bloating on high-protein legumes in a pasture) is a common phenomenon. It is not uncommon for cattle to bloat³, a process which, without human intervention, is usually fatal.

Bison, it seems, find ways to take care of themselves and are particularly suited to the Iowa environment. This is true about their tolerance of extreme temperatures, obstacles which they overcome without the help of managers.

I had one winter that it got cold enough that it froze, but they would still go down in that creek and paw and break the ice and get some water. And they’re pretty good too... they’ll find water or else they’ll eat the snow and convert it over. A beef cow, they won’t do that I believe (Doug).

But you know even this hot summer that we had this year, you’d go down in the pasture and think they’d be in the shade somewhere but a lot of times they’ll be just out in the sun, playin’ or whatever, where they could be in the shade. You know the heat don’t seem to bother them and in the wintertime, the cold don’t bother them a bit (Will).

Lon and Lee both reported that their bison would drink out of mud puddles or small streams when it rained instead of drinking out of the watering tanks they had installed; Lee was surprised by their ability

³ Bloat- an ailment that occurs when the cow’s rumen fills with gas

to drink “crappy” water: “it don’t seem to make them sick. There again I think that’s still hereditary from way way back when. They’d rather drink off the ground than out of something mechanical.” Overall, Tim and Will said their bison eat less and drink less than their domestic livestock do, but “of course they grow slower too” (Will).

Not only are bison relatively self-sufficient, they are also largely disease-free. The only disease problems managers report are internal parasites and some problems with pink eye. Mark says, “As far as management health-wise, either you’ve got a live buffalo or you’ve got a dead buffalo. It’s just most of the time we don’t have too much health problem with them.” Therefore, a few managers like Doug and Lee vaccinate their animals, but most managers don’t vaccinate against any diseases or use antibiotics. At the tribal refuge, Darci said that once when two animals gored each other and were injured as a result of a round-up, they put antibiotics in the watering tanks to medicate their wounds, but they otherwise don’t vaccinate or medicate them. Many of the private producers stressed that their animals were “grown naturally” and that they didn’t receive any antibiotics (Mark, Lee, Lon, Deb and Frank). Similarly, Mark and Doug, who both finish their bison on grain, emphasized that they don’t use any growth hormones; while others didn’t mention the use of hormones, it was clear that hormones were not compatible with their management strategies and philosophies.

All of the managers did express concern for bison’s intolerance to internal parasites, and all medicate against the parasites, including both of the refuges. In fact, some private owners used the least medication against parasites. At Dave’s place, they worm only every 3-4 years and do so by putting out free-choice medicated blocks, or in the wet summers (when internal parasites are more prolific) using a dart gun to medicate animals without handling them (Jake). Will and Tim worm occasionally, and avoid handling the bison by crumbling wormer into a self-feeder mixed with other grain (Will, Tim). Others worm yearly, and do so with various methods, including a spray on wormer, an injection, or an

orally-administered wormer. The only other major disease problem was described by Darci, who said the tribal herd had had a serious problem with lungworms, which was also a result of some pasture management problems at the time. Some of the bison died, and they dispersed the affected part of the herd (Darci).

Bison reproduce with considerably less support from managers than domesticated animals require. Often, cattle are regularly monitored before calving and require assistance in the actual process itself; people may deliver calves by putting cattle in a handling chute, fastening ropes or chains to the calf's feet and literally pulling the calf out of the birth canal. Bison managers almost never intervene in this process. At the reserve Diane explains that when bison give birth, "They do it themselves, and we usually don't even know about it until it's over." Private producers share that philosophy. As Doug says, "They always say leave them alone," and Jake points out that they've hardly ever had problems with calving:

They calve really well, you don't have to pull calves... we've only had like three or four over these 35 years now that have had issues having a calf, because the calves are a lot smaller than with cattle. I mean, cattle have been raised to have large calves. (Jake)

Jake reveals a crucial point. Since humans have genetically selected cattle over time for size and fast-growth, cattle have evolved to have larger calves. In fact, their ability to do so is often dependent on human supervision during the calving process; otherwise those large calves may not survive birth. Bison, on the other hand, have smaller calves and have evolved without human intervention. In the end, this makes calving a much less work-intensive process for bison managers.

Similarly, bison hardly ever reject calves after giving birth or fail to care for them the way domestic livestock sometimes do. It is not uncommon for cattle or sheep to refuse their offspring, and in those cases managers often step in and bottle feed the baby or facilitate bonding between the mother and the offspring. As Darci at the tribal reserve noted, "Buffalo calves are very good; buffalo mothers are

very good- they're actually very protective. They will keep their calves kind of hidden." Even the calves themselves are especially hardy, a source of amazement for Lee, who said:

I've had calves come in December, January, just one or two. It'd be a terrible blizzard if it hurt them at all. They're born with I think twice the hair that a calf that's born in the spring [has], they're just like a little woolly bear. And [beef] calves, they freeze their ears or freeze their tails, but a buffalo, I've never had that happen.(Lee)

Only Frank and Deb reported a case in which they intervened when a cow had problems calving by pulling the calf and raising it on a bottle. In their case, the cow had been bred before she was fully mature. They eventually sold the mother when she didn't breed back.⁴ Because bison are wild, such intervention is difficult, so it is fortunate that it is rare. At the refuge, cows that have such problems die, because, as Diane says, "even if we wanted to we couldn't do anything to help. We'd have to tranquilize her just to get near her." Tim and Will had calving problems with one cow, which they promptly sold. In one case, when Doug attempted to check a new-born calf, the mother got nervous and started stomping the ground, accidentally breaking the calf's ribs, an injury which was fatal. For refuges, intervening in such processes is undesirable in its own right, as managers want natural genetic selection to take its course. For private managers, the difficulty of intervention also makes it undesirable; producers don't want that genetic stock to remain in their herd and face calving problems repeatedly. If they do successfully intervene, they are likely to sell or butcher the animal, as Tim and Will did. Ultimately, bison reproductive patterns cause private managers to depart from 'norms' that might be applied to other livestock. They have to wait longer for mature animals and offspring, and thus profit more slowly, but animals may remain productive longer. Further, the work of facilitating the calving and mothering process is almost non-existent; even if it were necessary in a few isolated cases, bison behavior makes it difficult and undesirable for managers to intervene.

⁴ Breeding back is a term used to refer to livestock's ability to become pregnant after having a calf

While the reproductive process requires little work from managers, bison's slower rate of maturity constrains herd growth and affects private managers' profitability. In a typical cattle production system, animals reach maturity at age one to one and a half. At that age, male livestock are said to be finished and ready for slaughter, and heifers⁵ are also ready to be bred. In contrast, Doug explained, bison are usually not mature until age two and a half to three. At that age, bison are large enough to butcher (or finished) and bison heifers are sexually mature and ready to be bred. "It takes about a year longer than what a beef will.... If they do breed too early, then that cow or heifer, she's kind of done growing...If you give her that extra year...it builds her body- frame" (Doug). Thus, the reproductive process cannot be rushed. Bison that are bred at a younger age won't be as successful individuals and in some cases, could die giving birth, as Diane explained happened at the refuge.

This year for the first time we found a dead bison cow... it was only a two year old... after looking at the skeleton... there was actually bones of a calf there too. So we think that she probably died giving birth, but it was probably because she was so young and she wasn't quite ready for it.

The longer maturation time has important implications for building a herd and preparing animals for slaughter. As Mark summarized, "If you own cattle, you can breed a beef heifer back in one year. [A buffalo heifer] will not breed until she's age two, she's not sexually mature. So it takes twice as long to build a bison herd as it does a stock-cow herd." Furthermore, whereas domestics, once sexually mature, are expected to give birth once a year, bison may 'skip a year' as they get older. "Even if they skip a year, it doesn't really matter" (Frank)... "We're usually patient because sometimes they will- depending on how old they were with their first calf or if they're getting a little older" (Deb). "When they get about so old, they start skippin', but that's Mother Nature again" (Lee).

⁵ The term heifer refers to female cattle which have not yet had a calf; similar terminology was applied to bison females over the course of interviews.

Thus, for bison-growers who rely on selling animals or meat to make money, slower rates of offspring replacement translate into slower returns on investments, including not only the capital investment of buying the bison, but also the continuing expenses of feed and labor. When starting a herd, private owners may not see any cash flow from the bison for two to three years and thus take on a substantial amount of financial risk in comparison to domestic livestock. Though established herds have more regular cash flow because some proportion of the herd reaches maturity every year, slower reproduction causes bison herds to be less productive than domestics in terms of annual saleable output. Thus a few interviewees pointed out that raising bison was, “Not a get rich quick scheme” (Tim, Mark).

On the other hand, some producers speculate that bison may remain productive longer than domestics. Lee told about a friend in Cheyenne, Wyoming, who'd been a long-time bison producer. Though he'd had to feed them range cake⁶ to supplement their diet as their teeth got bad, his bison lived for 39-40 years. Lee also said he had 20-year-old bison in his own herd that were still having calves every year. In contrast, cattle in the conventional system rarely remain productive beyond 10 -15 years of age. Finally, the product itself is different. Many interviewees explained that bison was higher in protein and lower in fat; USDA research has shown that 100 grams of raw bison contains 109 calories and 1.8 grams of fat, whereas 100 grams of beef contains 291 calories and 24 grams of fat (Anonymous 2001b). Thus, Marchello and colleagues write that bison is a “highly nutrient-dense food because of the proportion of protein, fat, minerals, and fatty acids to its caloric value” (1989:185).

While bison are more “hands-off” than domestic livestock, they may be more “hands-on” than other wildlife. Diane explains that as a wildlife biologist, “...most of my job is actually plants, because you can't really do much with animals. You're usually just manipulating the vegetation, and that attracts

⁶ Range cake is a high-quality forage supplement commonly used in the West

... wildlife..." This is clearly not the case with bison, since in Iowa, free-roaming bison herds are a thing of the past. Instead, bison have been brought in from other herds to populate both the federal and tribal refuges. Once introduced, bison can't simply roam like other wildlife. Not only could bison pose a threat to people, crops, and other private property, off the refuge they could face dangers like cars and hunters. Furthermore, it would be counterproductive for prairie restoration, studies, and cultural efforts, if the bison simply roamed away from the refuges. Thus, the bison have to be confined. "They are in this kind of weird category because they're fenced in, so they're not able to be as wild... it's different." (Diane) "It's kind of a hybrid between wildlife and livestock" (Diane). Though Darci asserts that at the tribal refuge "[The bison are] treated like wildlife... If they need a little help we'll help them, otherwise they're on their own," she explained that they provide salt and mineral for the bison "because they are within a contained area so their habitat has been altered" (Darci). Ultimately, wildlife management for bison often includes more direct manipulation and interaction with the animals. "It's kind of neat to have a wildlife species that we actually handle...it's always exciting during the roundup...It's kind of neat to feel like you're actually having some hands-on experience with them" (Diane).

Bison managers: Different People

For refuges whose goals are to reconstruct the native prairie ecosystem or to provide a habitat for bison, the acquisition of bison is quite straightforward. But given bison's associated risks (both financial and physical) as well as their departure from the norms of traditional livestock handling and care, bison are challenging venture for private owners. Why, then, would private individuals choose bison as an enterprise given the twin difficulties of risk and learning how to manage an unfamiliar animal? As described above, not all of bison's idiosyncrasies are risk-laden; in fact, bison can offer a low-maintenance approach to land management to a certain degree, which does provide some incentive to

private managers. Yet, even if bison are in some ways “lower maintenance,” embracing an alternative approach to land management may require private owners to think differently or even *be different* than their mainstream counterparts.

“They’re too hard to handle. Trust me; it takes a special individual to want to raise bison” (Mark). Mark was not the only interviewee who described bison managers as different from other livestock managers. “I mean you have to be a little different to raise them” (Art). Because “dealing with the bison is ...unique,” Doug himself “feel[s] kind of unique.” Lee elaborated on this difference when he explained that because raising bison “takes special management,” it would “always be a novelty. It’s going to be one like me that likes animals and likes that type of thing.” Others shared that sentiment: “It’s like horses; you’d better have a passion for it... It takes a little more time, maybe; you’ve got to be a little more dedicated I think. I mean, it’s a lot easier just to have a beef cow” (Frank). “You have to be read to deal with [the handling] and want to do it” (Deb). Thus, not just any person could or would choose to have bison, and not every farmer could or would not simply switch to raising bison if they became a more lucrative venture; instead, liking the animal, wanting to raise it, having a passion, desire, or a dedication is a prerequisite. In other words, those who decide to raise bison are not simply motivated by money; they have to *enjoy* working with the animals.

While managers themselves articulate that they are different, they don’t describe just how or from whom they’re different. From my etic perspective, they were distinct from other land managers not only in their self-ascribed passion, but in the ways that they interacted with and conceived of their animals. Many people enjoy the bison for its own characteristics; it’s no coincidence that managers cited reasons such as fascination for their decision to raise bison, in many cases, such an interest or devotion is reason enough. “Originally, I was fascinated by them back in 1981... And that’s how I got started. I just thought it was neat, I guess... just different, and back...30 years ago...they just weren’t around here.”

(Doug). Even when the market crashed, Doug's fascination with the animals kept him in the business, "When it crashed, then it just broke. A lot of people got out of it, and I guess, I had a stronger desire to stay in it. I mean it was more than a money issue, it was just I was fascinated by the animal is why I stayed in it." Lon was fascinated by bison since he was a little kid and used to have the family stop the car on vacations when they drove past herds in Western Iowa and Colorado. When he was in high school, a friend bought a few bison and Lon wanted some too. It wasn't until adulthood that he was able to make that long-term desire a reality and now bison are a significant part of his lifestyle. As he said, "I used to spend a lot of time in town when I wasn't working [at my off-farm job], but now [that I have bison] I'd rather be out here working on something or watching the bison. I could just sit out there and watch them for hours." Lon told me about the personalities of his bison and the fights that had occurred between his bulls; he is not the only manager who keeps tabs on the bison's social interactions. Lee likewise spends time with his herd, and explained that his cows have a social pecking order, and that bulls and cows pair up and stay together. "It's just interesting to watch the interactions in those animals, and mine are as tame as you can get a herd, because I'm with them a lot." Frank and Deb, who have only a small acreage, talked about bison as a "hobby" and said, "They're fun to watch...They are way enjoyable." Their house sits near the enclosure, and they enjoy grilling outside and being able to see the bison interact.

We're kind of lucky that it's such a small [paddock], that we can see [the social interactions]. Some people, they don't see that. We watch them a lot and we sort of see what we do. We're closer to them than most people are, so we see the family (Deb).

Managers at the reserves likewise enjoy spending time with the herd. "When you get really close to them, it's exciting," Diane says. Darci talks about her experience with the bison:

Going out and watching the buffalo, it kind of relieves some stress. Because you get to know them, and they know who you are and everybody's got their own personality and they know right away if they like you or not. And, They usually know if it's one of [us] three going out there in my vehicle. And they're ok with that. They'll come up to the truck and stuff. And it's nice to know that they're comfortable enough with you.

As Darci's experience suggests, people find the interactions interesting and take pride in getting to know how the animals behave. As Lee says, "You can watch a buffalo, if you've been around them as long as I have, and you watch their eyes, and you can tell if they're agitated or in a good humor. You can just see it."

People feel that this relationship is not one-sided. As Darci's comment reveals, bison get to know people as well. Not only do people describe bison's interactions with each other as part of a conscious social process, they also perceive that their bison know and identify people. Frank and Deb only work their bison together, and if they have to have a vet come, they make sure all the bison are sorted and in place first, because as they say, "The minute they smell other people they're wary." Lon described that his bison preferred one of his trucks to the other and, when describing his nephew's accident with the cow, said that he'd told his family not to get in the pens with the bison, because they didn't recognize the strangers and would be more likely to become stressed, while he'd be safer on foot. Lee once bottle-raised a calf whose mother died, and thought she is now an adult cow, "Lucky" often approaches his truck and lets him pet her.

Many managers commented on the bison's ability to learn and on their intelligence; Lee says they're "Very smart. When they get out ... you drive down there and they see you coming, they'll head right back where they belong. They know they're out." He went on to say that if bison get out, you shouldn't fix the hole in the fence but use it to get them back in, because "they've got a memory like an elephant." With that memory, they never forget experiences like going through the chute. The first time calves go through "like a bullet" but the cows that have been through before refuse to go. Bison intelligence, social interaction, and emotion were described in even more complex scenarios, in ways that made bison seem almost human. When Lee sold meat, he used to shoot his bison on the farm and then take them to the slaughtering facility:

...and I swear, they knew which one was going to die. You know I'd have a bunch of bulls in the yard feeding them, and somebody was always between me and the bull I was going to shoot. I said I always figured that somehow they sense who's gonna die. I don't know. They're quite an animal, they really are (Lee).

Lon explained how he'd had a hunt on his property, and when the hunter first shot the bull and dropped him, the herd gathered around the bull, preventing him from taking another shot, and one of the cows "rushed" the hunter, chasing him off several times before he finished the hunt. Lon and Will both explained separate incidences in which older, dominant herd bulls got kicked out of the herd and got "depressed." In Will's case, after the bull left the herd, they found him dead. Upon consulting with Lee, they agreed it was "like they die of depression." When Diane witnessed the tail-end of a birth, she saw other female members of the herd come over and help clean the calf off.

Dave, Sarah, and Jake's entire management philosophy is based on the intelligence and social interactions they see in their herd. In fact, they relate that they've been accused of anthropomorphizing their animals, a charge with which they don't quite agree. When it comes to whether or not they project emotions onto their animals, Sarah says,

We are, we're totally doing it, but I don't think of it as that they're human emotions, I just think that they are emotions...that we have the same emotions that they have. So it's not that we're trying to make them into people, it's just saying that they're no different than people (Sarah). They're universal emotions (Dave).

Their management strategy revolves around maintaining the herd's collective intelligence. They explain that each individual in the herd has an important function and acts as a source of knowledge. Retaining the knowledge and experience of older individuals makes the herd as a whole more efficient. Sarah explained that older generations teach younger generations how to forage, showing them which plants to eat and when to eat them, as plants may grow or become palatable at different times. Their bison have learned to eat unconventional things like black locust pods, crab apples, and hedge apples from Osage orange trees. Sarah pointed out that foraging knowledge is especially valuable during infrequent

or cyclical events like droughts and floods, when the vegetative structure and environment are altered. Older, experienced individuals can better equip the herd for survival under such conditions.

Family members such as aunts, uncles, and grandmothers are not only important sources of knowledge, but may also lower stress in the herd by contributing their altruism.

If you have a set of genes that will produce an individual that doesn't necessarily breed... but is more helpful... like helpers at the nest, then you're going to have a more competitive family. You will have one that takes on the roles of making everyone else more efficient, lowering stress, [etc.]. So it's an altruistic gene... They say... that altruistic genes will breed themselves out because they will never reproduce and create new altruistic offspring. But if you look at it as a family and...that lineage... will produce an altruistic gene, then it will continue on... If as a whole, your herd, your tribe, your flock has helpers that make it more efficient, then you will survive enough to continue to pass on those types of genes or behaviors (Sarah). So that's what the family is. That's why we tell people... you don't have to produce offspring to pass on genetics (Dave). You don't have to look at individual traits, you can look at the traits as a whole (Sarah).

Grandmothers, for example, may take care of grandchildren, reducing stress on younger females and increasing their productivity. Similarly fathers, grandfathers, uncles, aunts, cousins and siblings all have important roles to play in the social fabric of the herd, which Dave and Sarah explain is much more complex than the simple mother-offspring relationships valued by conventional livestock producers. The loss of family members, then, not only causes a loss of knowledge, but also stresses remaining herd members, causing them to be less productive and psychologically “dysfunctional” (Dave). Ultimately, Dave, Sarah, and Jake believe selection and competition occurs more at the herd than at the individual level. Therefore, they strive to keep many generations in their herd (including old cows that may no longer be productive) and to foster a functional social structure that they feel mimics historic, natural herds.

To maintain these matriarchal “family units,” they keep all age groups in the herd, even old cows that are no longer producing. They feel that it is both counter-productive and inhumane to slaughter or remove part of a family and leave remaining family members to cope with the loss. Therefore, they do

not sell or slaughter individuals of a certain age class per the agricultural norm; rather, they slaughter or sell a family unit in its entirety, including young and old members. They are able to do so because as the herd grows, families “spin-off” and create satellite herds of closer genetic relationship, which can be 50-100 individuals. Dave explained that these smaller families separate themselves slightly from the larger herd and graze in different areas, though when threatened, they return to the larger herd for protection. These satellite groups can be sold or slaughtered without jeopardizing the entire herd structure. Dave notes that Native Americans likewise slaughtered bison in family groups and says, “In nature, extended families hunt extended families.” By stampeding bison herds over buffalo jumps, Native Americans slaughtered family units. The diversity of animals in a herd also complemented the needs of the tribe’s diet. The oldest and youngest animals with tender flesh would be eaten by those with digestive problems, or the very young or very old who couldn’t chew well, while men ate the high protein meat of bulls, and lactating women would need the higher fat content of cows (Dave). When Dave, Sarah, and Jake slaughter their animals, they taste-test the carcasses and sell them with descriptors such as ‘milder taste’ or ‘good for body builders,’ indicating the flavor and what types of people might prefer the meat.

When they harvest animals for slaughter, they move 3-4 animals into a separate pen and shoot and field dress them out of sight of the herd to minimize psychological stress. They also give prayers during the field slaughter out of respect for the bison. They mourn the loss of herd members, as does the rest of the herd. Therefore, when an animal dies naturally, they drag the carcass into the trees but leave it accessible to the herd.

I like the idea of having carcasses out there... not just for the sake of leaving the resource out there, but also for the herd. Because... we do harvest and part of the herd leaves, and they never see them again.... [leaving the carcass] gives them an opportunity to grieve... but also psychologically not every animal that they lose sight of is just gone...they can go back and see that there is a body there. It closes the loop a little for them (Sarah).

Jake noted that the herd will go back and sniff the carcass, and if it's a calf, the mother cow will stay with it for a few days before returning to the herd. "It's good to just leave them out there, it's kind of a little funeral, I guess" (Jake).

Dave and Sarah say the removal of satellite groups simulates a natural progression of herds, whereby families split off and occupy new territories. "...By butchering the family groups, we're kind of mimicking a family leaving and starting their own territory somewhere else" (Sarah). As the herd continues to grow, more discrete splits occur. From what Dave has read, the maximum unit for social recognition is around 300, so, once his herd grew above this number, he expected it to divide more permanently.

We knew the big split would happen historically... and then they'll stay split....We got up to almost 500, and thought when are they going to do the split? Because it's like, this is your hypothesis and history's theory, I mean...this is what they knew... And all at once they did it, they split off (Dave).

This process of division, Dave asserts, is a similar process for people, including tribal societies and modern day corporations. Furthermore, because herds divide and occupy territories, the conventional belief that bison need thousands of acres to roam is false. Functional herds live on smaller territories, and graze in an efficient manner that provides optimum disturbance for the ecosystem (Dave).

Because functional animals with intact social structures know how to graze at optimum efficiency and most appropriately utilize the forage, Dave, Sarah, and Jake don't interfere by rotating the herd or managing their movements on their land, much of which has never been plowed or has been planted with native species. Dave critiqued the human view of animals as overly paternalistic, with a pervasive and false sense of superiority. He compared the treatment of animals to the treatment of slaves, "It's no different than how plantation owners viewed their slaves...it's the same stuff... It's exactly

the same how people think of their animals. So if you had a paternalistic...slave owner, that's about the best you could ever get. I mean, no one thought of them as your brother's keepers, and that's what you've got to have."

Dave, Sarah, and Scott's example illustrates how managers bond with their bison, how they consider their bison to be intelligent and social, and how seeking to understand bison can be a stimulating intellectual pursuit. Yet, their example also demonstrates how bison managers feel linked to an historic landscape. Bison provide both a means and a motivation for thinking about the prairie as well as the social and ecological history of Iowa and the Great Plains. While Dave, Sarah, and Scott specifically seek to recreate the social and ecological structure that existed in historic herds, others attempt to create an historic ecosystem or to preserve an historic animal. Though few other managers offer such elaborate theories about bison's natural role in the prairie ecosystem and their interactions with native peoples, bison nonetheless remain a link to a prairie legacy for many managers. This is self-evident at the federal refuge, where bison were brought in to complete the "historic ecosystem" (Diane). It's also quite overt at the tribal refuge, where the historical connection is more personal because the tribe links its own past to the bison's history. Darci relates that bison

Complete part of the path for the [tribe], because with the [tribe], they disappeared when the buffalo disappeared...When we got the buffalo back, it was the first time in I think in 180, 150 years the buffalo were back on actual tribal-owned property. Which is something I don't think any other tribe has...Buffalo came back to buffalo land and Indian country.

The bison was a dominant species before the influx of pioneers altered the prairie and forced the tribe out of their traditional territory, though the tribe subsequently returned and purchased land. Thus returning the bison to their own land allows tribal members to reconnect with an ecosystem that they consider culturally and historically meaningful. As Darci said, bison "fulfill the [tribe's] culture."

When private owners think about management regimes, they often revert to speculation about how it might have been when bison roamed freely, and this often influences the management choices

they make. When I asked Art about how he managed, he spoke of the evolutionary history of the bison without humans, saying they “don’t really” manage them. “It’s our feeling that they’ve gotten along for 50,000 years without us and so we’re not gonna do anything. So we don’t buy a certain bull and that sort of thing.” When Lee talked about the need to give bison mineral, he talked about a bison lick said to have existed in Kentucky: “They cut paths to that mineral lick, according to what I have read, that were deeper than a man on horseback. Countless hooves all the time, cutting away at those trails.” Tim invoked evolutionary history to explain why bison might be prone to parasites:

My theory is that when they were in the wild, they were always moving, so that they wouldn't be eating where they'd been manuring. But then when you take them and you pen them up, you know, they can't. Whereas like the domestic animals, they've been penned up for centuries.

Managers connect bison not only to the landscape, but also to the native cultures that historically occupied it. Lee described bison and “Indians” as being “intertwined” and explained, “They always fascinated me, all from as soon as I was old enough to read... You know Indians and buffalo always fascinated me.” Doug’s public field day included a friend from Des Moines of Native American heritage, who set up a teepee and showcased tribal dances with his family and friends. Frank and Deb, who attended, thought the “Native Indian dance was really nice.” When Art does hunts and tours, he devotes a significant amount of time to history, showcasing part of a 25,000-year-old Giant bison (*Bison latifrons*) skull. He also invokes some Native American ceremonies that he read about. Before tours, he does a smudge feather ceremony. For hunts, he uses four different ceremonies:

We normally start with a smudge feather ceremony the first day before the hunt, and then after they've shot their bull we do a Crow Indian tobacco ceremony, and they don't burn the tobacco but they cast it into the wind, in the four directions starting from the west and rotating around the clock...and then we have a blood ceremony that they take blood from the buffalo that has given up his life to them, and they mark both cheeks, or somebody else with them does it, and then they have to leave the mark there until the sun sets on that day, and by doing that the hunter's agreeing to carry on the tradition of the buffalo so that he can go up to the big ceremony in the sky. And then we have a crown royal ceremony too (Art).

Because bison have captured their passions and imaginations, managers feel a sense of responsibility to preserve them. For Deb and Frank, getting bison was partially about what they called the “heritage” aspect of bison. “We both really liked the fact that, you know, they were so close to extinction, that we were kind of helping bring that back.” (Deb). Lee echoes the same sentiment “They just fascinated me. Those animals came so close to extinction, and they came back a long ways.” “Bison intrigued us. You know it was the Native American animal since basically the beginning of time” (Mark). Thus, for Mark, raising bison is “like keeping on tradition...”

It's something that's been around, that's what was here, that's the native species that was here when America was discovered, and we're basically maintaining that. Other than Ted Turner, if it wasn't for private herds there wouldn't be buffalo scattered across the United States. They'd be either in national parks out west or Ted Turner's ranches and that'd be it. You wouldn't have buffalo from coast to coast, all over. So it does give you a good feeling, because there's a lot of people out there that do appreciate the animals for what they are (Mark).

Thus, bison offer many avenues of fascination for growers, which make raising bison worth the challenges. While I didn't complete a survey of conventional Iowa farmers, from an etic perspective, the behaviors and mindsets of bison managers seem different. I haven't often heard farmers associate growing corn with the Native American cultures who grew that crop, nor can I imagine confinement owners spending time watching their cattle or pigs interact socially. Bison managers define themselves as “unique,” “different” and “special,” specifically because they “want” to raise bison and are “passionate” about it. It is clear that they also derive enjoyment both from interacting with their animals and from pursuing the far-reaching ideas they associate with bison. Whether they are learning about the bison's social interactions, understanding the historic prairie landscape, or connecting with native cultures, bison managers value their ties to those ideas. And, because of the bison's near extinction, managers like Mark feel that they are doing ‘good’ by preserving and maintaining them. This helps to explain why bison managers can justify their actions based on “fascination”, “curiosity”, and the “majesty” of the animal. Not only must managers be motivated to overcome the physical and financial

risks associated with bison and the challenges of learning how to manage them, in doing so they face significant institutional barriers. Therefore, bison managers operate outside of predominant agricultural institutions.

Raising Bison: A Different System

Not only are *bison* a different kind of animal, and bison *managers* themselves are different from other land managers, but *unique* in their dedication and mindset, these differences preclude the use of conventional agriculture-based institutions and necessitate bison managers to create novel social and economic realms. In other words, bison managers function within entirely different *systems* to those of other livestock or crop producers. Like working with bison, participating in alternative systems can be both challenging and rewarding.

First, little information exists about how to raise bison. The bison industry spends almost nothing on research (and probably has little to spend), whereas the Beef Board spends nearly four millions dollars on cattle research annually (Danz 1997:206). As Dave points out, agricultural research is often dictated by funding from industry and large donors.

They're always searching for funds for research and it's coming from conventional sources instead of unconventional, so they've always got to cater to those people... If you try to get too far out, like [some of my ideas], then they're not going to get the money from ...you know, the big beef industry.... [My ideas] are too much of a threat. (Dave)

At the refuge, management decisions come top down, and managers work with colleagues at other refuges to standardize management regimes, especially to evaluate and maintain their collective stock of genetic diversity. When I asked Diane, who hadn't managed bison before coming to work at the refuge, how she learned to manage bison, she said, "On the job. Well it was kind of funny because right after I got here was when we switched to doing this genetic management that we're doing now, so it was kind of, everybody in the [organization] was figuring it out together. So, we had some meetings or a

lot of emails going around, information being sent.” Diane and other managers also rely on a veterinarian who has a PhD in Wildlife Ecology to answer questions, especially related to the bison’s health. While the refuges generate and share information, when I asked Diane if the refuges collaborate much with private bison owners, she said,

Um, not really, because with the management we’re doing now... it’s a conservation management, and the bison on private lands are mostly production management, and so it’s... a different outlook. And there’s nothing wrong with what they’re doing, but it’s just a different thing than what we’re doing.

In contrast, Darci said the tribe’s Natural Resources Department belongs to the Intertribal Bison Cooperative, and the American Bison Association. Even though private producers have the bison to “fulfill a different purpose [than the tribes],” who “need the buffalo as part of who they are as human beings,” she attends meetings where “those people all come together with a general interest in mind, the welfare of the animal.” Yet, the government poses an interesting problem when it comes to bison, as she explains:

But then you’ve got USDA and the Feds coming in stating that, USDA says they’re treated like wildlife because they’re not a commercial entity; they’re wildlife. Then you have the Feds that come in and say no, they are commercial wildlife so they’re treated like livestock. But neither side will take responsibility for them, so there’s not a lot of grant opportunities, funding, or true management out there because everybody’s got their own perspective on it (Darci).

Because bison don’t fit neatly into the categories of ‘wildlife’ or ‘livestock,’ private managers have little access to formal research institutions like university agricultural extension services or wildlife management departments. Furthermore, many veterinarians, who provide animal health services for traditional livestock producers, have little experience with bison. Doug got bad advice from a vet 15 years ago, a mistake that caused pinkeye to spread through his herd. “I think I lost 14 calves that year from pinkeye right away” (Doug). He now works with a younger vet who doesn’t specialize in bison, but Doug says, “He’s learning too but he knows. He’s a young vet and wants to know the answers too so he

checks it out or too, like with Ames, he might be connected with them and ask them questions.” Lon similarly had problems with a veterinarian who came to his farm; the vet was afraid to handle his bison cow, used too much sedative, and in the end was unable to treat the health problem (Lon). In the absence of the institutions that traditional livestock producers use, private managers rely on each other and their personal experiences to learn management techniques.

Lee, who got his first bison in 1954, says when it came to management, “Nobody knew much.” He was a charter member of the National Bison Association (NBA), which helped producers share information and learn how to manage through experience. Doug is a member of both the Minnesota Bison Association and the NBA, which both disseminate books on management. He’s attended conferences through these organizations, even going as far as Montana and visiting Ted Turner’s ranch. Like other producers, he was a member of the Iowa Bison Association (IBA), but after the bison market crashed around the year 2000, he says that association became less active. Tim and Will as well as Deb and Frank were also members of the Iowa Bison Association, but also said that in recent years, it had stopped putting on events and they hadn’t been active members. I asked Mark if he was a member of the IBA:

We had been, I don't know if that is a viable organization anymore. We were members of it for yeah about 5 years, and I haven't heard from a member for oh, probably 6-7 years. I don't even know if that operation, or if that organization is still, I think it's still a group, but it's not an organized group... we were members but we're not now. We haven't heard from 'em for quite a while (Mark).

Despite the current lull in the IBA, producers continue to network. In fact, producers don’t only learn from each other in formal settings; informal networking between private individuals is arguably even more important. Mark and his family were mentored by an older couple who had bison, and Frank and Deb, Will and Tim, Mark, and Lon all used connections with other producers to learn about bison. These connections were especially important when first deciding whether or not to raise bison and

learning how to manage them. Frank and Deb "...talked to a lot of people that had done it before" and said that "talking to people was the best thing." Mark said that "management-wise we kinda went into this...green" and "got mentored" by another producer who "gave us the ins and outs." Others also felt that fellow managers played an important role in educating them about bison and management. Many of the managers I spoke with knew each other or knew of each other. Most managers knew Lee, and had great respect for his knowledge. Lon said Lee was "one of the biggest reasons I stay in it," and Mark said Lee was a "phenomenal guy," adding,

If I could spend more time with him I would because that is just a wealth of information that when he passes away will be gone forever...I mean, he took the buffalo herd over from his father, and then his kids, and his grandson have their own herd...he's probably of anybody in the state of Iowa, He's got the most time with buffalo in the state of Iowa of anybody. I'm pretty sure they had the first herd.

Connections with other producers go beyond management advice; they are central to marketing as well. Marketing is a more challenging process for bison-manager than other livestock producers. As Lee explained, "You know you just don't buy them and when you're ready to sell them take them to the sale barn. That isn't the way you market them. [Selling them] isn't as easy as cattle; you've got to find a place." Though there are many sale barns throughout Iowa which host regularly scheduled livestock auctions, bison sales are a rarity due to the small number of producers and consequently small market. Doug goes to an annual bison sale in Minnesota, sponsored by the MBA, but such sales and market-based gatherings don't seem to be a consistent feature of the Iowa bison scene. Thus, whereas a livestock producer doesn't have to think too much about marketing because he or she can always take live animals to a sale barn, a bison grower must find markets for their niche product, using connections both with other producers and directly with consumers.

The history of the bison market can illuminate this current marketing situation. In the past, the bison market has proved volatile; the price of bison plummeted around the year 2000, and many private

producers left the business. The crash was caused by the growing bison population, which in the United States spiked from 98,000 in 1989 to 125,589 in 1992; by 1999, the bison population was estimated at 296,850 (McDonald 2001:103-121). This growth was mainly realized on private lands as bison gained popularity among ranchers and livestock breeders in the 80's and 90's. The continued demand for 'breeding stock,' or live animals with which to start new herds, kept the price of live bison high. But the growth of the private herds outpaced the consumer demand for bison meat, and the bubble eventually burst, causing the live bison market to crash. In 2001, the Canadian Bison Marketing Council reported,

The bison industry is currently going through an unusually difficult growth phase. The industry has outgrown its current markets and has yet to develop or find sustainable larger markets. The immediate challenge is to find markets of any kind in which to move the current surplus livestock. The long-term challenge is to find or develop growing and sustainable markets to keep pace with the industry's rate of growth" (Anonymous 2001).

Doug explained his own experience during the market crash, and how he coped:

Well, they were, um, oh, prolly 15 and 18 years ago it kinda got to a breeder's market so it was a good high market, you know. A cow would bring 3,000 dollars if she was bred like crazy, and calves, they'd bring 800 to 1000 dollars, and then, oh, 11... 12 years ago, the market crashed, and that same animal... [a] calf, was 100 bucks and a cow was 200 bucks, and so, that's when we, you couldn't, they were too cheap, so then we started marketing the meat... Doug

Mark mentioned that bison herds had been liquidating, and when I asked him why, he also described his perception of the market crash:

When we got into it, when we bought into the business, the reason we got into it was we were gonna sell meat. Prior to that, probably 80% of the people who got into buffalo got into it because it was a hot market and they were going to make a pile of money selling breeding stock, and they did. They made good money for a few years, and then all the sudden, I... can't remember what made the buffalo market crash, but it crashed a couple years after we bought into it. And it crashed and you could buy a herd of buffalo for pennies on the dollar, and we did. We bought a lot of buffalo. And the reason that these herds liquidated is 'cause 80% of these people that we were buying their herds were only in it for the breeding stock, and when the breeding stock value went to zero, nobody altered their course and went into the meat industry. Where we, that's what we went in and that's what we stuck with. And that's why most of them went to the wayside is because they only, they didn't adapt. And they didn't want to. They just wanted to raise animals, have people come out and buy their animals... And that's fine,

you need to have people out there like that, but there was way too many of 'em at the time the crash came and that caused most of them to go... So that's pretty much the main reason. The main reason is breeding stock went rock bottom and most of these people just liquidated to get out of it, get the money back that they had, and they were done (Mark).

Doug and Mark illuminate not only why the bison market crash caused many private growers to sell out, but also the strategy that allowed some growers to stay in the business: direct marketing. In fact, all of the private bison managers sold meat directly to stores, restaurants, or private consumers. Because Doug had a “stronger desire” to continue raising bison than others, he had to market meat; as he said, “I mean we had to resort to building a market to stay in it.” Like Mark, other growers started out with meat-marketing in mind or with a few head as a hobby that grew into a meat market. Yet, direct marketing meat isn't an easy enterprise.

Lee used to market, something his son continues to do, but that Lee doesn't want to “mess with” anymore. Direct marketing requires extra time and skills, and is a challenge that most conventional livestock growers do not face. For bison growers, those challenges start at slaughtering. Like other animals, a bison cannot be stressed before it is slaughtered or it will be a “dark-cutter,” as Lee calls it. In other words, the stress hormones in its body will ruin the meat. But, since bison are wild and easily stressed, it's difficult to load them onto a trailer and take them to a locker without tainting the product. Dave kills and field-dresses his animals on-farm, which reduces the stress of loading them and hauling them; Art likewise shoots his in the pasture. But many lockers prefer the bison to be killed on site, so most other managers take them to the locker live. I asked Will and Tim, who take bison live to the locker, how they make sure their animals stay calm before slaughter. Will explained,

We like to [sort and load them] the evening before and just let them sit on the trailer overnight. That way they've calmed down, they're, you know, the ride doesn't seem to bother them any, and a lot of times they're just laying in the trailer. So, that's what we like to do...The loading and everything is real calm, except for about 10 seconds... that's the part where they're jumping on the trailer.

To further complicate matters, however, most lockers cannot actually handle live bison in their facilities; "...They prefer not to take a live buffalo, because a buffalo does a lot more damage, and it depends on the size of the buffalo" (Darci). The facility that Will and Tim use is no different. "We take 'em there live. And with the locker here [in town] they don't want the live animal in the building. So we have to take our own rifle and shoot them on the site, and then they drag them in" (Will). Others likewise shoot their animals on site. Will and Tim are lucky that their nearby locker processes bison; Doug drives his live bison over two hours (one way) to a slaughtering facility, and Lon takes his over an hour.

Most livestock must pass either state or federal inspection upon slaughtering if it is to be sold for food. Similar, though perhaps murkier laws, apply to bison. Managers said they had their meat state or federally inspected, but, unlike livestock producers, they have to pay for state inspection. "We have to have a state inspector there, you know, when they butcher. And then one thing interesting, and I'm not sure what the reason is, but we have to pay the inspector to come and do that. Where if we were taking beef or pork, you know pig, or whatever in, they'd do it at no charge" (Will). This fee came up in multiple interviews. Lee cited it as one of the hassles of marketing meat, saying it was \$50.00 per hour to have them inspected for retail. Doug cited the price as \$70.00 per animal:

The thing I have a little problem with too is like, when we go to the locker and get it USDA inspected, we gotta pay our own fee, which is, they charge me 70 dollars a head for inspection. And, years ago it started out at 25, and then it'd been 50, and then they just upped it here the last couple months, last month to 70 dollars. And the big buffalo producers out west, they've been trying to get the government to step in and pay for the inspection like they do on beef. And I just, I tell them you just pay your own inspection fee. You do not want the government stepping in and then you've got to do what they say (Doug).

While arranging and preparing for slaughter certainly requires a great deal of effort and investment, so too does actually marketing the meat.

Most conventional farmers are not directly faced with consumer preferences, including product quality, preferred cuts of meat, and price. But by establishing direct markets, bison managers interact with either retail stores or consumers to sell their products. Bison-managers market in different ways depending on the how many animals they have, how large their market is, and how much time they have to spend. Lee's son's buys licenses at farmer's markets and sells his meat there, another expense that Lee doesn't want to incur. Other growers also have full-time jobs off-farm or other major on-farm enterprises that provide income but leave less time to manage and market bison. Lon knows he might sell more meat if he went to farmers markets, but he doesn't want to get licenses and spend time away from home, since he works off the farm full-time. Because he would prefer to spend time with his bison and his 6-year-old daughter, who's interested in the animals, he markets in individual packages from his home and additionally at Hy-Vee. Much of Art's labor revolves around his bison, since he rents out his tillable ground and only has a small cattle herd. He markets meat from his home and also ships meat to customers. Will and Tim, who are busy growing crops and milking cows at their certified organic farm, sell bison meat in individual packages from their home and at a local food coop.

Larger markets require even more labor. Mark farms organically and also conventionally in a partnership with his father and his brother. The partnership sells whole animals to two local cafes and two specialty stores (not health-food venues), and also sells halves and quarters directly to consumers. Mark says, "We've talked about it and I don't want to give [the bison] up. I'd like to have more time to spend with it, but we're spread so thin... but it could probably be a lot better business if we put more time into it, but we just don't have the time to dictate to it..." Doug and Cheryl as well as Dave, Sarah, and Jake have the largest herds and largest markets. Doug works construction, but his wife, Cheryl, makes weekly trips to deliver their meat to many health foods stores and restaurants in central Iowa cities; they also sell individual packages at their home. Dave, Sarah, and Jake use Craig's List to direct market halves and quarters to people in large cities across the country. Slaughtering, marketing, and

delivering bison cross-country in a refrigerated truck provides two full time jobs for Doug and Jake, and Sarah works part time. Clearly, managers must invest time into creating markets; as Deb and Frank say, "With full-time jobs we just cannot [create a meat market]." It's much easier for them to sell some meat directly- in halves and quarters, or sell to Doug for his meat market.

Sustaining those meat markets, especially larger markets, not only requires a lot of time, but also necessitates access to many animals. Therefore producer connections are crucial, not only to buy and sell breeding stock, but also to provide animals for meat. Private managers buy and sell live animals from one another, either informally contacting each other to express willingness to buy or sell, or advertising their animals. Mark recently bought bulls from Lee; Deb and Frank bought their first heifers from a nearby producer. Doug and Cheryl rely on the animals of others for their meat market; as Doug says, "It takes quite a big herd to create and maintain a meat market." He'd prefer if more people got into bison, so that there would be more animals with which to meet his consumer demand. Similarly, though Mark said 95% of the meat he sells is from his own herd, he does buy animals from other herds to supplement his own meat production.

Direct marketing requires producers to arrange slaughtering and sales, but also to educate consumers, to explain their product, and to advertise. Producers disseminate information on such varied topics as the taste of the meat, the health benefits of bison, the environmental impacts of bison, and recipes or tips for preparing bison meat. It can be difficult to market if consumers are ill-educated about the product. As Mark reports, "The first years we started this, we had a hell of a time sometimes selling meat, because everybody associated buffalo with venison." Mark says people expected bison to taste like deer meat, and "getting people to try it the first time was the biggest obstacle. Once they tried it, it sold itself." Doug and Cheryl constantly promote their product by advertising in a state-wide magazine; they have also had it featured in a school district education program. During our interview, Cheryl

received a call from a customer asking how to prepare the meat. Cheryl tells customers to cook it “low and slow” so they don’t ruin meat and have a bad culinary experience. Will and Tim go to ‘Meet the Farmer” taste tests at the local coop where they share their meat and talk to consumers about their farm. Dave includes extensive publications on his website about his humane treatment methods, bison herd structures and ecology.

Now, producers say the bison meat market is strong and growing, bolstered by the health foods and sustainable agriculture movements. Because bison is low in fat and cholesterol but high in protein, it is perceived as a healthy meat. Producers report that the vast majority of their meat customers are health conscious individuals.

...in the, last year, it has just more than doubled. I mean now ...There's a place for the meat to go now because we're in a healthfood society now...like Dr. Oz or different shows or doctors are aware of the health benefits, higher in iron, low in fat, and high protein, and there's people that can't eat beef or pork, but they can eat buffalo. Is the big thing, so makes the health food stores easy movers of the meat for us... (Doug).

Doug even pointed out that some customers, especially heart patients, are unable to eat beef and pork because of the fat content, but they can eat bison. Will says many of his customers are “...interested in not only their own health but the health of the Earth.” Doug said 90% of their customers are health conscious; Sarah and Jake added that customers specifically choose their product because of their humane field slaughter or ethical treatment of family groups.

It makes it a little easier to market the meat, because before when people didn't even know about it, it was kind of hard to market the meat, and now, people are getting more and more educated about the buffalo and how good it is for you, so they're more interested and that makes it easier to approach people about buffalo (Cheryl).

Rising consumer consciousness about personal health and nutrition as well as the environmental and ethical concerns surrounding meat production have helped the bison meat market boom. But it's difficult to sell meat at a retail store or restaurant if the product can't consistently stay on the shelf or on

the menu. Increased demand means that many producers have not been able to supply enough. "Right now we have pulled out of most of the stores, because we can't supply the stores enough" (Mark). Art describes his meat as "grass-fed" and says, "We don't sell in cafés or grocery stores, because with ours being grass-fed, we'd soon run out of product and we'd have to buy someone else's. And the chances are it would have come out of a feedlot. So, we just sell here at the ranch we also do mail... to both coasts." Evermore consumers want to buy directly from producers as well. Frank and Deb have a wait-list of 8 people who want to buy meat, and Tim says, "People have been calling here looking for buffalo meat, and we don't have enough animals to supply what we should be supplying."

While meat markets are a major source of income for bison-producers, the novelty of the bison presents other marketing options as well. Frank describes it well: "It's kind of like the Indians I think, not much goes to waste." Many producers have sold winter hides (although taxidermy costs make those more difficult to sell), and many frequently sell skulls. Not only do bison growers sell by-products directly to consumers, which they often do, but they also network with artisans or neighbors. Will and Tim sell skulls (at \$75.00 a skull) to a local artist who paints them and resells them. Similarly, Doug regularly sells bones to a jewelry-maker, who sells his wares online and in upscale venues, even going to Italy for sales. Doug also works with a local woman who uses bison liver and other less-saleable products to make baked dog treats that she sells to the Humane Society and animal shelters, as well as to pet-owners.

Marketing isn't confined to physical products, however. Bison growers can sell experiences as well. As briefly mentioned above, Art not only sells meat, he also sells hunts. In fact, hunts, tours, and meat sales are equally important for his bison-related income. Art's hunts include a three days of room and board. He's also the only producer who sells tours, which are mainly a summer business. His tour routine includes history, Native American ceremonies, and a hay-ride into the herd where guests can

feed bison ear corn. Doug also sells hunts; Lon has sold one or two in the past. Likewise, some of Dave's meat clientele harvest their bison, but the process adheres to the operation's normal humane field slaughter. Tim and Will didn't have the time to sell hunts, but others feel that hunts are unethical. Lee refuses to do them; "I think too much of my buffalo to let you stick a bunch of arrows in it and run around and slowly die. When I shoot a buffalo I want him dead, I don't want him to suffer at all."

"If you don't like people, it's not a good business to be in" (Art). Art says this of his hunts and tours, but his comment is spot-on for other bison producers as well. This system necessitates social interaction with consumers, stores, restaurants, other producers, and even artisans. Yet, because bison are unique, they garner informal interest from family, friends, neighbors and community members. Thus, bison growers share their passion and fascination for bison in non-market based social interactions. For Frank and Deb, their hobby has turned into a way to educate people. They "do a lot of little family tours" which involve showing people the bison and sometimes taking them for rides on horseback. "Kids really enjoy the farm. Not many kids are raised on the farm anymore (Frank)...Or get to experience animals, livestock (Deb)... We enjoy having people come and get to enjoy them" (Deb). Similarly, Lee told about the years when with bison and other exotic animals, his farm was like a "poor man's zoo."

People would come, well in the spring, on these kids' field trips, we'd get several (towns) they'd bring bus-loads of kids to see that stuff. Then I'd fix up some hay-racks and put them on there and drive them through the buffalo...I enjoyed it. I thought it was something I liked to do. (Lee)

Those social interactions have lasting and far-reaching effects. Lee told a story about registering at a hotel desk in Kansas and running into an adult who'd visited his farm as a child: "The guy behind the desk says, 'I'd hoped I'd be on duty when you came... I just wanted to tell you how much I appreciated all that stuff.'" Lon had talked to his daughter's kindergarten class about bison. He was proud of her ability to "rattle off" all the details about the herd. Lon said he was recognized by strangers in the

community as “the bison guy:” indeed it seems that he had attained almost a level of fame. Many people have told him that they drive alternate routes to be able to see his bison, and a neighbor told him that during the week, the local retirement home takes bus trips to his farm, parking on the road and watching the bison. Dave says people drive by his place to see the bison. Dave, Sarah and Jake also host tours for groups like school kids and prairie enthusiasts, explaining bison and their theories about social interaction.

At the federal refuge, educating visitors is an important part of the mission, and bison are an important feature of the education program.

This refuge is different than a lot of other refuges.... In terms of how other refuges see us, a lot of people think our most important role is in environmental education and...we call it visitor services- just attracting people and educating people when they come out here, so that's a pretty big important part of what the refuge does and that justifies our funding (Diane).

Diane went on to explain that bison attract visitors and volunteer, and that the refuge's funding is partially determined by the number of visitors and volunteers. “In terms of the refuge, people come out here to see the bison, and if this was just prairie with no bison, we wouldn't get nearly as many visitors” (Diane). Likewise, the tribal refuge garners interest from community members, “Overall, the community seems to be very happy that they're here... a lot of people will come out and watch them, a lot of people will bring their kids out to watch them” (Darci).

While the uniqueness of the bison necessitates and facilitates these opportunities for social networking, those connections make bison-managing an even more fulfilling and fascinating endeavor. It seems that this unique system culminates social rewards, and that those rewards further motivate growers to raise bison. Producers enjoy getting to know each other and their customers. “The different people that we've met through the years of being in the...buffalo association and the consumers that we've connected with, that's just made it all a very interesting venture I guess you'd say” (Will). “I've

met so many people through the National Bison Association. All over the United States they'd come to that" (Lee).

Dealin' with the bison is just kind of unique, and going to the buffalo and meeting other producers, and it is, you kind of associate with something... I don't feel too much that the other buffalo producers in other areas, they're not really in competition with you too much. (Doug)

As Doug's quote reveals, producers not only respect each other and learn from each other, but those interactions give producers the sense of belonging to a social group.

Such a sense of 'belonging' or 'having a purpose' is not confined to producer interactions. Working with consumers, providing a healthy product, and creating a forum for education are important social interactions that have "enriched" bison producers' lives. Art, who goes to a few rendezvous to sell products, says that doing so is "more like a vacation than like work." As the world map that hangs on his wall, stuck full of pins, indicates, he's given tours to people from all over the world. This is another aspect of his enterprise that he enjoys.

Because they consider their meat to be healthy, and because they create important relationships with their customers, bison producers feel they contribute directly to people's health. "You feel like when you sell it your selling it healthy, to people and their children, and that makes me feel good" (Deb). Doug especially talked about the health benefits of eating bison, which he feels have impacted not only his own life and his family, but members of his community as well.

Like, my wife here, she's got cancer, breast cancer, 4 years ago or so...when she got cancer...the doctor said if she wouldn't have been on buffalo meat to build her body, her higher iron content and higher protein, that there was no way that she would have pulled through all the chemo and radiation that she went through...so I feel that has contributed a lot on the health end of it. There's another lady in, young gal in church and her husband has worked with me in construction...but she is real low in iron. And I mean, she was taking like 10 iron pills a day...she's had a couple miscarriages, just strictly because she's low in iron. And we finally, she lost the one, and so I said... 'just give her meat, get her on it and have her eat it if she will'... and it brought her iron content of her body back up that the doctor said 'I don't know what you're doing but you

don't need to be taking these iron pills anymore'... their previous baby they lost, but now they had...one since that one. So I mean, there's a lot of health reasons for it...(Doug)

Doug also talked about selling bison liver to a cancer patient, and he felt that the meat helped him as well. "...He was, at that point he was so far into it that it wasn't gonna bring him back. You know. But it did extend him a longer life for a little while there, which was good anyway." The quality of the meat is something that makes bison different from other livestock, and perhaps their concern for health distinguishes bison growers from conventional farmers. But it is direct marketing, necessitated by this unique system, that allows producers to learn about their customers' health, provide healthy meat, and feel that they have contributed to the healing process.

While Doug clearly appreciates helping people in his community, Mark also feels tied to his customers. Associating with the 'type' of people that "appreciate buffalo" seems to help him identify with shared values. In fact, the consumer network, in Mark's case, is an important reason to continue raising bison.

People that appreciate buffalo, well, I can relate to the organic side. People that appreciate buffalo are like organic people, I mean they appreciate the simpler things, and they appreciate the quality things. I'm not a staunch advocate of conventional agriculture. Never have been, never will be. I don't like the direction it's going in, I never have. That's one reason that I do organic. And buffalo is kind of the same way. There's a certain quality of people that appreciate that product, the same way there's a very distinct quality of people that appreciate organic and what it does. So it's kind of nice to be related to those people. I feel more grounded that way, you know, more personable to people that way. (Mark)

The system of raising bison, though challenging, provides opportunities for social engagement that reinforce managers' enthusiasm and motivate them to continue.

Bison growers do operate in economic and social frameworks distinct from the majority of land managers in the state of Iowa; this alterity, however, is not just an embedded consequence of raising bison. Most growers actively separate themselves from that dominant landscape; they don't like it, and bison present an opportunity to depart from it. Mark makes this clear in his comments about the kinds

of consumers he works with, describing how he sees both bison and organic land management as different from conventional agriculture. “We wanted to get into something that could make a living on the ground, you know without row-crops, and we decided that maybe buffalo would work, and I still think that’s kind of the case. I mean I think they’re a good thing” (Tim). Art explained his choice of raising bison partially because “...we didn’t want to raise more corn and soybeans.” Others likewise wanted to raise bison because they were unsatisfied or uncomfortable with features of the conventional system. Lon didn’t like the beef industry, especially the use of hormones and chemicals. He chose buffalo not only because he was fascinated by the animal, but also because he knew he could raise it naturally without those synthetic inputs.

The feeling that bison should be raised “naturally,” especially without the use of hormones and antibiotics, came up in multiple interviews and was one way growers distinguished their product and methods from conventional livestock. Doug says beef producers frequently ask if they used hormones in their bison; he says matter-of-factly, “We don’t do that with our buffalo.” Producers were not only critical of the chemicals implanted directly into livestock, but also of the inputs used to raise row-crops. Doug explained his negative experience with agricultural chemicals:

I did some roofing for big crop people up in Conrad. And every day we was working on the roof, here comes the airplane flying, spraying crop dust or whatever they were spraying right over the top of the highline wires, right over the roof, and we start coughing and gagging...I says, ‘man you just, why can’t you just quit that, you know?’ And she says, ‘well, we have to keep the best crop we can any way we can, whether there’s much nutrients in it or not’... But I mean, you know, they feel they’ve got so much into it that that’s how they’re gonna get their most return and everything, and you’re killing the ground too...

Doug tied those chemicals back to the food produced from conventional agriculture, saying, “the chemicals and herbicides that are put in the corn that [is] fed to beef and pork” are a major reason some people cannot eat those meats. When I interviewed Will, he had just returned from his first trip to Washington, D.C., where he had protested the use of genetically modified organisms. He says, “In 10 or

20 years I think this whole GMO Monsanto thing is gonna fall on its face” (Will). Though Mark prefers organic farming, he also farms some ground conventionally in his family partnership and for landlords who prefer conventional management. When I asked him about the future of agriculture, he said, “As fast as it evolved in the previous ten [years], I don’t even want to know what the next ten looks like. GMOs and the new hybrids and the traits, it’s just overwhelming. I don’t see it going in a good direction... I argue that fact with my family all the time.” He even refers to conventional agricultural techniques as “evil.”

I try to do more sustainable stuff than the mainstream person would on their conventional ground. I plant cover crops. I use less invasive fertilizer. I use my organic fertilizer on my conventional ground...I try to make good with the evil that I’m working with, I guess I like to say. I like and appreciate my organic ground way, way more. It’s a lot more work, but it’s work that I appreciate. At the end of the day I feel better about what I did with the organic ground than I ever will with conventional ground, ever. (Mark)

Dave describes conventional agriculture as “aggressive” and “exploitative:” “People think aggressive, exploitative agriculture will produce the largest yield and the most money” (Dave). Sarah points out that conventional systems are only profitable “because you’re not paying all the costs” including the use of inputs like petroleum-based fertilizer.

While private bison growers dislike the chemical inputs to agriculture, refuge managers further bemoan the loss of habitat caused by destructive agricultural practices. Diane says she thinks agriculture has “been going downhill lately” because “corn prices are so high that they’re plowing up every little thing that’s left.” “I’m from the west, where it’s just different out there. And here everything is so cultivated. And there’s just not any little tiny bit of habitat left” (Diane). Darci agrees:

Property that is not in row-crop, for example this is all wetland and timber, a lot of that’s being plowed under and being put into row-crop because people want money... and I understand that. But what that does is take away from the habitat... including [habitat for] the buffalo... Wildlife is battling the bottom dollar, and they’re going to lose, they always lose. And I hope they don’t, but people have to be able to eat and you have to pay your bills.

Darci reveals that the high price of corn significantly impacts the Iowa landscape; not only does it drive the cultivation of marginal lands, it also bolsters the expansion of huge farms. Bison producers, like many small farmers, feel the pressures of farm expansion. "You can see what's happening. They're all getting bigger and bigger and bigger, and the small guys will get crowded out" (Lee). Like other farmers, bison producers have watched the price of corn increase and with it the price of land. While I was completing interviews in fall 2011, some land in Iowa sold for \$16,000 per acre. Though bison growers are alarmed at the price of land, many also identified government commodity programs as the root cause of farm expansion and rising land prices: "Government programs. Pull that, the rug goes out. Then there's going to be a lot of ground for rent, and nobody to rent it. To equip again and start farming after you've quit- that's almost prohibitive!" (Lee). Tim voiced his opinion of the government subsidies paid for commodity crops, saying that they don't truly serve the farmer:

The subsidies that people talk about aren't for the farmer; they're to control the commodities- what they can bring in. That's what the subsidies are all about. If they want farmers to grow corn, they'll subsidize corn. If they want beans, they'll subsidize the bean. And that's, you know these commodities, not just this country runs on 'em, but more or less the world.

Talking about the difficulties of making money as a buffalo grower, Frank sarcastically said, "We need a farm program for buffalo." Art is attempting to preserve his small farm for his children. He's created a trust: "They can't sell the land, and they can't mortgage it. Which is all part of preserving it for somebody, anyway. It's hard to keep small farms anymore. You just can't do it. And the price of land now, you couldn't get started even if you wanted to."

The rising prices for land and corn, largely supported by subsidies, affect people's profitability and their ability to raise bison. As Deb noted, "People liquidated [their herds] in '08 when corn got high." Whether or not bison growers are finishing their animals with corn, the price of corn affects their bottom line. As corn becomes more valuable, farmers increasingly plant corn on ground otherwise used as pasture or for hay crops. Therefore, less hay is grown, and hay becomes more expensive. Likewise,

the price of both prime crop ground and less desirable, marginal land rises. The rising price of inputs and property makes it difficult to justify grazing bison on land that might otherwise be used for more valuable crops, or buying increasingly expensive hay. Diane explains that the recent subsidization and popularity of bio-fuels, which increased the demand for corn, has accentuated those ill-effects. At the tribal refuge, caring for the bison is an additional expense, and the ground that the bison refuge covers could be used for crops.

...With the cost of the bio-fuels, that raises the cost of fuel and everything else, and trying to buy winter hay for the buffalo, hay property is just not out there much anymore. So, it just drives the price right up to the point where, just like most farmers, if you can't afford your livestock, you get rid of them (Diane).

Not only do bison growers consider themselves different from conventional agriculture, some also feel that conventional agriculture actively discriminates against them. "I feel more like I'm on the farmer's market end of it, kind of helping the push or whatever, and so the big crop farmer today, they kinda, I feel they kinda look down on me" (Doug). Lee said, "You know people all thought we were crazy when we got them." This prejudice manifests not only in the opinions of neighbors or farmers, but also within institutions. Accustomed to the entrenched agricultural system supported by risk-lowering subsidies, lending institutions and financial advisers can't see the profit or the point in raising bison. Doug says that his tax accountant has "told me for the last six years to get out of it." Cheryl added, "She still sees it as a hobby." When Doug first wanted to raise bison, it was a challenge to get people to take him seriously. "...Thirty years ago, you know, you talk about buffalo and ...everybody thought they were on the extinct list yet. And it was pretty low profile. You go to the bank, you know, and he'd just laugh in your face. 'You want to borrow money for what? Is there such an animal?'" (Doug). Dave faces similar problems with his bankers today:

You can get more prejudice...all of this is alternate-type and all they look at is what they can sell animals for at a sale barn and sell land for if they were to take it back from you when land prices

are high. So, they would look at this as a lot more valuable if we had it into row crops than into pasture (Dave).

The dominant agricultural landscape does not value bison in the multifarious and intricate ways that bison managers themselves do. Managers actively distinguish themselves from that system for multiple reasons; some find it environmentally unsustainable. Others feel alienated by its promotion of huge, industrial farms. Yet, they overcome the barriers embedded in the dominant system by educating each other and creating novel markets. The alternative system they have created encompasses the interests of the unique individuals who raise bison and the idiosyncrasies of the animals themselves.

Discussion

While bison managers both on public refuges and private farms have brought bison back to Iowa, the future of Iowa's bison, especially those on private farms, depends upon the market for bison meat and products, as well as prices and government programs that incentivize conventional agriculture. With the high demand for healthy and sustainably raised food, private growers say the bison market will be strong and reliable for a long time. As Mark says, bison is a "quality niche market that will not slump." Despite the high price for bison, private producers predict that it will remain a niche market. "I don't think there's gonna be a whole lot of people jumpin' into it," Will says. Producers felt bison would remain a niche not only because raising them is a challenge (after all, not just anyone would do it), and growing a bison herd is a slower process, but also because of commodity prices and the cost of land. Lee thinks that people will continue to grow bison, but that private bison growers will be constrained to the most marginal ground.

It will be limited to the rough ground that can't be farmed, because you can't afford to graze buffalo on that hay ground for what you can rent the ground for... when they get up to giving \$400.00 [an acre] for rent, you can't put buffalo or anything else on it. They're crazy! These people are crazy! (Lee).

Mark would like to expand the bison herd, but those limitations make it difficult for him and his partners to grow their herd.

If we're going to expand the herd we've got to have more pasture ground. Well, any good pasture ground went under the chisel plow the last few years with 6 dollar corn; you don't just get that back overnight. And to expand the herd we've got to have more acreage, and... everything that's decent ground is in row-crop and there's not much left for the buffalo (Mark).

If these expenses make it difficult to expand, they make it almost impossible to start a bison operation. Not only will it be difficult for new bison managers to start, but existing herds are faced with the problem of succession. Succession is a problem for many farms in Iowa; in 2007, the average U.S. farmer was 57 (Vilsack and Clark 2009). As Mark points out, "Most of the people that own the buffalo are in that older age category, and nobody in the family takes the herd over when they either pass away or they retire." Art and Lee are both members of that older generation. I asked Art about the future of his bison herd, to which he replied, "I'm 78. In 10 years I won't be here. But, It's set up for [my kids], and if they want to do it they can." Lee, who's over 80, showed me the etching of a bison that hung on his wall. He said he wants it engraved on his grave marker, a desire that reveals not only his profound devotion to bison, but also his age.

On one hand, the twin pressures of farm conglomeration and succession could cause a dramatic decrease in the number of bison in Iowa; on the other, the continued demand for healthy and sustainably-raised meat might provide enough incentive for present herds to expand and new managers to get involved. As Deb says, now that the bison market has improved, "We've had calls from people looking to get back in it." As we've seen, bison growers are devoted to their animals, and they don't want to give it up. Yet, the fertile soil of the tall grass prairie landscape puts Iowa's bison growers in competition with subsidized conventional agriculture. In the western plains, where there is more marginal land, the price of land is driven by grazing cattle. In that setting, it is likely more cost-effective to make the switch to bison.

The growth of bison herds in Iowa and across the United States has mainly been driven by private ownership. The majority of the bison population is now in private hands, and the continued growth of that population is largely dependent upon markets for bison products and other agricultural goods. I have argued that bison are different from other livestock, that their managers are different from other land managers, and that the system of management differs from conventional Iowa agriculture. Yet, this assertion leads a further question. This system of bison managing may be inherently different from conventional agriculture, but from an environmental perspective is it inherently good?

I did not study the environmental outcomes of bison management in depth, nor with standardized measurements. From an insider's perspective, many bison growers clearly perceive bison management to be more environmentally sustainable than conventional agriculture. Producers like Dave, Sarah, and Jake believe that bison, when properly managed, are sustainable and efficient -- better than conventional agriculture.

They've always been told, they think technology is more efficient. They think nature is maybe good for just nature, but you know, we got to feed a growing population...They don't realize that nature actually had it figured out what's the most efficient. You know, once the infrastructure's there, it's the most efficient short-term and long term. Pounds per, the quality of the meat you get, it's always going to be better. You can't get any better than that. So, no one realized that these wild animals, the infrastructure is what made them efficient (Dave).

If you look at it in a generation, [bison management is profitable]. In a generation this land will be just as good if not better than it is now. So is it profitable, yeah because we don't have to put fertilizer down every year, and we're not using thousands of gallons of gas (Sarah).

From an outsider's perspective it is somewhat difficult to make generalizations about the environmental outcomes of bison management, because bison growers do use different methods. While some bison growers strictly grass-feed their animals, a few finish their bison with grain, adding to the water budget and carbon footprint of their operations. Some have low animal densities, while others

have high densities, which could lead to overgrazing. All introduce some synthetic chemicals to the environment by using anti-parasite medications, and some bison growers vaccinate their animals. Though specific management decisions are not uniform, at the most general level, bison growers share some management techniques that make their management more environmentally friendly than conventional agriculture regimes. Bison management doesn't employ invasive pesticides or the destructive tilling used in row-crop agriculture. Managers don't feed regimented doses of antibiotics or implant hormones, practices frequently used in conventional livestock operations that have been criticized for causing antibiotic resistance and heightened hormones in food. Though some producers feed grain, they do not put bison on corn-only regimens that are fed to livestock in feed-lots and Confined Animal Feeding Operations (CAFOs). Even if they wanted to, managers couldn't cramp and confine bison in CAFOs, operations increasingly recognized as a source of air pollution and waste contaminants. Bison growers graze part or all of their herd. By keeping land in pasture (and in some cases native grasses) bison growers create space for diverse plant species as well as habitat for birds and other animals. Generally, land covered in perennial grasses resists soil erosion and retains water better than annual crops like corn and soybeans. Therefore, when comparing bison management to some of the most prominent features of conventional agriculture, including row-crops, feed-lots, and CAFOs, bison management is clearly an environmental improvement.

It is important to note, however, that bison management isn't necessarily always more environmentally sustainable than management of traditional livestock, specifically cattle. The foraging patterns of bison and cattle are different, with evidence that cattle are more selective than bison in their foraging habits (Plumb and Dodd 1993). Yet, because cattle and bison are both large grass-feeding herbivores, some argue that stocking intensity and duration are likely to have greater influence than species difference (Knapp et al. 1999). Furthermore, some have postulated that the grazing effects of free-roaming bison would be more different from enclosed bison than the grazing effects of enclosed

bison and enclosed cattle (Plumb and Dodd 1993) and that significant differences in grazing between the two result from management rather than species (Towne et al. 2005). In other words, the grazing intensity might be a more important factor than the differences between bison and cattle, determining disturbance levels, ecosystem services, and overgrazing. Thus, well-managed cattle would likely be better for the environment than abysmally managed bison. There are certainly movements in Iowa to raise traditional livestock like cattle in natural and environmentally friendly ways, including sound grazing management. But, those techniques have sprung from other alternative agriculture movements, and are not a part of the production-based livestock and crop regimes that characterize conventional Iowa agriculture.

Ultimately, in comparison with conventional agriculture, the system of bison management lends itself to greater environmental good. But, even if we establish that to be true, others argue that the proliferation of bison on private farms may not be positive for the future of the species itself. This argument might seem counterintuitive at first, but it raises concrete concerns. Judith McDonald discusses how private bison management might alter the “innate, natural species characteristics” of bison (106), and suggests that those characteristics are crucial to bison’s survival as a wild species. Feeding bison grain, putting them in semi-confinement or small pastures, dehorning, or genetically selecting for characteristics like body type and mild temperament could possibly alter the species forever. As earlier described, many of the Iowa growers I interviewed did engage in selection, especially removing aggressive animals, or selecting for certain phenotypes. Lee says that modern bison are different than those he started with in 1954, and he considers them to be a “better animal” now because they yield better. “Our buffalo have evolved to more of a meat animal than they were when we first had them” (Lee). Lon, on the other hand, would prefer his bison to retain their original wild phenotype. Some dehorned, fed grain, or kept them on Though McDonald acknowledges that some private growers object to raising bison as cattle and prefer the characteristics achieved through natural

selection and adaption, she writes, "As a new century begins, the issue has changed from the extermination of bison to their loss as a wild species through domestication." ((McDonald 2001:116).

The concern for the future of bison as a species is a valid one: commercial, industrial uses of bison may change their characteristics. However, in public herds and refuges, human management is still a factor, and that intervention may also alter the course of bison's evolution. On the two refuges I visited, bison are fenced in, handled in a yearly round-up, and wormed with the same chemicals used on livestock. At the tribal refuge, bison have access to watering tanks and are rotated through pastures. Once a year a few head (usually bulls) are slaughtered for the consumption of tribal members. At the federal refuge, bison are implanted with microchips, and managers evaluate the herd's genetic diversity, selectively retaining rare alleles, whose functions are unknown. The refuge has capped its bison capacity at around 90 animals, and thus they remove one and two year old animals whose genetics don't contribute to the herd's diversity. Though human interference takes different forms on refuges than on private farms, it nonetheless exerts change. Lacking native predators and other natural mechanisms for selection, even those bison on public refuges may experience selection for different characteristics.

Bison have already been somewhat altered. Their continuing success as a species depends upon how well humans can mimic natural settings to keep them true to form. To preserve the species, I suggest that more knowledge should both be generated about bison and made accessible to all those involved in their management. This proposal predicated networking between public refuges and private individuals. While Diane said the federal refuge didn't network with private growers because producers have "different goals," the results of this research challenge the fundamental assumption that private individuals raise bison solely for economic gain. Private bison growers often hope to benefit from the species' innate characteristics and would prefer to create a natural setting for their animals. But, mainstream agricultural institutions don't provide information about raising bison in natural settings, and private producers are left to guess at how far they can depart from conventional agriculture and

remain successful. Lon, for example, originally wanted to plant his bison pastures to native prairie, but with only 60 acres of pasture he was unsure whether native plants would provide enough nutrition to sustain his bison. In situations like this, prairie restoration experts and refuges with reconstructed prairies could provide information and skills to help managers restore prairie and improve environmental stewardship on private lands.

On the other hand, private individuals watch their bison interact and theorize about their roles in the landscape. They can contribute a great deal of knowledge and experience to private refuges about bison behavior and proper management. Lee, for example, talked to the manager at a public refuge, where salt wasn't provided for the bison. He noticed they were deficient when they licked his vehicle. He recounted the refuge manager's view that the bison wouldn't have needed a salt block in nature, but argued that the land was depleted in salt, minerals, and other nutrients from years of farming. Now, the refuge does provide salt and mineral. This is but one small example. Dave, Sarah, and Jake's theories about herd structure as well as other manager's observations of social interaction and behavior could generate questions for scientific research and provide evidence for studies of animal behavior. If Dave's theories about herd social structures were lent the authority of academic research, they might revolutionize the management of public herds.

Networking between private producers and nature preserves could be valuable in other ways as well. Lon, who wants to expand his herd, faces the difficulties I mentioned earlier; land is much too expensive to buy. He had hoped to forge a partnership with his county, which owns many prairies, because as he says, "bison are a part of that ecosystem." He thought he could provide the much-needed ecosystem service of grazing and in return have the opportunity to expand his herd. Though the issue was complicated by personal factors, the response was negative.

Overall, my work suggests that the large social gap between refuge managers or wildlife experts and private bison owners should be filled. Both public managers and private owners have an interest in

preserving bison and educating the public about them. Working together, these presumably different groups of people could generate more robust knowledge about bison and how to best manage them. Their complementary knowledge could shed light on the intricacies of the prairie ecosystem. And, perhaps most importantly, generating and sharing knowledge would enable bison managers to preserve the integrity of wild and majestic North American bison.

Conclusion

After a history of near-extinction, bison have been reintroduced to much of the Great Plains, including Iowa, at the hands of both public and private managers. Bison are clearly different in many ways from domesticated cattle. They are wild and untamed; they are suited to the dramatic climate, and they can “take care of themselves.” Yet, they also reproduce more slowly than domestics. They are difficult to handle, and they don't fit neatly into the feeding or slaughtering structures of conventional agriculture.

The people who choose to raise bison, then, must overcome those obstacles. They choose to do so because they are self-professedly “different” and even “passionate.” From an outsider's perspective, bison managers differ from those who practice conventional agriculture because they approach their animals with a different mindset and interact with them in different ways. Bison growers watch and bond with their bison; they speculate about their evolutionary history, and through their bison they feel linked to the historic Iowa landscape. In managing bison, growers must think and invest long-term, getting lower production from their animals, but putting in fewer inputs. These animals and their devoted managers thus create a system of land management that departs radically from conventional agriculture. Furthermore, that alternative system appears to be more environmentally sound. Yet, bison have likely already been altered by human intervention, and it is possible that private and even public management could have changed the characteristics of the species. Their preservation, therefore, depends not only on markets for bison and other agricultural goods, but also on sound human

management, which would be much enhanced by additional scientific research as well as partnerships between private and public managers.

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Appendix A: Management profile

Manager	Land Size	Number of Animals	Stock Density (bison/acre)	Feeding	Marketing
Diane	700 acres	91 +20 elk	.13	Grazing, no supplemental feed	N/A, but gets more \$ for visitors
Darci	205 acres	17	.08	Grazing, some supplemental hay	N/A. Community uses some meat
Doug & Cheryl	400 (timber and pasture)	230	.58	Cowherd- grazing and hay. 'Finishing' young on corn for last year	Meat sales to Restaurants, health food stores, consumers. Some hunts.
Lee	280- some in crop	64	.23	Cowherd- Grazing, hay, cornstalks	Live animals sold to Iowa State research lab.
Frank & Deb	12	20	1.666	Grazing, hay, some grain	Meat to consumers, also to Doug
Art	300	25 +15 Hereford cows	.08	Grazing and hay "grass-fed"	Meat to consumers, Hunts, Tours
Will & Tim	30	Had 24, now down to 6	.2	Grazing and organic hay "grassfed"	Meat to consumers, local coop.
Lon	60 acres	50	1.2	Grazing, hay, or cornstalks. No grain, but sometimes other forage 'grassfed'	Meat to consumers and Hy-Vee. Some hunts
Dave, Sarah & Jake	670	300	.45	Grazing and hay 'grassfed'	Meat in whole and half carcasses to consumers using Craig's List
Mark	70	20	.29	Cowherd-grazing, hay and cornstalks, 'Finishing' young on corn for last 90 days	Meat in whole and half carcasses to consumers, two cafes, two stores

Appendix B: Consent form

My name is Kayla Koether and I am a fourth year student at Grinnell College in Grinnell, Iowa. As part of my independent study project, I am doing a research project on the perspectives of Bison-growers and the social, economic, and environmental sustainability of raising bison. Because you grow or manage bison, I would like to make observations pertaining to your bison operation and interview you about your interests in bison-raising, your bison management techniques, and your thoughts on bison, agriculture, and native species reintroduction. You are free not to answer any question if you don't want to, and you may stop the interview at any point. Participation is voluntary, and if, at the end of the interview & observation, you would prefer that I leave all or part of your information out of the study, you can ask me to do so.

The interview will take about an hour, and there will be no risks to you. Your identity will be kept confidential- in other words, I will know your identity, but I will eliminate all references to your name and location in my notes, papers, and presentations. Because Bison-growers are a small, dispersed population, however, those who know you or your management techniques may be able to identify you. I plan to archive my project, including audiofiles, in Grinnell college's archives, but if you prefer that information relating to you not be stored in the archives, I will respect your request. If you have any questions, please contact me at koetherk@grinnell.edu, or at (563)-880-6873. You may also contact my professors, Jon Andelson at andelson@grinnell.edu and Kathryn Jacobson, at jacobsok@grinnell.edu. Please sign below to indicate that you have read these paragraphs and agree to participate.

Thank you,

Kayla Koether

Printed name: _____

Signature: _____

Date: _____

Please initial if I may audiotape our interview: _____

Please initial if data may be stored in Grinnell college archives: _____

Appendix C: Original interview questions

Themes I want to address

Do people have purposes for raising bison?

What are these purposes?

How relatively strong are they?

Are their hierarchies? What are they?

How did they develop these purposes?

Did/do informal or formal education play a role?

Did/do experiences?

Did/do relationships?

Have purposes been static over time?

Did purposes influence acquisition of bison, or vice-versa?

Are purposes related to something other than the envt, market, culture, food systems?

Do people set goals? Are they related to purposes?

Do purposes explain management strategies?

How were management strategies developed?

Did they spring from purposes, or vice-versa?

Which came first? (Purposes or management)

How did people learn to manage bison?

Does formal and/or informal educational background help explain management?

Does education affect purposes and management in the same way?

Did experience play a role in creating or adapting them?

Did relationships?

Direct question...

Why do you raise bison?

Do you have any specific reasons or purposes for raising bison?

What ones are the most important?

Could you rank them?

How did you get interested in bison?

Can you describe how you decided to raise bison?

How did you develop these purposes & perspectives?

Did any formal or informal educational experiences influence your sense of purpose?

Did any certain experiences?

Did relationships? Who encouraged you?

Would you say that your purposes are the same now as when you started raising bison?

If they've changed, what has influenced that?

Has raising bison changed your sense of purpose?

What are your goals? How do they relate to the reasons that you raise bison?

Is your management style influenced by your goals and purposes? How?

How did you develop your management style?

How did you learn bison management?

Did any formal or informal educational experiences teach you management practices?

If so, are they the same experiences that influenced your sense of purpose?

Did any certain experiences influence your management?

Did relationships?

What management strategies do people use?
Do these strategies reflect "best fit" for purposes given the literature?

Can you explain your management practices and philosophies in detail?

What kind of bison do you grow (woods, plains)?

Do you have any sort of phenotypic ideals for bison?

How do you cull/select your bison herd?

Do you have any concerns about genetic diversity of bison?

How do bison mother?

How do you facilitate calf survival?

What do you notice about bison behavior?

Does behavior change seasonally? Do they seem to want to migrate?

How do you control this or create movement?

How do you fence for bison?

How do you treat bison diseases?

If unexpected diseases or problems arise, where do you get advice or seek care?

What do you feed bison?

Do you provide supplemental salt/mineral?

At what age do you finish/slaughter them?

How do you slaughter and process bison?

What parts of the bison do you make use of? (Market for head, hides?)

How do you dispose of carcasses?

How do you physically handle bison?

What diseases are bison prone to? How do you prevent them?

How do you provide water?

how do you graze?

How do bison tend to graze?

Is this different from other livestock/herbivores/ungulates you've worked with?

Graziers

Feedlot

how do you build a ration for a bison?

Cattle 3% of their body weight daily intake in dry matter...

protein levels, energy levels for growing/fattening?

How do you deliver feed?

How do you handle waste?

Have management practices evolved over time?

Do education, experience, relationships, and \$ affect management strategies now?

Do people feel that management strategies reflect their purposes?

If so how, if not, why not?

How do purposes and management relate to outcomes?

Do people articulate outcomes as a result of management?

... of purposes? ... of both?

What types of outcomes do they articulate? (Environmental, social, economic, other)

How do articulated outcomes relate to purposes?

Do people feel that they are fulfilling goals or purposes?

If so does this contribute to their overall sense of self (a positive social outcome?)

Do people feel that they are socially, economically, environmentally sustainable?

What are perspectives on livestock and other native species?

Have your management strategies changed or evolved over time?

If so, what has influenced those changes?

Does your current management style reflect your purposes?

If so, how, if not, why?

What results and outcomes have you seen from raising bison?

What contributes to these results/outcomes?

Do you feel that you're fulfilling your goals/purposes?

How does raising bison contribute to your overall sense of self?

Has bison raising changed other parts of your life?

Do Bison contribute to your quality of life? If so how?

Do you think that in your case raising bison is socially, economically, and environmentally sustainable?

Do you think it's sustainable in general (for other people as well)?

How do you feel about other livestock?

What are your opinions on the reintroduction of species?

Can native species be profitable or part of the economy?

Would you like to see bison introduced at a larger scale on the former prairie?

If so, how should they be managed (privately, in parks, refuges, etc)?

What about the Bison Commons idea... is it feasible?

How do you hope agriculture will look in the prairie states in the next 10-20 years?

In 50 years?

How do you hope your farm will look in the next 10-20 years?

In 50 years?

Do you think your children will raise or manage bison?

Would you like them to/encourage them to?

How could bison growers be best supported?

What outcomes do I see (soc. Env. Econ)?

How is the environment impacted?

How have bison impacted the growth rate of grass?

Plant species diversity?

Quantity or diversity of bird species?

Quantity or diversity of frogs/amphibians?

Quantity or diversity of insects?

Have bison changed the physical landscape?

Do they create wallows?

Do they change erosion?

Do you soil sample?

Has the soil changed? How?

Do you use any soil ammendments? What & why?

Has the quality of your water changed? How can you tell?

Do your bison produce any harmful wastes?

How efficient are feeding practices? (water-grain-meat)

How much fuel do you use?

How much water do you use?

Where does this water end up?

What about traces of drugs in the environment-concern?

Do you use antibiotics? How often/for what diseases?

What about dewormer or antiparasitic treatments?

What are the social outcomes?

Do networks enhance social outcomes for bison growers?

Are you in any bison groups or societies?

Do you participate in other social networks? If so what kind?

Producers

Do you direct market? If so can you describe your marketing network?

What social connections help you market bison?

What variables affect the price?

What type of product do you market?

Who is your average customer & what appeals to them about your meat?

Refuge managers

Who is your average visitor? What draws them to your preserve?

Have bison helped you increase visitor traffic?

How do you interact with neighbors?

How do you interact with other community members?

Do you continue your education (i.e. attend seminars or classes related to bison)?

If so, how does this contribute to your sense of yourself as a bison-grower ?

If so, are there social networks that have developed through education?

Do you invite groups to your farm/preserve?

Do you educate people about bison?

If so who: neighbors, livestock growers, friends, consumers, school children?

Do you encourage other people to grow bison?

How do I measure economic gain, how do they?

stocking rate

land value

land purchase price

hours spent

fuel cost

feed cost

equipment

niche vs. conventional market?

price of bison in each market?

What kind of capital expenses do they have?

Operating expenses?

Are bison the whole income?

What economic benefits do you see from raising bison?

Does anyone in your family work off-farm?

Are bison profitable?

Do they want more people to raise bison, or would it ruin their market?

Appendix D: Shortened interview questions

- Ask about reasons
 - What were your original reasons/purposes for raising bison?
 - What are your reasons/purposes now
 - How have they changed
 - Most important?
 - Did raising Bison give rise to new purposes
 - How did you develop these purposes?
 - First get interested in Bison
 - Formal or informal educational experiences?
 - Other experiences?
 - Relationships/people?
 - What are your goals? How do they relate to the reasons you raise bison?
- Management
 - Is your management style influenced by your goals and purposes?
 - How did you develop your management style?
 - How did you learn to raise Bison?
 - Formal or informal education?
 - Other experiences?
 - Relationships?
 - Same as how you got interested?
 - Can you describe your management?
 - How many head?
 - How many acres
 - Feeding
 - Selling
 - What do you sell?
 - Who is your customer?
 - Using other parts
 - Slaughtering
 - Hunts/Tours
 - Selection
 - Calving
 - Diseases
 - Fencing
 - Water
 - Carcasses
 - Worming
 - Has your management strategy evolved over time?
 - What has influenced these changes?
 - Does your current management style reflect your purposes? Yes- how, No- why not?

- Outcomes
 - Social
 - Networks
 - Producer
 - Any networking with environmental groups or preserves?
 - Neighbors
 - Community
 - Education
 - Others
 - Your own
 - Passing the herd
 - Customers/Marketing
 - Environmental
 - Bison grazing... different from other livestock?
 - Grass growth
 - Plant diversity
 - Wallows
 - Birds
 - Amphibians
 - Erosion
 - Soil sample? Soil change?
 - Water
 - Economic
 - What economic benefits do you see?
 - Do you have any off-farm source of income?
 - Do you have other income from the farm?
 - How much of your income comes from bison?
- Do bison contribute to your quality of life? If so how?
- Do you think in your case raising bison is ecn, env, and socially sustainable?
- Is it sustainable in general (for other people as well?)
- Would you like to see Bison grown/reintroduced on a larger scale?
 - If so parks, private management
- Future
 - Do you think Bison will remain a niche?
 - What do you think will happen to the bison industry in the next 10 years?
 - Do you think other native species could have similar market success?
 - What are your goals for the next 10 years?
 - How would you like your farm to look in 10-20 years? 50 years?
 - How will agriculture look in the next 10-20 years?
 - Do you think any of your kids/nieces/nephews/friends will raise or manage bison?
 - How could bison growers best be supported?

Appendix E: Discussion of original hypothesis

I originally crafted a hypothesis that emphasized the conscious decision-making power of the herd manager. I hypothesized that bison growers have different hierarchies of purposes for raising bison and that they therefore employ different management strategies. In other words, I assumed not only that managers developed purposes (with some being more important than others), but also that those purposes consciously influenced and guided their management strategies, although I did recognize that purposes were likely not the only variable at play in decision-making. Furthermore, I expected that both these purposes and their corresponding management techniques would influence social, economic, and environmental outcomes. In general, I supposed that a purpose was formed, but tempered by a manager's individual circumstances, including the characteristics of resources such as land, capital, and education, social support networks, and beliefs. Through the construction of a purpose and within the framework of other constraints, a manager would create a management strategy. And though this strategy would influence social, environmental, and economic outcomes, the way in which it would do so would again depend on individual circumstances. To use a simple example, if two different herd managers, one operating on public land and another operating on private land, articulated the same purpose, "to use bison to reconstruct native prairie," they may have to employ different strategies to do so, given that they are working with different land parcels (and thus different microenvironments), different funding sources, and potentially different social networks. They may differ in their beliefs about the composition of a native prairie or the means by which bison could influence reconstruction. The environmental, social, and economic outcomes, even if using a very similar management strategy would not be the same, because they would also depend on the character of the local community and environment. If the two had similar stocking densities but one had steeply sloping land and deep ravines while the other worked on a flatter, gentler landscape, the way in which their management alters the physical space would be disparate. Therefore I formulated the hypothesis, and the questions I would

ultimately pose to bison managers, to gather information about managers' purposes, management strategies, environmental, economic, and social outcomes, as well as other variables that might affect land management.

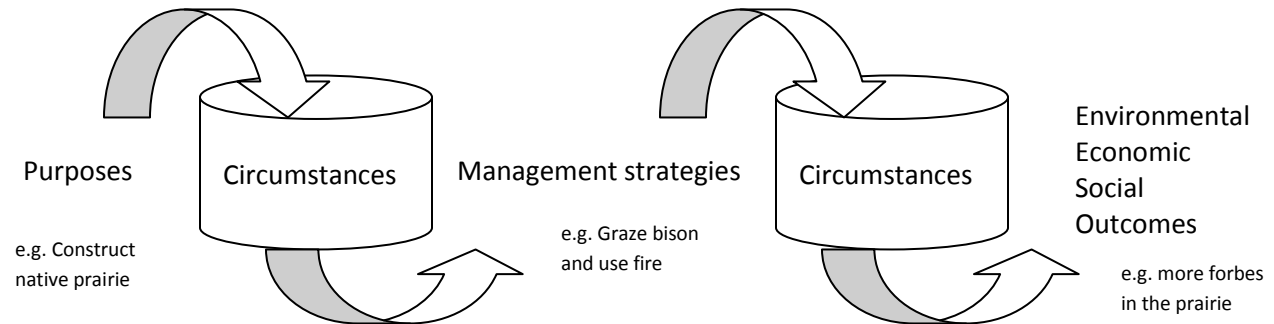


Figure 1. Flow chart of hypothesis

Dissecting my hypothesis : Do purposes influence management strategies?

Due to the free-form nature of interviews, people articulated what I will categorize as ‘purposes’ for raising bison in a few different ways. Some directly referred to them as ‘purposes,’ while others spoke of ‘intent,’ ‘goals,’ ‘reasons,’ or even ‘why I do it.’ Most bison managers articulated some purpose or reason for having a bison herd, but the character of those purposes varied drastically from herd manager to herd manager. Generally, purposes did account for management decisions, but only at the coarsest of scales.

Dad approached my brother and I about diversifying the farm and wanted to get into something, an alternative form of livestock or something like that...I think he wanted to try something new is all, [there] was really no rhyme nor reason to it, or no purpose to it, he just wanted to try something different and that's what we chose (Mark).

Though Mark articulates a lack of purpose for raising bison, he simultaneously identifies purposes for which his father originally made the decision. In this case purposes do reflect management strategies, but only in the most general sense: the purposes of diversifying the farm with “an alternative form of livestock,” and trying something “new” and “different” influenced the general management decision to

reduce the size of the cow herd and raise bison. Yet, these general purposes cannot directly account for finer-scale management decisions with their bison herd, such as their decision to finish⁷ bison on grain in a feedlot, or their use of both organic and conventional anti-parasite treatments. Similarly, Art, a bison grower in his 70's, describes his reasons as follows: "We kind of wanted to diversify some. We raise register polled Herefords, and still do, but we didn't want to raise more corn and soybeans, so we decided to go into buffalo." Again, raising bison was a response to those original purposes, but those general purposes cannot capture micromanagement decisions with the herd, such as their decisions to sell hunts and tours.

Such coarse or general purposes were articulated commonly. One of the most frequently described purposes was explained as fascination, curiosity, or long-term interest in the animal itself. Three of the managers cited fascination as their main purpose for raising bison, and four others spoke about curiosity, intrigue, or the "majestic" nature of the animal as one of the reasons they chose to raise bison. While fascination was a consistent and important purpose for managers, it did not lend itself to the formulation of herd management strategies. Once again, people explained that fascination led to the general strategy of raising bison, but no one verbally connected that 'fascination' to micro-level management decisions. Frank and Deb, a couple who had a private herd, said they enjoyed handling livestock, as they had both grown up on farms, and they wanted to try something new [by getting bison], but further explained, "We both really liked the fact that, you know, they were so close to extinction, that we were kind of helping bring that back...we wanted to do that and we thought they were majestic." Once again, these purposes only predicated having bison, but did not dictate any specific type of management with the bison. That's not to say that these general or more abstract purposes could not describe micro-level management, only that growers didn't articulate a causal link between these purposes and micromanagement decisions. In these cases although purposes do

⁷ Finishing generally refers to the period during which young animals are fattened for commercial meat purposes

influence management. They fail to do so at anything other than a coarse scale and therefore don't lead to a nuanced explanation of land management.

The inability to predict specific management practices from general purposes was not the only analytical problem. In some cases, the trend is reversed: management strategies create new purposes. For Mark, his direct-marketing management strategy has led to the creation of a social network, which has thus been a reason to continue to raise bison.

We've had a chance to liquidate the last three or four years and we just can't bring ourselves to do it because we've got such a good customer base now and there's not that many herds around... I guess we've built up such a good customer base and relationship with people we don't want to give it up.

For Doug, a grower in his 50's who raises bison because he finds them fascinating, his strategy of direct marketing and learning about the health benefits of bison meat has made him feel that he is helping keep his customers and his family healthy, which has become a secondary purpose to continue raising bison.

In other cases, purposes were less coarse and progressed more logically and directly to specific management practices. For instance, Diane, a refuge herd manager, explained the refuge's purposes as follows: "The refuge was established primarily to do prairie and oak savanna restoration and reconstruction...Bison were brought in as part of that because bison were part of the tall grass prairie ecosystem historically and the process of grazing was an historic process with prairies." This purpose of prairie restoration quite clearly necessitates a specific type of management: bison grazing on prairie grasses. Diane also articulated more purposes with the bison in conjunction with their complementary management strategy. These included "trying to learn more about how bison fit in with the prairie" which leads to their research on the ground, and "trying to get genetic diversity out there and help conserve the species by protecting all of the genetic material," which explains their yearly round-up and

genetic testing on all the calves. Similarly, one private herd manager told me that his main reason for raising bison was to utilize his pastures. This purpose thus led to the management strategy of raising bison on grass and not feeding grain or employing a feed lot. At the tribal refuge, Darci explained that the purpose of raising bison was to fulfill the tribe's culture, a purpose that went beyond simply having bison. Because this particular tribe originated in the Eastern Woodlands culture area, the bison don't have the same cultural significance as they would to Plains cultures, but nevertheless are an important part of the culture.

The goal is that they [bison] complete the circle, they complete one of the circles within the [tribe's] culture...there's cultural significance for the buffalo, but they're not pets, they're part of wildlife. Within the plains culture they're more of a religious icon... you won't see that in the eastern culture (Darci).

When I asked how this purpose affected their management, Darci said:

It's affected the fact and the theory that they need to be wildlife, we don't name them; they're not pets. We are here to provide them a home, because they are part of the [tribe's] way of life... and they are treated as wildlife, because that is their intent from the creator to be wildlife.

Darci further connected this wildlife treatment to more specific management; they don't give the bison any supplemental feed (beyond their perennial grasses) unless their health is being threatened, they don't cut their horns, they don't do any genetic selection with the herd and they don't "alter [them] in any size, shape or form."

Yet, even these three cases that show the most direct influences of purposes on management illustrate a shortcoming in my original hypothesis. In all cases, purposes themselves are not objective and concrete; instead, they leave room for a considerable degree of subjective interpretation. Having a purpose of reconstructing a prairie still depends upon an individual's subjective understanding of what a prairie is or should be, and what reconstructing it means. Similarly, a purpose of utilizing a pasture could be interpreted differently by people who want to utilize the pasture to achieve different ends. Clearly what it means to "fulfill a culture," a phrase Darci used at one point in the interview, is quite subjective

and subject to debate. This same argument applies to the management strategies that flow from those purposes; though the wildlife refuge has a purpose of “protecting the species” and “conserving genetic diversity,” their decision to use genetic testing and culling based on common or rare genes comes from a particular concept of the best method to achieve those purposes. For the tribal herd, the strategy of treating the bison like wildlife is also constructed; one must decide how to define ‘wildlife’ and again determine the best methods with which to treat something that falls under that definition. Even coarser goals face this scenario of interpretation; for example, the purpose of ‘doing something different’ predicates that an individual first identify a norm and construct a meaning of difference. Therefore, people take an active role not only by having purposes, but also by constructing the meaning and value associated with both purposes and management.

My hypothesis thus failed to account for people whose purposes didn't necessarily lead to fine-scale management strategies, but who had created other narratives or philosophies upon which to base their management. Such philosophies were often the forums of self-expression, voice, and autonomy that I originally envisioned would be captured by understanding people's purposes. For instance, Art, whom I earlier introduced as a manager who ‘wanted to diversify,’ a purpose that doesn't lead to much management detail, had quite an interesting management philosophy nonetheless. When I asked how he managed the bison, he said:

Well, we don't really. It's our feeling that they've gotten along for 50,000 years without us and so we're not going to do anything.

The most stunning example of this sort was Dave, a manager who said he'd got into raising bison to ‘get back to the land’ and also because he wasn't interested in continuing his career in the park service, where'd he'd worked most of his life. Yet, those purposes did not capture his independent interest in bison, which he'd worked with during his earlier professional career. He explained his complex theory

about bison behavior and the social structures of all herd animals. His entire management strategy, including details, was based upon this unique theory.

In creating my hypothesis, I attempted to give managers an autonomous voice by allowing them to articulate their purposes, but purposes did not always give managers much of a voice. While it is true that purposes do influence management strategies, they didn't provide the most interesting perspective from which to explore the individuality of managers, the decisions they make, and the systems in which they operate. Thus, it was more appropriate to turn to other themes which managers themselves raised to better understand how bison and herd managers fit into Iowa's contemporary landscape.