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Bone Dispersion, Weathering, and Scavenging of Cattle Bones

Melinda Potmesil

Abstract: In this research project, the goal was to study the pattern of disbursement of cattle bones from the site of death, observe any signs of scavenger marks and categorize the degree of weathering on the bones. In order to have a comparative data set, three sites with different characteristics were chosen. The three sites were chosen because of the ability to date the death of each cow, the length of time between each death, and the different locations, which each animal died. The oldest site was a one-year-old yearling heifer which died in May of 1992. The next site was a twelve-year-old cow, which died in October of 2000. The last site examined was a five-year-old cow, which died in May of 2002. These three sites were chosen to act as a timeline and to form comparisons for the changes in bone dispersion, scavenger marks, and weathering.

Background

This experiment took place on the ranch in western Nebraska approximately thirty miles north of Alliance, Nebraska. The area is comprised of traditional grassland, which has been used for cattle grazing for over fifty years. With the permission and help of the landowners John and Elaine Potmesil, sites were chosen and the experiment began in the fall of 2002.

Methods

The data collected from each site was procured in the same manner. To begin, a five-by-six foot square was used to represent the approximate size of a mature cow. The square was staked out over the approximate area where the animal had died. The square served as a uniform base area to take the measurement from all three sites. It was also assumed that any bones within the square were in their original position from when the cow died. The area around the square was then walked in ever-widening circles to locate the dispersed bone. Each outlying bone was marked with a flag, which allowed for easier measuring, but also provided a visual representation of the disposal

pattern. Each bone's distance and angle from the square were recorded. All distance measurements were taken from the northwest corner of the square with a 200-foot tape. The angle was determined with a level, set over the northwest corner stake. Using a compass, the level was set to magnetic north. The level was also used in conjunction with a target to determine the change in elevation across the site. Once the bones were marked, each bone was examined for weathering. To standardize the weathering patterns, the 1978 Behrensmeyer scale was used to identify the degree of weathering. Photographs were taken of the entire site, staked square, and several unique bone concentrations.

Site One

The first site recorded was the oldest of the three, and contained the bones of a yearling heifer that died in May of 1992. While there was no definable carcass left, the square was set up over the approximate area where the cow died. This area was evident because the grass under the carcass had not yet fully re-grown. After flagging the outlying bones, it became evident that topography and slope had played a large visible role in the dispersion pattern.

The heifer had died near the crest of a hill, and the majority of the bones were on the western, downhill, side of the square. Not only were the majority of the bones on that side, but they had dispersed six-times as far as the bones uphill of the square. The farthest bone to the east was 51 feet from the square, while on the western side the farthest bone was 310 feet, four inches away. Another geographical feature near the site is a small gully north of the square that runs east to west. Run-off from the hill usually follows this gully to pool in a basin at the foot of the hill. The skull and four other bones were found in this basin. The elevation was taken at the farthest outlying points and at the square. From the western most point to the square, the elevation decreased 14 feet six inches over 310 feet four inches. To the east, elevation increased two feet one inch in 51 feet. Over the course of 11 years, rain and snow drainage would have been able to steadily move the bones down the western slope. While scavengers undoubtedly moved some of the bones, the slope of the hillside had a distinct effect on the bone movement.

Surprisingly, few instances of scavenger marks on the bones were visible. The marks observed were not the random scratch marks expected from scavengers. Rather, many of the bones had been extensively chewed. The scavengers seemed to be chewing on the bones rather than leaving the random scratches typical of eating meat off of the bone. The chew marks were also fresh; within at least the

last six months. Twenty of the 58 bones found at the site were either chewed or fractured beyond the point of identification. The remaining 38 bones have very few to no visible marks. One bone had small parallel marks typical of what a rodent might do to sharpen its teeth. Scavengers, presumably coyotes that are common in the area, could account for the rest of the marks and chewing found on the bones. However, cattle may also be responsible for some of the chewing marks. Cattle have been known to chew on bones if they have a phosphate deficiency. As to the lack of expected scavenger marks, this may be accounted for in the weathering condition of the bone.

All the bones from this site ranked as a stage 4, "patches of fibrous bone with moderate flaking and cracking," and stage 5, "deep cracking and extensive flaking," according to the 1978 Behrensmeyer's scale (Frison and Todd 1987). The deterioration of the bone was ranked as a stage 4, "advanced exfoliation; little of outer surface remaining." Due to the deterioration of the exterior, any marks that may have been made immediately following death would no longer be visible. Small, shallow scratches made from scavengers eating or carrying the bones, would have been worn off by the extensive weathering, erasing the evidence of the scavengers presence. Many of the bones had extensive cracking with most, or all, of the exterior gone, leaving the fiber of the bone exposed. On the skull, the fissions only loosely held the skull together. This type of weathering is typical of being exposed to the elements for an extended period of time.

Site Two

Site Two is of an older cow, approximately 12-years-old. This older cow became lame and died in October of 2000, and died in a far corner of the pasture along the fence line. The exact area for this animal was much easier to identify. Within the square, several segments were still connected. Several sections of vertebrae, six ribs, the left scapula, and one femur were all groups with a small area. Scattered outside the square were a total of 79 bones.

The most distinct characteristic about the dispersal pattern was the presence of the fence. The five-by-six square was positioned with in a foot of the fence line. Only two bones were found on the opposite side of the fence; one rib and two connected vertebrae. Both bones were less than a foot and a half away from the fence with neither showing any markings.

The absence of scavenger marks, the close proximity to the fence, the absence of more bones, suggests that natural forces carried the bones to the other side of the fence. The limiting of dispersal to one

side of the fence was expected. It would be impractical for a scavenger to try and carry or drag a bone through a fence with only six to eight inches of clearance when there is an entire pasture on the other side. Other than the presence of the fence, the geography seems to have little effect on the bone dispersion. The bones were in a rough starburst pattern from the square. The farthest bone was 151 feet away with only a three foot and eight inch elevation increase over that span.

The scavenger marks were much more typical of what was expected to be found in Site One. Half the bones had at least one scratch, which could be attributed to a scavenger. The bones were also more fragmented. There were three concentrations where the whole bone was identifiable, but it was fragmented into many smaller unidentifiable pieces. These concentrations included: the right scapula, an ulna, and two vertebrae. The two vertebrae were the only bones showing extensive gnawing. They were the most widely scattered bones, but many were still held together in segments by sinew and cartilage. The majority of the bones, which were no longer attached in segment, still had visible amounts of sinew and muscle attached to them. Positive evidence for scavenger activity was identified in that portions of the carcass were dragged away from the square. The pelvis, which was still complete, was dragged 20 feet from the square. Also moved away from the square was a leg. The femur, tibia, several phalanges, and a hoof were strung in a rough line with each other, as if a scavenger had drug the leg away to eat in solitude.

The weathering on the bones was very slight, a stage 2, "limited surface weathering; some longitudinal cracking" according to Behrensmeier's scale (Frison and Todd 1987). Since sinew and muscle were still attached to the bone, they protected the surface to some degree. The bone surface was intact on most of the bones, making it a stage 2 deterioration, "slight exfoliation of bone cortical surface." The preservation of the outer covering also made is very easy to observe the scavenger marks on the bones.

Site Three

Site Three, and the most recent, was five-year-old cow that died in May of 2002. The cow died in the middle of the pasture 203 feet from a windmill and water tank. Of the three sites, the place of death was most clearly defined at this site. The trunk of the carcass was almost fully intact, and although the head and legs were gone, the rib cage remained; held intact by the hide. Outside the square 56 bones were scattered.

Although Site Three had only two fewer bones than Site One, the area in which they were dispersed was considerably smaller. Site Three had the least dispersion of the sites. The farthest outlying point was only 54 feet 4 inches compared to 310 feet from Site One. The area surrounding the carcass was open and flat. The windmill was the only anomaly near the animal. Having died near the windmill, there would have been some increase in cattle movement near the carcass. However, it seemed to have little significant effect on bone dispersion. The presence of cattle could have trampled or dispersed the bones; as calves have been known to carry and play with bones (see below). Elevation also seemed to have little effect. The elevation change across the entire site was less than a foot. With level topography, the overall bone dispersion resembled a starburst pattern. Contrary to Sites One and Two, there was no concentration of bone in any direction.

On the carcass itself, there were no visible scavenger marks. Surrounding the square was an abundance of fragmented ribs. Twenty-one of the fragments were mostly likely part of the broken ribs, but were too small and chewed to identify. Of the larger bones, only the mandible showed evidence of being chewed. As a whole, the bones showed a few scavenger marks, even less than Site Two. One leg, which had been dragged about 20 feet to the south was still connected to the hoof, and covered with hide. The lack of marks and high degree of preservation was surprising considering the carcass had been there over a year. One possible explanation lies to the south. Approximately half a mile south of the site is a large blowout, which is used to dump cattle carcasses. The cattle brought to the blowout would have died from miscellaneous causes from old age to lightning strikes.

The main reasons for moving the carcasses from where the cow originally died are to keep predators away from the calving area and to avoid contaminating any water supply. This area has been used as a disposal ground for five years and it now contains 25 to 30 carcasses of varying ages and states of decomposition. The amount of carcasses would have attracted more scavengers to the area, in fact, hunters often use the blowout to call in coyotes and trap other small game. It was predicted that with the scavenger activity so close to Site Three, the bones would be well marked and dispersed. However, the opposite effect seems to have taken place. The availability of the other carcasses in the area seemed to have drawn all the scavengers away from the animal at Site Three.

The bones were in good condition, between stage 1, "unweathered, dry," and stage 2, "limited surface weathering; some longitudinal cracking" (Frison and Todd 1987). Similar to site two, the bones still had a good portion of muscle, sinew, and in some cases, hide

covering them. With the hide still covering some bones, very little if any weathering took place. The scavenger marks are visible, but with so much sinew and muscle remaining on the bone, it is very possible that some of the scavenger marks are not yet visible. Similar to the weathering stages, there is very little deterioration, only a stage 1, "bone surface intact" (Frison and Todd 1987).

Other Contributing Factors to Dispersion

Several other factors are possible influences on the dispersion of the bones. One is the vehicle traffic, which is present in and around all three sites. While it is unlikely a truck, four-wheeler, or motorcycle would have driven over the entire carcass, once the bones started to disperse, it is likely that some of the smaller bones would at one time have been run over by a motor vehicle. One possible example of this is the skull and mandible from Site Two. Both of them had a large section missing from the left side, which was not similar to any other bones in the other two sites. The three sites I chose seem to be largely undisturbed; individuals in the area could have taken the bones or moved them from their original location. On the property there has been at least one "novelty hunter" who collects bones to make art pieces. Hunters have also moved carcasses and bones to set up blinds to call coyotes.

Cattle would have been another constant factor in all of the sites. As mentioned before, cattle have a tendency to chew on bones to get phosphate. Calves have also been observed playing with the bones, picking them up and carrying them around much like a dog plays with a ball. Cattle trampling the bones may also have been a problem. All the areas would have had some trampling from cow trails, site two because of its proximity to the fence line and site three because of its proximity to the water tank.

Conclusion

After observing these three sites, several constant factors have become apparent. With regards to the dispersion of bones, one of the predominant factors is the geography of the land. Bones will tend to move downhill from the original site. Combinations of natural forces such as wind, erosion, and water drainage all have a part in the movement of bones. The fence in Site Two prevented the natural forces and scavengers from evenly dispersing the bones on all sides of the square. This is illustrated by the starburst pattern in Site One that formed when there was no predominant influence. Human intervention

also plays a part; people can influence the condition of the bone. Vehicle travel and movement by people can break up the bone or damage it.

The scavenger marks of a site are changed with the age of the bone, how long the carcass has been in place, and the availability of other food. It is inevitable that scavengers will come to a site and leave some traces behind, but how much is observable can change. The scavenger marks only seem to become visible when most, if not all, of the soft tissue is gone. Chewing of the bone was only observed on the bones that were considerably older and had been weathered significantly.

Weathering of the bones seemed to be one of the constant factors. Once the hide and soft tissue decomposed or was eaten, the bones all seemed to be deteriorating in the same fashion. All were exposed to the same type of elements, and all have the same observable stages of deterioration. However, weathering did have a great effect on the scavenger marks. At Site One, the weathering of the bone had completely taken off the outer surface of the bone, making it impossible to tell if there had been significant amounts of scavenger markings from the time when the heifer died. The deterioration was comparable to the weathering. All the bones deteriorated at a constant rate with each site representing a different stage of deterioration.

Works Cited

Frison, GC and Todd, LC. (1987) *The Horner Site: The Type Site of the Cody Cultural Complex*. Orlando: Harcourt\Brace Jovanovich.