

How Herbivores Shaped The Rangelands Of The Northern Great Plains

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Much of the conflict over what the Thunder Basin and the Northern Great Plains should look like is rooted in disagreement over what they looked like when the first Europeans saw them. Were they “Elysian fields of tremendous areas of luxuriant grass” (Fremont 1845), or were they “enormous plains which in winter are white with snow and in summer are gray with a saline alkali dust [which] preserve the common characteristics of barrenness, inhospitality, and despair” (Doyle 1930)? Were they covered with grass up to a horse’s belly or higher, or were they covered with short grass showing the effects of centuries of uncontrolled grazing by bison, elk, and other native herbivores?

The first European impressions of the Great Plains were recorded in journals of trappers, traders, explorers, and naturalists from the late 16th to the mid-19th centuries. Here, frequently in those early travelers’ own words (and their own spelling), is what they saw.

Grass to a horse’s belly or taller was characteristic, not of the Great Plains, but of the tallgrass prairie to the east, dominated by big bluestem, switchgrass, and Indiangrass. Oñate, in 1601, described tallgrass prairie on the lower Canadian River; “...in many places the grass was high enough to conceal a horse” (Bolton 1916).

The Great Plains Before European Settlement

The Great Plains between the 100th Meridian and the Rocky Mountains were dominated by short grasses; buffalograss and blue grama in the north, mesquite or galleta grass in the south. Trudeau, a trader on the upper Missouri in 1803-1805, wrote: “Vast and high prairie, separated from the river by low and humid plains, present to the eye a monotonous expanse...small arid hills, the greater part bare or covered with short grasses” (Abel 1921). In 1805, Francois-Antoine Larocque, Charles McKenzie, David Thompson, and Alexander Henry (who we’ll encounter later) were fur traders with the Northwest Company, stationed at the Mandan villages on the Missouri just below present-day Lake Sakakawea. Larocque complained, “It is amazing how very barren the ground is between the Powder River and the lesser Missouri...Our horses are nearly starved” (Wood & Thiessen 1985).

James Pattie (1833), a traveler and teller of tall tales from Kentucky, grumbled about the hard surface of the shortgrass prairie. On the Platte in 1824, he wrote: “The plains are covered with a short, fine grass, about four inches high, of such a kind, as to be very injurious to the hoofs of animals”. Pattie also told of packs of hundreds of wolves, “white as snow and big as sheep”, and reported about three horrendous Indian fights per week.

William Franklin (1879), on the Platte in 1845 with Col. Stephen Kearney’s expedition, wrote: “...there was scarcely any grass on the hills but the buffalo grass and that was parched by the sun.” Phillip St. George Cooke and Henry Carleton also accompanied Kearny up the Platte and down the Arkansas in 1845. Cooke (1857) commented “the buffalo has been before us, but we have found some scant grazing;--it is

buffalograss,-- very backward, and looks like curled gray horsehair...” and echoes Pattie, “...its sod is a near approach to wooden pavements.”

The military types seldom had the knowledge needed for extensive botanizing, and tended to mention only the showier forbs to the neglect of the grasses. James Malin (1961), geographer and ecologist at the University of Kansas, snickered at John C. Fremont’s (1845) comment about “...hunting plants among the grass”. The terms buffalograss, grama, and mezquite grass were used quite interchangeably for the short grasses. Finally, differences in the grass species recorded by the various expeditions may reflect differences in location and season, as well as differences in botanical knowledge.

The military journalists seldom mentioned the taller but less-abundant mid-grasses such as western wheatgrass, needleandthread, sideoats grama, and Indian ricegrass. But they were there, then as now; better trained naturalists identified them. Absence of these grasses indicates serious overgrazing, but they return with better management. Grasses indicative of overgrazed and disturbed rangelands, including annual barleys and bromegrasses, dropseeds, sandburs, sixweeks grass, and tumblegrass, were also present (Hart & Hart 1997).

Prickly pear cactus is sometimes regarded as an indicator of overgrazing by livestock, but it was present before a cow or a sheep ever saw the Great Plains. Prickly pear was recorded up and down the Plains from 1804 by Larocque (Wood & Thiessen 1985) to 1849 by Stansbury (1852). Lewis and Clark (Moulton & Dunlay 1983), on the upper Missouri in 1805, recorded: “The prickly pear is now in full blume and forms one of the beauties as well as the greatest pests of the plains”. On the South Platte just above the forks, the Long Expedition (James 1823) found that: “Prickly pears became more and

more abundant...they occurred in such extensive patches as considerably to retard our progress, it being wholly impracticable to urge our horses across them.”

In other words, the Northern Great Plains rangelands appeared to be heavily and frequently grazed. Yet Brunner (1997) states: “If one examines the habits of bison, one finds they used ‘flash’ grazing. The herds moved into the land, grazed it, and moved on. Most of the plants were grazed once per grazing season. Domestic cattle on the Great Plains today graze and regraze each plant, changing the vegetation over time to sod grasses”. This statement represents one rationale for intensive rotation grazing and even for removing livestock from the rangelands entirely; it is frequently echoed by other authors.

Again, journals of early explorers, travelers, traders, and trappers were used to examine two hypotheses: 1) traditions of bison migration are not supported by observation, and 2) the Great Plains was so fully occupied by bison that migration would have usually taken them to areas already grazed by other bison. Information is presented on maps, on which a solid circle indicates a day on which bison sightings were recorded; a solid circle with a number next to it indicates the number of days in one place, with bison sighted each day. If bison are seen nearly every day, we can assume the country was fully occupied, unless the bison are following the same path, at the same speed, as the diarist. A dotted line with no number next to it indicates a single day with no bison sighting; a dotted line with a number, indicates the number of days with no bison sightings. An open circle with a dot inside indicates the party camped in one place for the number of days indicated, with no information on bison sightings. Usually such

camps were in or near Native American villages, and bison were seldom seen in the vicinity of villages.

Few of the diarists stayed in one place long enough to determine how long bison continued to graze an area, or how soon the same or another herd arrived to graze on it again. Alexander Henry (Gough 1992) operated trading posts on the Red River of the North, near the US-Canadian border, from 1800 to 1808. His journal records plenty of bison in the vicinity of the posts at all times, except for the winter of 1803-1804. Extensive prairie fires in the summer of 1803 had destroyed nearly all the grass around the post, so that even the post horses were hard put to find enough to eat. Lewis and Clark (Moulton & Dunlay 1983) camped near the Great Falls of the Missouri in June and July of 1805. During their 29-day stay, they reported bison in the area for 19 days. These two observations indicate bison grazing was more like a “slow burn” than a “flash”.

At a later date, Charles Goodnight (Haley 1936) related that the summer of 1867 was very dry in the Texas Panhandle, and bison herds had gathered on the Little Colorado River in such numbers that “They had remained until the grass was gone, and had died from starvation by thousands and thousands. The dead buffaloes, which extended for a hundred miles or more, were so thick they resembled a pumpkin field”. Although there was still good grass on the Rio Concho, 30 miles across a divide to the southwest, the bison had stayed on the Little Colorado.

Distribution Of Bison

Lewis and Clark (Moulton & Dunlay 1983), moving upriver from S. Louis in 1804, saw their first bison near the junction of the Missouri and the Big Sioux Rivers

(Fig. 1). From there to the Mandan villages, they moved through herds of bison for several days, separated by one to three weeks where they saw no bison, usually in the neighborhood of concentrations of North Americans. On 16 September 1804, just above the mouth of White River, "...vast herds of Buffaloe deer Elk and Antilopes were seen feeding in every direction as far as the eye of the observer could reach". On 17 September 1804, Lewis wrote "I estimate the number of Buffaloe which could be comprehended at one view to amount to 3000". But from 24 September to 16 October, they saw no bison because the Indians followed their boats upriver.

After wintering at the Mandan villages, Lewis and Clark continued upriver on 8 April 1805, but saw no bison until 13 April, because "the country from fort Mandan to this place [about 50 miles upstream] is so constantly hunted by the Minetaries that there is but little game." From that time until they reached the Great Falls of the Missouri on 14 June, they were seldom out of sight of the bison, and they describe "immence herds of Buffaloe, Elk, deer, & Antelopes feeding in one common and boundless pasture" and "The whol face of the country was covered with herds of Buffaloe, Elk & Antelopes." As mentioned previously, they saw bison 19 of the 29 days they spent near Great Falls, until they left on 15 July; "infinitely more buffalo that I had ever before witnesses at a view," "a herd of at least a thousand buffaloe," "Capt. C. Assured me that he believes he saw at least ten thousand [buffalo] at one view." However, they saw bison only on the first day after leaving the Great Falls, and saw them no more all the way to the Pacific.

On the return journey, parties under Lewis and Clark separated. Lewis saw the first bison on the South Fork of the Sun River, west of Great Falls, on 8 July 1806 (Fig.2), and on 11 July recorded "...immence hirds of buffaloe...I sincerely belief that

there were not less than 10 thousand buffaloes within a circle of 2 miles.” He saw “immense herds of buffaloes” nearly every day on the Missouri until he reached its junction with the Little Missouri River, where he rejoined Clark. Clark, in the meantime, had traveled down the Yellowstone, where he saw his first bison on 16 July near Livingston, Montana. On 24 July; “Saw immense number of Deer Elk and buffaloes...for me to mention or give an estimate of the different species of wild animals on the river particularly Buffaloes, Elk Antelopes & Wolves would be incredible.” He was better at observation than at spelling or capitalization; other journal entries read “Buffaloes and Elk is astonishingly numerous on the banks of the river,” “...obliged to land to let the Buffaloes cross over...the river was crowded with those animals for ½ an hour...” and “more Buffaloes and Elk and antelopes this evening than usual.” Martin and Szuter (1999) postulated that bison were so abundant on the Yellowstone and upper Missouri because this region had no permanent inhabitants, but was a buffer zone occasionally “probed by various Indian war parties.”

Below the mouth of the Yellowstone, bison were not seen as often, but the numbers were great. On 29 August, just past the mouth of the White River; “I had a view of a great number of buffaloes than I had ever seen before at one time. I must have seen near 20,000.” Again, it would appear that the country was so full of bison that there was little opportunity for them to move to fresh grazing after grass was heavily grazed.

Larocque (Wood & Thiessen 1985) apparently found bison much less frequently on the Yellowstone in 1805 (Fig. 3). The greatest concentration was on the upper Heart River; on July 9 “...as far as the eye could discern Buffaloes were seen in amazing numbers.” But when bison were present on the Powder, Big Horn, Yellowstone, and

upper Missouri, they were present in force. "...The plains on the western side of the [Powder] River were covered with Buffaloes..." [27 July]. However, "It is amazing how very barren the ground is between this and the lessor Missouri. Northing can hardly be seen but those Cornin de Raquettes [prickly pears]. Our horses were nearly starved." Which explains why bison were seen on only one day of the 17 required to cross this stretch of country. "...Plenty of buffaloes between the Large Horn and the River aux Roches Jaunes [the Big Horn and the Yellowstone]" on 28 August. "Elk and Buffaloes in the greatest plenty" [16 September] and "...the greatest number of Buffaloes..." [29 September] on the Yellowstone. "...Plenty of Buffaloes on both sides of the River" [5 October] on the Missouri.

In May and June of 1810, bison were scarce on the middle Missouri. Brackenridge (1904) and Bradbury (1904) saw their first bison near the mouth of the Platte River, but saw bison only 11 of the 51 days required to travel upstream from the Platte to the Mandan villages. This may be an underestimate; although Bradbury did not record bison sightings from May 23 until June 4, on June 8 he wrote "Our hunters killed two buffaloe and two elks. Of the former we had for some days past seen a great number of herds..." The herds were, as usual, enormous; on June 22 "I counted seventeen herds; but the aggregate number of the animals it was difficult even to guess at; some though upwards of then thousand." Bradbury also noted, "[The Aricaras] often kill many more [buffalo] than they can possibly dispose of". Coming back downstream required only 8 days from the villages to the mouth of the Platte; bison were seen for 4 days.

Bradbury describes the difficulties they had in saving their boat and themselves in a severe storm, and writes, "...I felt much for my friend Brackenridge. Poor young man,

his youth, and the delicacy of his frame, ill suited him for such hardships.” But Brackenridge wrote, “...I felt for my friend Bradbury. Poor old man, the exposure was much greater than one of his years could well support.”

On the middle Missouri, bison were even more rare in 1833 and 1834. Maximilian, Prinz zu Wied (1843) saw no bison below the Cannonball River, and very few from there to 6 days above Fort Union, at the junction of the Yellowstone and the Missouri (Fig. 4). Then they saw bison for 12 successive days. On 25 July, Maximilian wrote, “...we were approaching the part of the country called Mauvaises Terres [the badlands], where we could not expect to find much large game,” but on 27 July, “...saw the whole prairie covered with herds of buffaloes.” Maximilian did not record bison sightings during the 37 days his party spent at Fort McKenzie, near the Great Falls. He noted, “All these [53] people lived entirely on meat, so that we may assume that two buffaloes daily were required for their consumption.” but “...we were often short of meat.” Hundreds, perhaps thousands of Indians had remained in the vicinity of the fort for Maximilian’s entire stay; this probably accounts for the scarcity of bison. Coming back downriver in September, again they saw bison every day in the stretch of river where they had been so plentiful in July, but they required only 5 days to cover the distance. They wintered at the Mandan villages, and saw bison only once in April, after they resumed their journey downstream.

From 1804 to 1834, we note a progressive decrease in bison on the middle Missouri, but Lewis and Clark (Moulton & Dunlay 1983) reported dense populations on the upper Missouri in May through July of 1805 and July 1806, and Maximilian (1843) reported them in July and September of 1833. Ferdinand V. Hayden (Warren 1981)

wrote in 1857, "...although in the valley of the Yellowstone and along the Upper Missouri thousands may yet be seen...none, except now and then a stray bull, are seen on the Missouri River below Fort Clark [north of Bismarck, North Dakota]..." Clark (Moulton & Dunlay 1983) saw large numbers of bison nearly every day on the Yellowstone in July of 1806, but Larocque (Wood & Thiessen 1985) saw them only occasionally in September 1805. Hayden (Warren 1981) wrote "Descending the Yellowstone River in the summer of 1854, I saw, for the distance of 350 miles, the prairies on both sides of the rivers covered with herds of buffalo..."

By the early 1800's, bison were seldom seen on the Platte below Grand Island, Nebraska (it should be understood that references are to present-day towns and cities). The Pawnee were established on the Loop and the lower Platte, and apparently kept the bison pretty well thinned out.

Fremont's (1845) journal is not sufficiently specific on locations to draw a map. On his way up the Platte in 1842, he first saw bison 30 Jun 1842, "...swarming in immense numbers over the plains, where they had left scarcely a blade of grass standing," 30 to 40 miles above Grand Island. His party saw bison every day but one through 7 July, when "Buffalo absolutely covered the plain on both sides of the river..." above Julesburg, Colorado, on the South Platte. The next day, Fremont wrote, "For the next mile or two, the ground was dotted with buffalo carcasses, which show that the Indians had made a surround here... Two of Three hundred [Arapaho] were sweeping across the prairie... the chief pointed out a band of the bison on the other side of the Platte... the chase commenced...It had been a large band, probably three or four hundred in number;

but, though I watched them closely, I did not see one emerge from the fatal cloud [of dust] where the work of destruction was going on.”

It may have been a common practice among Native Americans to wipe out an entire herd. Henry wrote “Not one of the whole herd do they allow to escape: large and small, fat and lean—all must fall to prevent their alarming other herds.” Warren wrote (1981), “The intention of the Indians [Hunkpapa Sioux] was to...kill the animals by surrounding one band at a time and completely destroying each member of it. In this way no alarm is communicated to the neighboring bands...”

Bison were found on the Platte in the winter as well as in the summer. The eastbound Astorians noted: “abundance of bison, which seemed absolutely to cover the country on the Platte below the Forks” from December 1812 to March 1813 (Irving 1834). In December 1824, Ashley recorded, “...the valleys were literally covered with buffaloe...numerous herds of buffaloe moving down the river...”(Dale 1918).

In 1820, Steven Long (James 1823) saw bison almost every day from Grand Island to the vicinity of Fort Morgan, Colorado, often in great numbers (Fig. 5). On June 22, just above the forks of the Platte, “...immense herds of bisons, grazing in undisturbed possession, and obscuring, with the density of their numbers, the verdant plain...it would be no exaggeration to say, that at least ten thousand here burst on our sign in the instant...In the morning we again sought the living picture, but upon all the plain which last evening was so teeming with noble animals, not one remained.” But on June 23, “Large herds of bison were seen in every direction...” and on June 24, “...saw immense herds of buffalo, blackening the whole surface of the country.” If these were the same herd seen on June 22, they hadn’t moved far; but they were more likely have been

different herds. Long's party was out of sign of bison for 10 days, then saw them 5 days of the next 12. Of Bell's Springs, near Cañon City, Colorado, James wrote, "...the country around them abounds with bison, deer, &c..."

It would seem that in most years, along the upper reaches of the major rivers traversing the Northern Great Plains, the country was fully occupied by bison. There was little opportunity for "flash grazing" or what we today would call high-intensity short-duration grazing. The grasses, forbs, and shrubs were grazed repeatedly, whenever new green growth showed itself. The uplands might have received some respite from grazing during the summer, when "All the small rivers were completely dried up" by mid-July. However, Larocque (Wood & Thiessen 1985) saw plenty of bison on the uplands between the Missouri and Little Missouri in July 1805.

Grazing intensity would have been high, and the travelers would record "...not enough forage on a mile square...to have furnished even on squadron [about 100-120 horses]..." (Carleton 1943); "...scarcely any grass on the hills..." (Franklin); "Our horses were nearly starved" (Larocque; Wood & Thiessen 1985); "The grass in this arid soil, always so scanty, was now actually swept away by the buffalo..." and "Buffalo very numerous, and have eaten the grass down considerably, and have not left much for the horses" (Palliser; Spry 1968); "They have ravedged this small Island...Nothing remains but the large Elk and Oak trees...Brush wood and Grass are not to be seen in this little wood..." (Henry; Gough 1992)

Bison And Water Quality

Bison adversely affected the water quality in all seasons. The smaller streams were often dry; Maximilian (1843) found "All the small rivers were completely dried up"

by mid-July, 1833, near the junction of the Milk and Missouri Rivers. The larger rivers usually contained water, but the quality of water in streams of all sizes was highly variable. Listen to these descriptions. In 1805, Lewis and Clark recorded that the water of the Poplar River in Montana was “transparent, it being the first of this description that I have yet seen discharge itself into the Missouri”, but the Yellowstone was “turbid” (Moulton & Dunlay 1983). The Cannon-ball was “muddy” (Bradbury 1904). James (1823), with the Long Expedition, wrote, “When Foundation Creek [near present Fountain, Colorado] began to rise, it was soon covered with such a quantity of bison’s dung...that the water could scarcely be seen.” “The water of the South Platte was perfectly opaque with thick yellow mud” (Stansbury 1849).

Alexander Henry (Gough 1992) may be responsible for the original muddy river story. He wrote in 1806; “The water of the Missouri is so impregnated with earth...that a stranger would scarcely venture to drink it...In the winter...when the water is not so terribly thick, it is not to the liking of the natives, and they frequently mix a certain quantity of clay with the water they drink. In the spring, when the ice drifts down, the water is very thick and muddy, and quite to their taste.”

Not only ice drifted down in the spring. McKenzie (Wood & Thiessen 1985) wrote in 1804, “...in the Spring both side of the River are in several places covered with rotten carcasses and Skeletons of Buffaloes, Elks, &c...” The journal of Lewis and Clark for 9 April 1805 (Moulton & Dunlay 1983) relates, “...found a number of carcasses of the Buffaloe lying on shore...lodged on shore by the high water when the river broke up...” In 1810 botanist Bradbury (1904) “began to notice...the great number of drowned buffaloes that were floating on the Missouri river; vast numbers of them were also thrown

ashore, and...on the points of islands.” Maximilian (1843) counted “...1,800 and more of the bisons’ dead bodies...in one place.”

Other Grazers And Fire

Bison were not the only grazers on the Great Plains. Great numbers of pronghorn antelope, elk, and feral horses roamed and grazed on the Plains; antelope numbers may have been equal to or greater than bison numbers (Shaw & Lee 1997). Maximilian (1843) recorded not only enormous numbers of elk, but elk of enormous size; “...a most significant stag of twenty antlers [points, counting both sides]...the horns, from the head to the point of the uppermost antler, [measured] in a straight line, four feet one inch...” and “The immense horns of an elk, fixed at the head of the boat, the sixteen antlers of which were all hung with joints of meat...”

Prairie dogs may have been the most abundant mammals in North America at the time of the first European explorations (Seton 1929, Byer 2001, Detling 2001). Lewis and Clark (Moulton & Dunlay 1983) cross a prairie dog town 7 miles wide, and a prairie dog town in Montana was estimated to be 30 to 40 miles long (Messiter 1890). To the billions of prairie dogs add billions of other grazing rodents, rabbits, and jackrabbits.

At times grasshoppers denuded the Plains as effectively as mammalian grazers. Harmon (1922), on the prairies of Alberta, encountered “...grass-hoppers in such prodigious numbers...devour everything before them leaving scarcely a leaf on the trees, or a blade of grass on the prairies...” in Saskatchewan in 1802. Hind (1968), on the Souris River in 1858, wrote “Those portions of the prairie which had been visited by the grasshoppers wore a curious appearance; the grass was cut uniformly to one inch from the ground...” Henry (Gough 1922), on the Red River of the North in 1808, complained

of “...great swarms of grasshoppers...spreading destruction wherever they pass, even the very trees are stripped of their leaves...” On the Yellowstone in 1806, Clark (Moulton & Dunlay 1983) found “...emence Sworms of Grass hoppers have destroyed every sprig of Grass for maney miles on this side of the river...” On the North Platte west of Fort Laramie in 1842, Fremont (1845) reported “There had been no rain, and innumerable quantities had destroyed the grass...the scanty yellow grass crisped under the foot, and even the hardest plants were destroyed by want of moisture...buffalo were very scarce...”.

Thus the Great Plains presented a shifting mosaic of areas grazed or not at all, lightly, or mostly heavily by animals of all sizes, from bison to grasshoppers. The less-heavily grazed areas periodically supported fierce prairie fires (Perryman 2001), which may have reduced bison populations. McKenzie (Wood & Thiessen 1985) “...observed whole herds of Buffaloes with their hair singed—some were blind; and half roasted carcasses strewed our way” between the Souris and upper Missouri in 1804. Such reductions, and those caused by drought and severe winters, allowed some recovery of the plains vegetation. Fires may have had greater influence than grazing in shaping the vegetation of the tallgrass prairie, where bison were much less plentiful than on the short and mixed-grass prairie. However, fire was instrumental in controlling trees along the streams. Fremont (1845) reported “no wood” on Crow Creek below the present site of Cheyenne, but large willows and cottonwoods are plentiful there now.

Conclusions

On the uplands and away from the cities, farms, and highways, the vegetation of the Thunder Basin and the rest of Northern Great Plains landscape is much the same as

when bison and other grazers, as well as fire and climate (Larson 1940, Ellison 1960, England & DeVos 1969, Roe 1970, Hart 2001). While bison moved, it does not appear they “migrated”, if migration is defined as following a regular and predictable seasonal or annual route. Often bison were found continuously in the same location for weeks or months. At other times they were absent, and neither presence nor absence followed predictable patterns. While bison may have occasionally “flash grazed” and moved on, densities of bison were so heavy that probably another herd moved in a few days or weeks later and regrazed the area, provided there was anything left to eat. It reminds me of the old story about the squad in World War II (this was one of those movie squads, with each soldier from a different ethnic group). Ol’ Sarge says, “Well men, there’s good news and bad news! The good news is that you get a change of socks! The bad news is: Private Ryan, you change with Levine; Sanchez, you change with Kowalski...”

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rangelands types, we compared the grasshopper community composition and dynamics in the rangeland of the northern slopes of the Qilian Mountains. In total, 55 grasshopper species were collected from 2007 to 2009, representing three families and six subfamilies. The subfamily Oedipodinae was dominant, followed by Gomphocerinae and Catantopinae. Species abundance varied among rangeland types (RTs). The greatest abundance of grasshoppers was found in mountain rangeland, while the lowest abundance of grasshoppers was caught in alpine shrublands. Three species (*Chorthippus cf. brunneus* (Thunberg) (Acrididae), *Chorthippus dubius* (Zubovskii), and *Chorthippus* sp.) were collected.

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â€¢ Northern Plains Rangelands â€¢ Physiography, Soil, and Native Vegetation â€¢ Seasonal Weather Patterns â€¢ Soil Formation â€¢ Prehistorical Conditions of Rangelands â€¢ Problems Inherent in Grasslands Effects of Environmental Factors â€¢ Climatic Factors Affect Plant Growth â€¢ Plant Water Stress Frequency and Periodicity â€¢ Grazing Starting Dates â€¢ Grass Growth in Height â€¢ Effects of Fall Grazing on Height â€¢ Proactive Management of Pest Grasshopper Habitat Effects of Partial Defoliation â€¢ Grazing Effects on Rangeland.â€¢ â€¢ Capturing Greater Wealth from the Land â€¢ Old Style Range Cow vs Modern Rangeâ€¢ Evaluation of Processes that Inhibit Encroachment of Woody Species into Native Rangelands of the Northern Plains. ! Vol. IV. Montana's Northern Great Plains encompass some of the largest and most significant native grasslands remaining in the United States.â€¢ Sage Grouse Monitoring Montana rangeland ecologist Kelsey Molloy conducts field monitoring of the greater sage grouse. Each spring males gather on these lands known as leks, to impress females with their display. After mates are chosen, hens lay 6-10 eggs. The Northern Great Plains region has been experiencing a trend towards reaggregation of fragmented land parcels into larger operations since the 1930s. Grasslands were initially fragmented during the...â€¢ Richardson-Kageler, S. J. 2004. Effects of large herbivore browsing on the functional groups of woody plants in a southern African savanna. *Biodiversity and Conservation* 13:2145-2163.C CrossRefGoogle Scholar. Robinson, E. B. 1966.