Mob Grazing Research - University of Nebraska-Lincoln

Jerry Volesky, Walt Schacht, Miles Redden, Jordan Johnson, and Ben Beckman

An ongoing research project was initiated in 2010 to evaluate various plant, soil, and animal responses to different grazing methods on Sandhills subirrigated meadow. Ultra-high stocking density grazing, or "mob grazing," was one of the methods; it involves concentrating grazing livestock into small paddocks to achieve stocking densities of 200,000 lb/acre or greater. Maintaining animals at these densities usually requires moving animals through multiple paddocks per day. In a mob grazing system, each paddock is typically grazed only once per growing season. Practitioners report a wide variety of benefits including increased forage production, increased plant diversity, improved distribution of livestock grazing, improved soil function, and rapid rate of soil development (Gompert 2010; Peterson 2010). The high stocking densities used in mob grazing systems reportedly result in even distribution of grazing pressure, hoof action, and excreta across a pasture (Peterson 2014; Peterson and Gerrish 1995).

The objectives of our research are to quantify the effects of mob grazing on vegetation productivity, species diversity, forage utilization, and harvest efficiency as well as animal performance and forage quality when compared to more traditional grazing and harvest methods. Additionally, soil characteristics including structure, microbial populations, organic matter, carbon, and nutrient composition as well as plant root growth, litter decomposition rates, and dung beetles are being investigated in this research.

Research Methods

The project is being conducted at the University of Nebraska-Lincoln Barta Brothers Ranch located approximately six miles northwest of Rose in Rock and Brown counties. Vegetation of the meadow study is a productive mixture of introduced cool-season grasses and forbs with native warm-season grasses, sedges, and rushes. Annual plant production is about 4000 to 5000 lb/acre.

In addition to the mob grazing treatment, this ongoing research project includes a 4-pasture rotation with a single grazing period (4-PR-1), a 4-pasture rotation with two grazing periods (4-PR-2), a mid-July haying, and a control (no harvest of live standing vegetation during the growing season) (Table 1). In 2011, a continuous grazing treatment at a stocking rate equal to the other treatments was added to the study. Because this treatment was not part of the original experiment, all vegetation data from these pastures are excluded from the analysis. They were used only for analysis of animal activity.

There are two replications of the treatments with each comprised of the prescribed number of pastures. Grazing treatments were grazed by yearling steers with an average weight between 700 and 780 lb.

Table 1. Stocking rate, stocking density, and grazing days per season in an individual pasture or paddock.			
Treatments	Stocking rate (AUM/acre)	Stocking density (lb/acre)	Grazing days per paddock or pasture
Mob grazing (120 paddocks)	3.0	200,000	0.5
4-pasture rotation once-over (4-PR-1)	3.0	6,400	15
4-pasture rotation twice-over (4-PR-2)	3.0	4,800	20
Continuous	3.0	1,500	60
Haying	- -	- -	- -
Control (non-grazed)	- -	- -	- -

The treatments have been applied annually since 2010. Prior to initiation of the study, the meadow was hayed annually. The mob and 4-PR-1 treatments begin grazing in early to mid-June and continue for 60 days. The 4-PR-2 treatment begins in late May and continues for 80 days. The 4-PR-2 was selected as a conventional method of grazing meadows with a May start date to take advantage of cool-season vegetation growth and a second grazing period to take advantage of new vegetation growth following the first grazing period. The mob grazing period was designed to start later in the growing season in order to achieve optimum conditions for trampling 60% of the standing herbage, which was the target for building soils. The 4-PR-1 had the same starting date and grazing season length as the MOB so that their effects could be compared directly. Over the first four years of the study, grazing start dates varied slightly to accommodate drought or excessively wet conditions.

In 2010, 2011, and 2012, cattle in the mob treatment were moved twice daily into a new paddock (0.14 acre) at about 7:00 AM and 2:00 PM. Stocking rates were reduced 25% in 2013 in all treatments due to poor vegetation growth, and paddock size was reduced in the mob and number of moves each day increased to three to maintain stocking density similar to previous years.

Vegetation sampling included estimation of production by clipping quadrats in randomly located grazing exclosures placed in each pasture. Trampling, harvest efficiency (animal consumption), and utilization (trampling + harvest efficiency) were also measured 3 times in the mob treatment during the grazing period and each time 4-pasture treatments moved to a new pasture. Vegetation was sorted into live, standing dead, trampled herbage, and litter (dead plant material on the ground surface) categories. Basal cover and species composition were estimated using the modified step-point method in late June of each year.

Quality analysis of available vegetation (pre-grazing) was conducted on clipped samples collected during the grazing period in all treatments. Analyses included crude protein (CP) and neutral detergent fiber (NDF).

Animal response measurements included performance (daily gain) and animal activity (steps/day). Animal activity was measured by randomly selecting two steers from each treatment group and fitting them with data-recording pedometers.

Results and Discussion

Growing season precipitation and temperatures varied widely over the first four years of the study. Well-above average precipitation occurred in 2010 and 2011, drought occurred in 2012, and near average precipitation in 2013. Spring and early summer temperature were below average in 2011 and 2013, well-above average in 2012, and near average in 2013.

Vegetation Production

Annual vegetation production did not differ between any of the grazed treatments or control. Overall, production during the first two years of the study (2010 and 2011) averaged 4580 lb/acre compared to 3710 lb/acre during 2012 and 2013. Drought conditions and recovery were likely the factors in the lower production during the last two years.

There was no difference between grazed treatments in the amount of litter (Fig. 1). However, litter biomass in the non-grazed control was about 400% greater than the grazed treatments. The accumulation of litter in the control would be expected because of the lack of vegetation removal or animal impact. Similarly, the amount of standing dead vegetation was greater in the control compared to grazed treatments.

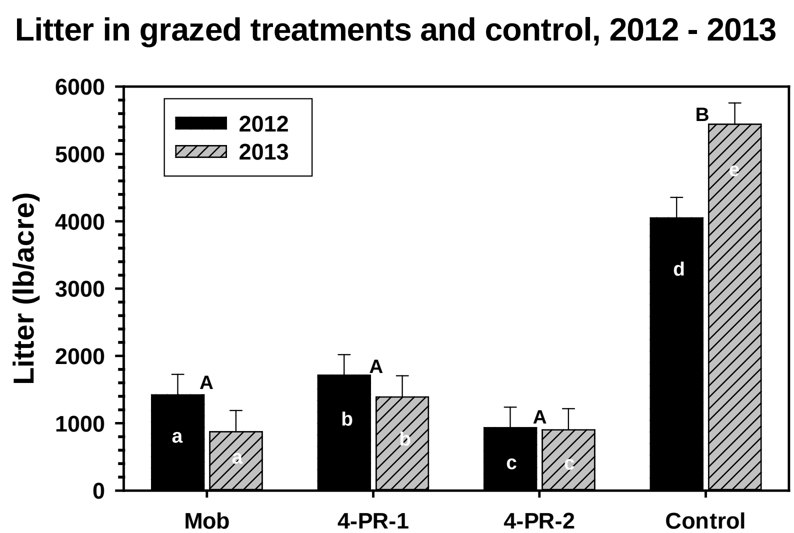

Figure 1. Litter biomass in grazed treatments and control. [abcde] Within treatments, year bars with like lowercase letters do not differ (P > 0.05). [AB] Within treatments, bars with like uppercase letters do not differ (P > 0.05).

Utilization, Trampling, and Harvest Efficiency

Utilization is the combined amount of trampling and harvest efficiency (consumption). Utilization under mob grazing averaged 88% and was greater than the 4-PR-2 treatment each year and greater than in 4-PR-1 during 2010, but not in 2011 and 2013 (Table 2). In all treatments, differences in utilization between years may be affected by production as well as starting date where it was observed that early in the season when vegetation was shorter and vegetative, the amount trampled was less.

Table 2. Utilization of standing live herbage (%) in the 4-PR-1, 4-PR-2, and mob grazing treatments in 2010, 2011, and 2013.			
Treatment	2010	2011	2013
	- - - - - - - - - - - - - - - - *(%)* - - - - - - - - - - - - - - - - -		
4-PR-1	65^{Aa}	85^{Ab}	85^{Ab}
4-PR-2	49^{Ba}	71^{Bb}	60^{Bc}
MOB	88^{Ca}	89^{Aa}	86^{Aa}

^{ABC} Different uppercase letters within columns differ (P < 0.05)
^{abc} Different lowercase letters within rows differ (P < 0.05)

The average amount of live vegetation trampled under mob grazing was 60%. This was at our planned level for mob grazing and about 58% to 125% greater than in the 4-PR-1 and 4-PR-2, respectively (Figure 2). The increase in trampling in the mob treatment is likely a result of stocking density, the associated high grazing pressure, and increased animal activity. Field observations found that trampling in the 4-PR treatments was patchy and uneven. Overall, there was a difference in percent trampled between years, with 2011 having the highest. This could be a result of the high production and extended period of wet condition that year.

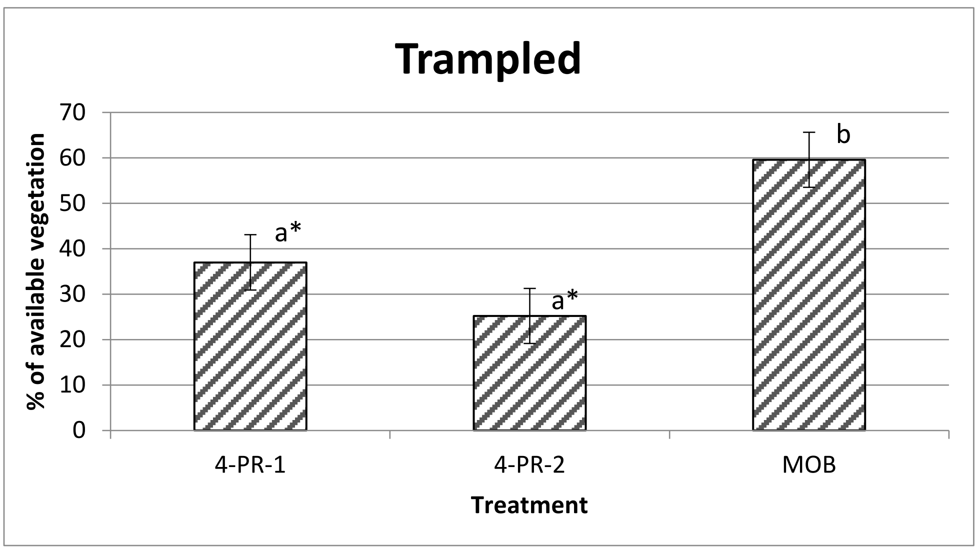

Figure 2. Percent trampled vegetation in 4-PR-1, 4-PR-2, and mob grazed pasture during 2010, 2011, and 2013. ^{ab} **Treatments with like lowercase letters do not differ (P > 0.05).**

Disappearance (harvest efficiency) of vegetation under mob grazing averaged 28%. This was similar to the 4-PR-2 treatment, but significantly less than the 4-PR-1 treatment (Figure 3). Overall, disappearance did not differ between years. High harvest efficiencies are regularly reported by mob grazing practitioners, but data from this study are contradictory.

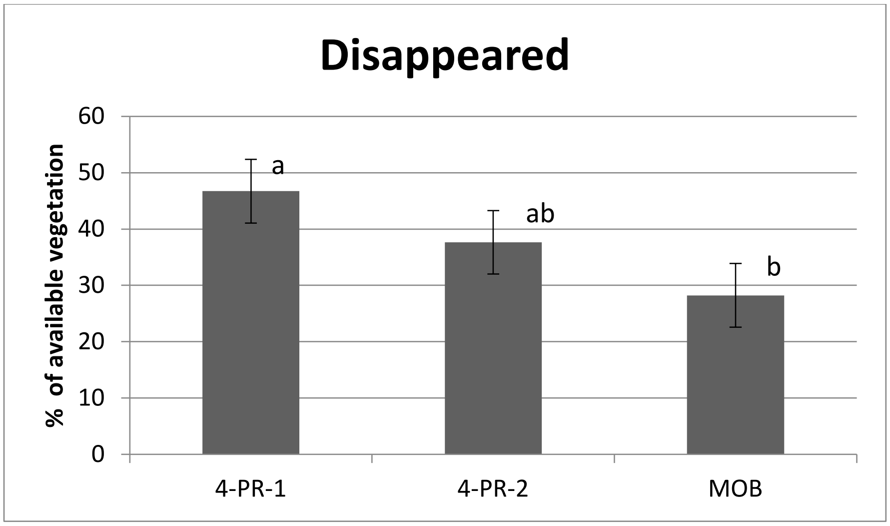

Figure 3. Disappearance (harvest efficiency) in 4-PR-1, 4-PR-2, and mob grazed pastures in 2010, 2011, and 2013. Treatments with like letters do not differ (P > 0.05).

Botanical Composition

There were no grazing treatment effects on botanical composition of vegetation. However, differences between years were observed (Table 2). Warm-season grasses were more abundant in 2012 compared to the previous two years, but were slightly less in 2013, and similar to their abundance in 2010 and 2011. Cool-season grasses declined across all treatments from 2010 to 2013. Annual climatic variation may have been the primary driving factor in the decrease in cool-season grasses in all grazing treatments and control plots. Extreme rainfall events resulted in inundated conditions over a large portion of the treatment area during the grazing season of 2011. Most cool-season grasses cannot tolerate saturated or inundated soil conditions for extended periods of time and many may have drown during this period. Drought in 2012 also likely had a detrimental effect on cool-season grasses.

Sedges increased in relative composition across all treatments from 2010 to 2013 (Table 3). It is expected that sedges would be a plant group to increase with the high rainfall in 2010 and 2011, but surprisingly, their composition increased in the 2012 drought.

The composition of forbs was at its highest level in 2013 (Table 3). Particularly in all grazed treatments, field observations suggest that increases in red and white clover were primarily responsible for the overall increase in forbs.

Table 3. Relative composition (%) of plant functional groups of warm-season grasses, cool-season grasses, sedges, rushes, and forbs for 2010 - 2013.

Plant group	2010	2011	2012	2013
	- (%)	- - - - - - - - - - - - - - - - - - - -		
Warm-season grasses	7^{a}	6^{a}	12^{b}	10^{ab}
Cool-season grasses	58^{a}	48^{b}	43^{c}	35^{d}
Sedges	17^{a}	26^{b}	32^{bc}	34^{c}
Rushes	11^{a}	12^{a}	7^{b}	11^{a}
Forbs	8^{a}	8^{a}	6^{a}	10^{b}

[1] Within plant group (rows), percentages with like letters do not differ (P > 0.05).

For ground cover in all grazed treatments and the control, the percent litter has increased from 93% to 98% from 2010 to 2013. Correspondingly, the percentage of bare soil had declined from 4.9% in 2010 to 1.9% in 2013. These changes would be expected because prior to 2010, this meadow site had been annually hayed.

Quality of Available Vegetation

In 2010, crude protein content (6.7%) of available vegetation was similar between mob and 4-PR-1 during July and August sampling dates. However, crude protein of vegetation during the second cycle (late July and August) of the 4-PR-2 (8.7%) was higher than the other two treatments. It is likely that the increase in CP content during the second cycle of the 4-PR-2 is a result of new vegetative growth following the first cycle. Crude protein content averaged 7.4% in 2011 and 2013 with no differences between treatments or dates. Neutral detergent fiber (NDF) averaged 67% and was similar between treatment with the exception of 2011, where NDF in the 4-PR-2 (63%) was lower than that measured in 2010 or 2013.

Animal Performance

Average daily gains (ADG) in 2011, 2012 and 2013, in the 4-PR-2 treatment differed among years, but were greater than the 4-PR-1 and mob treatments in all years (Fig. 4). The 4-PR-1 treatment had greater ADG than the mob treatment in 2011 and 2012 but was not different from the mob in 2013. In 2013, ADG in the mob was significantly greater than in 2011. Lower ADG in 2012 compared to 2013 in the 4-PR-2 pastures is likely related to the drought and less herbage production.

The greater ADG of the 4-PR-2 steers is likely the result of steers establishing grazing lawns in their first occupation of a pasture, and then concentrating grazing on highly nutritious regrowth on these lawns during the second occupation. Visual assessment of the 4-PR-2 treatments indicated that these grazing lawns had a tendency to establish on approximately the same area each grazing season. Low gains under mob grazing are likely a result of high grazing pressure and limited forage intake due to the high levels of trampling.

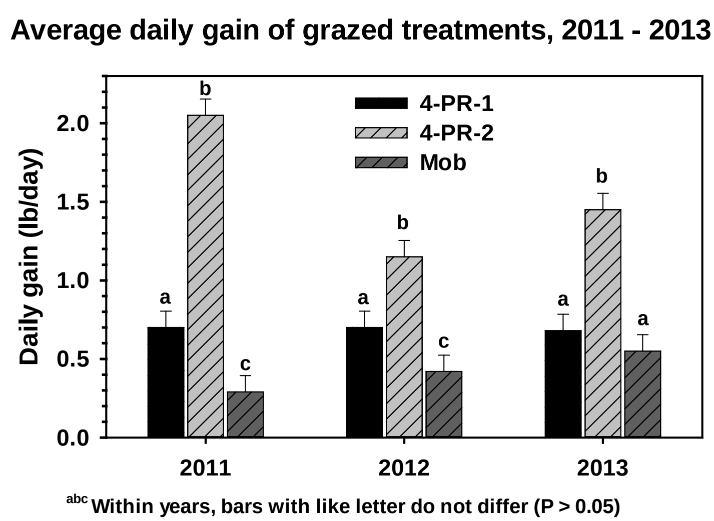

Figure 4. Yearling steer average daily gain, during 2011 - 2013.

Animal Activity

Except for the late June period, steers under mob grazing took more steps each day than steers in the 4-PR-1 or continuous grazing (Fig. 6). The increase in animal activity in the mob pastures is likely a result of the multiple daily moves and pasture shape. In 2013, steers were moved three times daily through pastures measuring only 13 ft. wide and 312 ft. long. While each move may contribute to high activity levels, observations indicated than this long rectangular pasture shape favored increased animal activity. As steers entered a pasture, the first steers to enter begin grazing almost immediately forcing the remainder of the steers to travel around them to obtain new forage. This perpetuated a leapfrog effect, in which an individual may have had to travel the length of the pasture to circumvent the rest of the herd and find fresh forage.

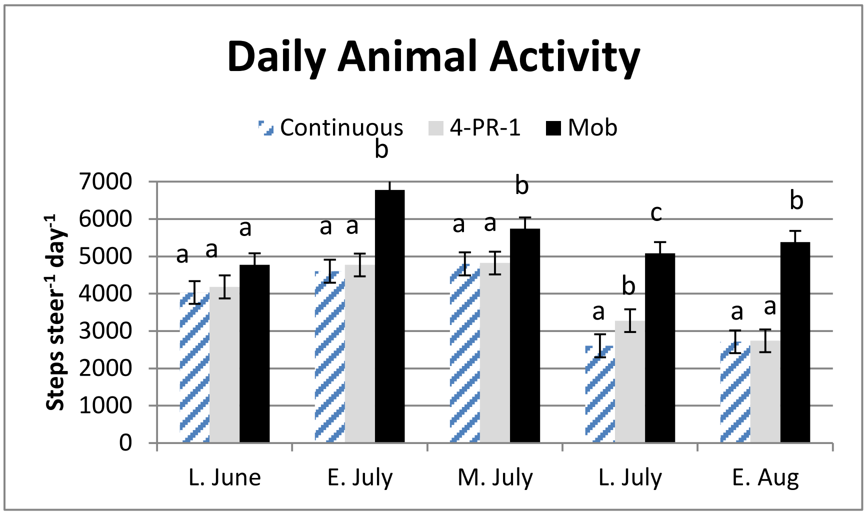

Figure 5. Animal activity (steps/steer/day) at different periods of the grazing season, 2013.

Within a day, peaks in animal activity in mob grazing corresponded to the times when animals were moved to a new paddock (Fig. 6). Steers in 4-PR-1 and continuous also had three bouts of higher activity within a day.

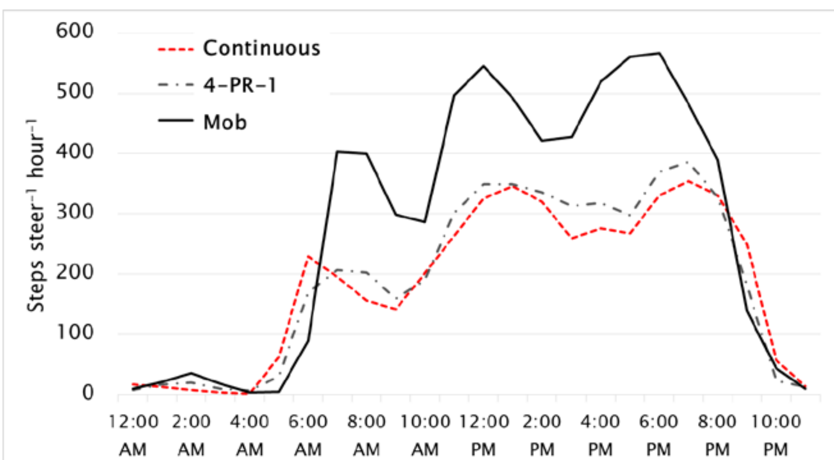

Figure 6. Average daily activity (steps/steer/hour) in continuous, 4-PR-1, and mob grazing treatments, 2013.

Conclusions

Ultra-high stocking density of mob grazing was an effective method of increasing vegetation trampling compared to a traditional four-pasture rotation. Trampling in the mob treatment of this study averaged 60% which was the target level of trampling. Mob grazing practitioners have indicated this level of trampling as the optimum level for increasing soil function. In the fourth year of this study, the increased trampling has not resulted in any significant changes in vegetation production or species composition compared to traditional four-pasture rotations.

Harvest efficiency under mob grazing was less than we had expected. This was likely a result of the high rate of trampling which limited forage available for consumption. Mob grazing does not seem realistic from a livestock production perspective if 60% trampling is desired. At 60% trampling, harvest efficiency is limited requiring moderate stocking rates or reduced animal intake which limits animal production. This low animal performance makes MOB grazing very difficult to justify from an animal production perspective. Significant increases in vegetation production would be required to offset the effects of mob grazing on animal performance as well as the additional infrastructure and labor required in a high management intensive grazing system like mob grazing.

References

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