Effect of Cages on Herbage Yield in True Prairie Vegetation[1]

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Highlight

Forage production under cages in True Prairie vegetation was 640 lb/acre greater than in uncaged areas in ungrazed pastures. Differences were higher on ordinary upland than on limestone breaks range. Weed herbage production was not changed by caging.

Cages to exclude animal influence are widely used in range research to determine herbage utilization in grazed pastures. Ideally, the only factor of the environment changed would be livestock grazing, thus rending a utilization estimate. That may not be accomplished. Cowlishaw (1951) found yields of herbage were greater on areas in a cage than on uncaged and otherwise undisturbed areas. The cages were 9 ft long, 4 ft wide, and 2 ft high at the center of the arch, with 1.75-inch mesh wire. Differences in yield were attributed to differences in microclimate, i.e., temperature, humidity, rainfall effect, and wind movement. Temperature and humidity were found to be greater under cages, therefore, vapor pressure was considerably increased.

Daubenmire (1940) speculated that differences in vegetation might be due to microclimatic changes and recommended that cages be as large and as open as feasible and low in stature. He presented no data to substantiate any cage size or shape as superior.

The Subcommittee on Range Research Methods (1962) suggested that the longer a cage remains, the greater the disparity in herbage yield between caged and uncaged areas. Heady's work (1957) discounted that, at least for California annual range, where early yields were greater on caged plots than on uncaged, but differences disappeared during the growing season.

The literature is sparse regarding the problem of yield differences due to cages. No real evidence supports one cage type over another, and microclimatic effects of cages have had little exploration. This study was to determine if a significant cage effect existed on True Prairie vegetation near Manhattan, Kansas.

Materials and Methods

The study area is in True Prairie vegetation near Manhattan, Kansas. Principle dominants are largely warm season grasses, i.e., big bluestem, (*Andropogon gerardi* Vitman), little bluestem (*A. scoparius* Michx.), indiangrass (*Sorghastrum nutans* (L) Nash), switchgrass (*Panicum virgatum* L.), and sideoats grama (*Bouteloua curtipendula* (Michx.) Torr.). Other grasses and some forbs constitute the small remainder.

Two ungrazed pastures of 44 and 60 acres were used. In the 60-acre pasture, 10 wire cages, 1 meter square and 75 cm high with a mesh of 6 × 6 inches were placed randomly in each of three range sites in late fall, 1966[2]: ordinary upland (OU), limestone breaks (LB), and clay upland (CU). Thirty cages also were placed in the 44-acre pasture, 10 in each of three range sites: OU, LB, and Claypan (Cp). Harvest was in early fall, 1967.

A milacre plot (4.36 ft^2) was clipped to ground level from each caged area and a like area immediately adjacent. Herbage was divided into forage and weeds. Forage consisted of grasses and grasslike plants and perennial forbs found in the climax plant community and grazed by livestock. The herbage was allowed to air-dry. Yields are reported as pounds/acre air-dry material.

[1] Contribution No. 1028, Department of Agronomy, Kansas Agriculture Experiment Station, Kansas State University, Manhattan 66502. Received March 28, 1968; accepted for publication July 6, 1968.

[2] Described by Anderson and Fly, 1955.

Table 1. Production of forage (lb/acre, air-dry) on caged and uncaged plots on OU, LB, CU, and Cp range sites and difference between caged and uncaged plots (60 paired observations).

Caged	2158
Uncaged	1518
Difference	640
P*	>0.001
t**	4.653

* Probability of larger value of t.
** Student's t.

Data were analyzed using student's "t" tests for paired observations.

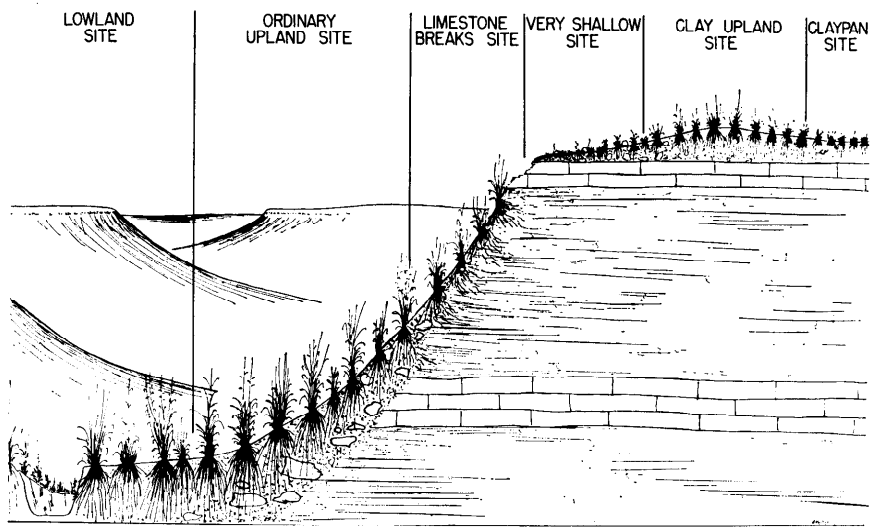

FIG. 1. Range sites in True Prairie vegetation in the Flint Hills of Kansas.

Results and Discussion

Forage production on caged plots was higher than on uncaged plots (Table 1); 640 lb/acre more air-dry forage was produced under cages. No evidence of any large herbivores such as deer was found in the area. Mesh of cages was large enough to permit free access to rabbits and other small mammals, however, no evidence of small animals was seen.

On grazed pastures in a nearby area the differences between caged and uncaged areas (7-yr avg) on moderately stocked pastures was 1,377 lb/acre, on lightly stocked—1,411 lb/acre, and on heavily stocked—2,080 lb/acre. The cage effect in 1967 would account for 47% of the average difference under moderate stocking, 45% under light stocking, and 31% under heavy stocking.

Herbage yields have been increased by limited clipping during the growing season (Jameson, 1963). Intense clipping during the growing season has reduced herbage yield. Yield increases may exist for one to several years. These effects exist on uncaged areas under grazing. During the first few years of an experiment using cages, the area grazed heavily would tend to have a greater relative difference between caged and uncaged areas than on pastures which were moderately grazed. On lightly stocked areas these differences would be exaggerated as well. Under grazing conditions this effect would be extremely difficult to evaluate.

Weed production was not affected by caging and no difference due to range site could be detected at generally accepted probability levels. However, the difference between caged and uncaged areas on OU was greater than on LB range at the 0.1 probability level, perhaps from differences in topography (Fig. 1) that affect microclimate.

Several factors could cause differences found between caged and uncaged areas: insolation, humidity, temperature, precipitation intensity, support, and/or wind movement. Although the cage effect limits the value of caging on assessing livestock utilization, alternative methods also have limitations. The basic danger in using cages to determine utilization is in not recognizing cage effects. Differences between caged and uncaged areas in grazed pastures may indicate grazing use, but they may seldom be true grazing-use figures. If that is recognized, cages remain a valuable research tool. Knowledge of cage effects over a period of years is needed to make adequate corrections.

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