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Drought and Stocking Rate Effects on Forage Yield from Western South Dakota Rangelands

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The vegetation of rangelands in a large portion of western South Dakota is an overstory of cool-season grasses such as western wheatgrass and green needlegrass and an understory of warm-season grasses such as blue grama and buffalograss (Fig 1).

In semi-arid environments, precipitation is the main factor that determines forage production. Many western South Dakota counties receive less than 17 inches of annual rainfall, with 75% occurring between April and October.

Pastures are usually managed as large units (more than 160 acres) because fencing and water developments are costly. Regrowth is usually limited to the spring, and 90% of forage is produced by July 1 (Heitschmidt 2004). Most grazing systems are continuous season-long grazing or simple rotational grazing with less than eight pastures.

Continuous grazing at appropriate stocking rates provides the highest animal performance and pounds per acre. Rest or deferred rotational grazing systems are usually initiated to achieve goals such as improving grazing distribution, range condition, and/or wildlife habitat.

Stocking rate is the key to manage rangeland resources. For example, at the SDSU Cottonwood Range and Livestock Experiment Station 75 miles east of Rapid City pastures that had been heavily stocked for 15 years produced only 58% as much vegetation growth as those that had been lightly stocked (Table 1). Moderately grazed pastures produced 72% of lightly grazed pastures.

Heavier stocking rates shift the plant community to shorter, more grazing-resistant species, such as blue grama and buffalograss that are less productive than the midgrasses.

Response of plant communities to drought (Fig 2) must be considered in developing sound management decisions. Precipitation interacts profoundly with stocking rate to influence vegetation growth. For example, at the Cottonwood station, spring precipitation (April + May + June) was found to be the most important predictor of annual forage yield. In lightly stocked pastures, spring droughts reduced annual forage yield by 21%, while reducing forage yield in moderately grazed and heavily grazed pastures by 27 and 34%, respectively (Table 1). The manager of rangeland resources who chooses to continually stock at heavier rates is at greater risk when drought occurs than one who chooses to stock at lighter rates. In addition, residual forage carryover from lightly grazed pastures may provide an extra benefit of available forage that would not be available in heavily grazed pastures during drought.

In summary, forage yield in semi-arid environments is limited by rainfall. Droughts are normal features of the northern Great Plains. Rangeland plant communities are degraded when stocking rates utilize more than 50% of the annual forage production. Spring droughts in western South Dakota can reduce available forage in heavily grazed pastures more than lightly grazed pastures. Light and moderate stocking rates can improve range condition, enhance range health, and sustain livestock production during seasonal fluctuations in plant plant production.

Reference
Heitschmidt, R.K. 2004. Drought management - Do you have to run out of grass before managing? p.77 in Abstracts: Rangelands in transition. Society for Range Management 57th ann mtg.

Table 1. Forage yield from pastures stocked season-long (May-November) at different rates in years with spring (April through June) droughts (5.7 inches, 75% of average) and no spring droughts (>5.7 inches) from 1945 to 1960, Cottonwood Range and Livestock Station near Philip, S.D.

	Spring precipitation (April-June)[1]		
Stocking rate, AUM/acre	Spring drought	No spring drought	Mean[2]
	lb/ac		
Light; 0.25	1590[ab]	2000[a]	1800[j]
Moderate; 0.40	1100[bc]	1510[b]	1300[k]
Heavy; 0.60	840[c]	1280[b]	1050[k]
Mean[3]	1180[y]	1600[z]	

[1]Means within a row and column followed by different letters (a, b, c) are significantly different (P < 0.10).
[2]Means within a column followed by different letters (j, k) are different (P < 0.10).
[3]Means within a row followed by different letters (y,z) are different (P < 0.10).

Fig 1. Clayey ecological site in 15-17-inch precipitation zone. Picture was taken in June after 3 consecutive years of normal or above normal spring precipitation. Note the abundance of green vegetation

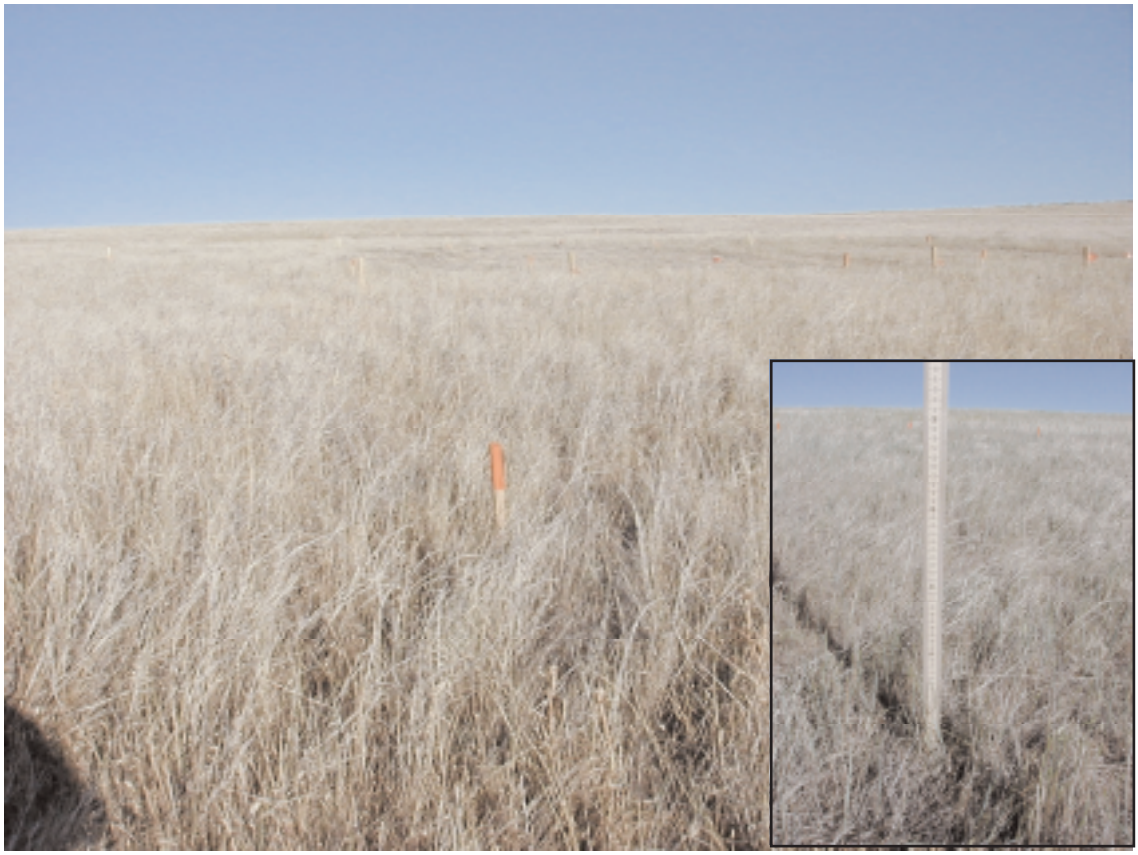

Fig 2. Clayey ecological site in 15-17" precipitation zone. The larger picture was taken in July during the 2002 drought. Western wheatgrass in normal years will grow 12-18 inches, previous year's growth is the standing dead seen in the photo; during 2002 it only grew 8 inches, as seen in inset photo taken in June.

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