FACT SHEET **No. 25**

Rangeland Watershed Program

U.C. Cooperative Extension and USDA Natural Resources Conservation Service

Manure Loading into Streams from Direct Fecal Deposits

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Livestock grazing on rangelands can contribute to nonpoint source pollution in streams. Although sediment is generally considered the largest water quality problem from livestock grazing, nutrients and pathogens may also be of concern. The major nutrients coming from cattle are nitrogen (N), phosphorus (P), and potassium (K). The relatively benign Fecal Coliform (FC), and Fecal Streptococci (FS) bacteria are used to indicate the presence of possible pathogens.

To be considered a pollutant, nutrients and pathogens must reach a stream. Nutrients and pathogens can reach the water either by direct deposit or by overland transport during a runoff event. In most semi-arid environments runoff events are infrequent. Therefore, direct deposit of manure and urine into streams seems to be the most likely mode of nutrient or pathogen loading by livestock. The potential for this mode of contamination depends on time, density, and access. The amount of time that livestock spend in or near streams can be variable as shown by studies at the San Joaquin Experimental Range (SJER) in the foothills of the Sierra Nevada Mountains in California and in Eastern Oregon (Table 1). The difference in drinking time in Table 1 may be that cattle drank from a trough at the SJER, and from streams in Eastern Oregon.

In 1989, Oregon researchers observed the daily fecal deposits and amount of time spent in the creek by different classes of cattle and during different seasons in a high desert stream in Central Oregon (Table 2). They found that time spent in the creek and direct fecal deposits varied by season. This perennial stream is one to three feet wide and ½ to three feet deep. It is characterized by 100 to 300 yard wide riparian zones and bottom-land stringer meadows with slopes generally less than five percent dominated by Kentucky bluegrass with some alfalfa and clover. During the winter months some meadows were used for supplemental feeding areas. These meadows and riparian areas were part of a larger pasture that included uplands with 10 to 40 percent slopes consisting of juniper woodlands, sagebrush, and bunch grass. These uplands were dry and relatively unpalatable by early to mid summer.

Table 1. Amount of time beef cattle spent drinking water as recorded in studies in California and Eastern Oregon.

Author	Drinking Time min/cow/day	Location
Wagnon 1963	3 to 6	SJER, California
Sneva 1970	17	Eastern Oregon
McInnis 1985	26	Eastern Oregon

Table 2. The amount of time† cattle spent in the stream and the number of defecations directly into a high desert stream in central Oregon. Time in the stream includes drinking, loafing, etc. (From Larsen 1989)

Season	Cattle Class	# of Animals	Time Spent in Stream min/cow/day	Instream Fecal Deposit def/cow/day
Summer	cow/calf	17	11.2	0.41
Fall	cow/calf	18	3.0	0.19
Fall	bull	19	2.3	0.00
Winter	cow	109	5.6	0.20
Winter	yearling	400		0.14
Spring	cow/calf	116	3.9	0.17
	Average		5.2	0.19

†Based on non-replicated observations for a two day period within each season. These values may not be applicable to other streams or grazing regimes and should be verified by further research.

The fecal loading rate of grazing cattle depends on the amount of time the cattle are grazing in a pasture with a stream. Using the values in Table 2 with estimates of defecation rates, nutrient content, and bacteria concentration in manure (Table 3) we estimated the potential nutrient and bacterial loading directly into the stream (Table 4).[1]

[1]This analysis was conducted by range scientists to obtain a rough idea of fecal pollution risk from range livestock. These estimates are based on average defecation rates, nutrient contents, and bacteria concentrations in manure and may not reflect the real rates and contents at the site and time of the study. Furthermore, it would not be scientifically valid to extrapolate these estimates to other locations or conditions or to scale the data up to a county, state, or national scale. There is simply too much variation in climate, land, cattle, and management to extrapolate this data to other situations. One or more environmental groups have used information from an earlier version of this fact sheet inappropriately to support their proposals to exclude livestock from rangeland streams.

Table 3. The amount of manure, nitrogen (N), phosphorus (P), potassium (K), fecal coliform (FC) and fecal streptococci (FS), produced by beef cattle. Based on one 1,000 lb. beef cow.

12 defecations/day
60 lbs manure/day (88% water)
5 lbs manure/defecation (88% water)
0.34 lb N/day
0.11 lb P/day
0.24 lb K/day
$3.84*10^{10}$ FC/day
$7.2*10^{8}$ FS/day

Sources: Johnstone-Wallace and Kennedy 1944, Moore and Willrich 1982, Moore et al. 1988

The estimates in Table 4 indicate that the amount of manure loading into a stream for any given day, season, or year from one cow is quite small. However, there may still be a concern about pollution. As much as 95% of deposited manure will settle to the bottom of the stream within the first 50 meters (Biskie et al. 1988). The bacteria in the sediment may remain alive for several weeks (Sherer et al. 1992). Less is known about what happens to the nutrients that enter the stream in the manure.

Therefore, daily inputs from directly deposited feces may accumulate on the stream bottom. Any disturbance, such as peak flows, can resuspend sediment creating high concentrations of bacteria, and possibly nutrients for a short period of time. The higher the density of livestock, the higher the concentration of pollution.

Any practice that reduces the amount of time cattle spend in a stream, and hence reduces the manure loading, will decrease the potential for adverse affects of water pollution from grazing livestock. It has been shown that providing a water trough, as an alternative drinking source, may reduce the instream fecal deposition during the winter by as much as 90 percent (Moore et al. 1993, see Fact Sheet #20). In addition, Clawson (1993) found that summer stream use dropped from 4.7 min/cow/day to 0.9 min/cow/day and bottom land use dropped from 8.3 to 3.9 min/cow/day when a water trough was provided as an alternative water source. This indicates that substantial reductions of creek use by cattle can be achieved without fencing out the creek.

Table 4. Estimates of the amount of manure, fecal coliform (FC), fecal streptococci (FS), nitrogen (N), phosphorus (P), and potassium (K) getting into the stream from grazing cattle based on one 1,000 lb beef cow.

Season	Manure		Bacteria		Nutrients		
	wet[†] (lb)	dry (lb)	FC (no.)	FS (no.)	N (lb)	P (lb)	K (lb)
Per Day							
Summer	2.05[‡]	0.25	$1.3*10^9$	$2.4*10^7$	0.012	0.004	0.008
Fall	0.95[‡]	0.11	$6.0*10^8$	$1.1*10^7$	0.005	0.002	0.004
Winter	1.00[‡]	0.12	$5.4*10^8$	$1.2*10^7$	0.006	0.002	0.004
Spring	0.85[‡]	0.10	$5.4*10^8$	$1.0*10^7$	0.005	0.002	0.003

[†]88% water
[‡]Based on non-replicated observations for a two day period within each season.

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