

Effects of Harvester Ants on Production of a Saltbush Community

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Highlight

The presence of denuded areas caused by harvester ants did not lower the production of a Nuttall saltbush community in the Big Horn Basin of Wyoming. Increased saltbush production around the perimeter of the denuded areas compensated for the absence of saltbush within the denuded area.

Western harvester ants (*Pogonomymex occidentalis*) are regarded as a pest of economic im-

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portance on many western ranges. Vast areas of partially denuded range have caused serious concern among ranchers and government agencies, and as a result considerable research on economic methods of control has been implemented. King (1962) estimated that approximately 850,000 acres in the Big Horn Basin of Wyoming were moderately to heavily infested. An earlier study by Hull and Killough (1951) estimated that some 90,000 acres in the Big Horn Basin had been completely denuded by harvester ants.

Other than observing and surveying the extensiveness of the denuded areas, little has been published evaluating the actual damage to range by harvester ants. Past studies (Headlee and Dean, 1908; Hull and Killough, 1951; Bohart and Knowlton, 1953; Severin, 1955) indicated that harvester ants are primarily seed

gatherers. Bohart and Knowlton (1953) also stated that ants utilize almost any protein-rich substance that they can move into their mounds. Hull and Killough (1951) and Knowlton (1963) report serious damage to rangeland by seed removal. Sharp and Barr (1960) found that stands of annual plants were more favorable to establishment of ant colonies than perennial cover of saltsage or shadscale. They also considered increased ant activity to be a result rather than a cause of poor range condition.

Some studies have evaluated the actual utilization of plants by harvester ants. King (1962) working in the Big Horn Basin of Wyoming found that average utilization of false buffalograss (*Munroa squarrosa*) in the denuded areas around the mounds was about 14%. Cole (1932) using a list-chart quadrat found that approximately 3% of the

cheatgrass brome (*Bromus tectorum*) and about 15% of the Russian-thistle (*Salsola kali*) were removed by harvester ants over a 3-month period. Preliminary study results by the University of Wyoming² indicated that percent grass cover was decreased by ant activity in a sagebrush-grass community.

Vegetation around the outside perimeter of denuded areas encompassing ant mounds was observed to be appreciably more vigorous and produce more forage than surrounding unaffected areas. This condition is referred to in this paper as "border effect". A similar response was noted on several plant communities in the Big Horn Basin; however, only the results are reported for the saltbush (*Atriplex nuttallii*) community.

The purpose of this study was to compare saltbush production around the perimeters of denuded areas of anthills with the production of areas not influenced by the border effect, and by considering forage lost due to the denuded areas, evaluate the overall effects of harvester ants on the total saltbush production of the area.

Experimental Area and Methods

The study area was located in the University of Wyoming's Experimental Sheep Pastures in the Big Horn Basin. The pasture sampled has been lightly grazed during the winter months at approximately 20% utilization for the past 8 years. This area is representative of the Nuttall saltbush community which is common to much of the Big Horn Basin. Nuttall saltbush is the dominant plant with very few associated species of significance to the overall species composition and forage production. Fig. 1 represents an example of the Nuttall saltbush community within the study area, and

²This study is being conducted in the Wind River Basin of Wyoming under the direction of R. J. Lavigne and H. C. Fisser of the Plant Science Division of the University of Wyoming.

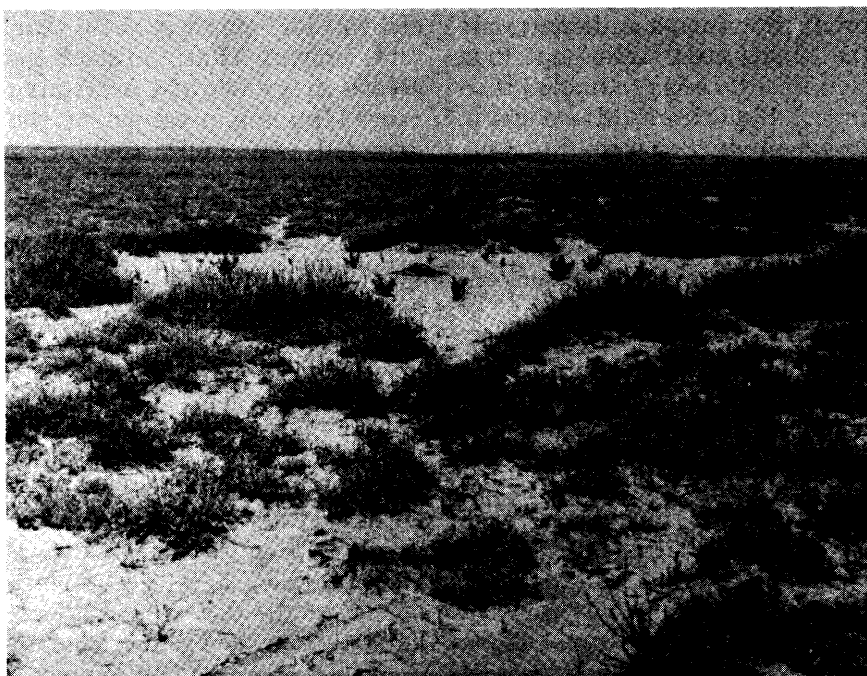


FIG. 1. Nuttall saltbush community with increased plant growth around the perimeter of denuded area caused by harvester ants.

illustrates the condition of increased plant growth around the perimeter area denuded by harvester ants.

Climate of the Big Horn Basin is arid with a long-term average annual precipitation of 7.76 inches. Approximately 50% of the total precipitation occurs in April, May, and June. High evaporation rates prevail, especially during the summer when temperatures over 100 F are common. Temperature extremes have been recorded from 106 to -51 F. (U.S. Dep. Commerce, 1962). The growing season is limited by depletion of soil moisture rather than by temperature, and usually extends over only a short period during the spring and early summer.

Vegetation around five anthills was sampled. The first one was randomly located; the remainder were selected as the four closest neighbors. Sample plots were located within three concentric 5-foot zones extending outward from the perimeter of the denuded area of each anthill along four predetermined azimuths of 90, 180, 270, and 360 degrees (Fig. 2). Estimates of production were determined by clipping 1 x 5 ft quadrats, air drying the forage, and converting to lb/acre. Only Nuttall saltbush was clipped. Other species did not contribute appreciably to overall production.

Cover of Nuttall saltbush was by ocular estimation of percentage foliage cover.

Results and Discussion

Increased vigor and foliage cover of Nuttall saltbush adjacent to the denuded areas around anthills (zone 1) resulted in an average increase of 166.5% in production over zone III which was beyond the primary influence of the border effect. Zone II represented an ecotonal area which had only a slightly greater

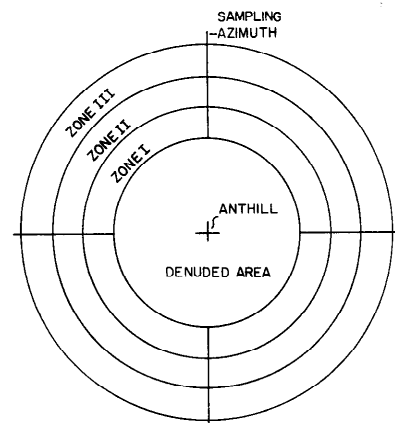


FIG. 2. Illustration of procedure used in sampling for production of Nuttall saltbush.

production (non-significant) than the unaffected area, but had significantly less production than zone I. Significant differences in forage production were found between zone I and both II and III, but not between zones II and III (Table 1). Average production of Nuttall saltbush was 2112.1, 977.8, and 792.4 lb/acre for zone I, II, and III, respectively. Percentage ground cover followed the same pattern. Average diameter of the denuded areas was 30.0 feet and ranged from 28.8 to 38.6 feet.

Increased production, vigor and cover of Nuttall saltbush around the perimeter of the denuded areas can be attributed to the greater supply of soil moisture available to these plants. Increased snow catchment and lack of transpiring plants within the denuded area both contributed to the greater availability of soil water.

The magnitude of the border effect is perhaps greater than might be expected. However, plant growth is not always a linear function of soil moisture. At certain intervals on the soil moisture-plant growth curve there may be a linear relationship, but there are thresholds under which there is little plant response to added moisture and above which there may be a negative response. The rate at which moisture is added and time of application are far more

critical for plant growth than total amount. Thus, the small increase in available moisture caused by the presence of the denuded area might well bring about a disproportionately large increase in plant growth by not only providing more water per plant unit but also by extending the length of time soil moisture was available.

To determine the effect of denudation by ants on the total production of the area, average production of a circular area having a radius of 30 ft with an anthill at its center was compared with an unaffected area of equal size (Table 2). The yield of the unaffected area was calculated from the production data

Table 2. Comparison of an average harvester anthill area with an equivalent size unaffected area, by zones.

Zone	Width ft	Area sq ft	Production lb ¹
Denuded	15	706.9	0.0
Beyond denuded			
0-5' (I)	5	549.7	26.6
5-10' (II)	5	706.9	15.9
10-15' (III)	5	910.9	16.6
Total (including denuded)	30	2874.4	59.1
Unaffected area	30	2874.4	52.3

¹Estimated production of area indicated.

Table 1. Production and percent foliage cover of Nuttall saltbush from concentric sampling zones around denuded areas of harvester antmounds. Average of 5 samples.

Anthill No.	Ave. diam. denuded area	Production lb/A			Pct. foliage cover		
		Zone I 0-5'	Zone II 5-11'	Zone III 10-15'	Zone I 0-5'	Zone II 5-11'	Zone III 10-15'
1	28.4	2478	1676	797	58	34	14
2	21.2	1830	653	1129	38	14	26
3	38.6	2440	1215	571	49	28	16
4	31.0	2103	740	788	35	17	16
5	30.6	1710	605	677	31	15	14
Means*	30.0	2112.1 ^a	977.8 ^b	792.4 ^b	41.8 ^a	21.4 ^b	16.3 ^b

*Means in each group with different letter superscripts are significantly different at the 0.05 level of probability as determined by Duncan's Multiply range test.

of zone III which was considered outside the area of primary influence. Production of the area containing the anthill was 59.1 lb of air-dry saltbush compared to 52.3 lb in the unaffected area. Therefore, increased production in the zone around the denuded area apparently compensated for the loss of production from the bare area. A border strip 10 ft in width surrounding a denuded area 30 ft in diameter has about 1.8 times more area than the denuded area. Thus it would only require a 40% higher rate of production to make up for the lack of production within the denuded area. A comparison of production in the 10 ft border (zones I and II) adjacent to the denuded area was nearly 100% greater than in the unaffected area, and if only zone I was considered this would be even greater.

Percent foliage cover of Nuttall saltbush in zone I (Table 1) was nearly 2.5 times greater than zone III, averaging 41.8 and 16.3%, respectively. Zone II had an average cover of 21.4% which was intermediate between the extremes. This relationship indicated that increased production was at least in part a result of increased foliage cover. Greater height and vigor also contributed to increased production, but was not quantitatively measured. This condition is evident in Fig. 1.

Changes in density or composition of other plant species were not evident within the study area due to the border effect. However, it was noted in heavy use areas adjacent to watering tanks, that borders surrounding the denuded areas were often invaded by fireweed (*Kochia scoparia*), Russianthistle (*Salsola kali*), halogeton (*Halogeton glomeratus*), and clamweed (*Polanisia trachysperma*). Under this condition of depleted range the border effect is not likely to be beneficial due to the ephemeral na-

