Use of a Crested Wheatgrass Seeding by Black-tailed Jackrabbits

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Highlight: *Black-tailed jackrabbit grazing pressure on a seeding of crested wheatgrass surrounded by native shrub vegetation has been estimated by the use of pellet counts. Grazing pressure falls off rapidly away from the edge of the field, 70% of the total being concentrated in a 300-m band around the edge of the field. By calibrating the pellet counts against others taken in an area of known jackrabbit density, and by using values available in the literature for forage consumption of jackrabbits, an estimate has been made of the absolute grazing pressure on the field in the 300-m band which is predominantly used. The forage removed by jackrabbits in this zone is estimated to be in the order of 60 kg/ha/yr. This is less than 10% of nearly all the yield values found, including those in poor years, in comparable seedings in this area. Apparently jackrabbits do not cause serious damage to established seedings of wheatgrass even when jackrabbit densities are high, as they were at the time of this study.*

It is well known that black-tailed jackrabbits (*Lepus californicus*) invade cultivated or managed fields during the nocturnal feeding period (Lewis, 1946; Bronson and Tiemeier, 1958).

This grazing behavior is difficult to observe directly. R. D. Anderson (personal communication) observed significant numbers of hares crossing the boundary of a seeding of crested wheatgrass (*Agropyron desertorum* (Fisch.) Schult.) by watching a sector of it. Routes to the edge of the field offering cover were preferred, and the hares were easily disturbed by activity or noise on the part of the observer, returning rapidly to cover at the field's edge.

It has also been widely remarked in the literature (Taylor et al., 1935; Phillips, 1936; Orr, 1940; Taylor and Lay, 1944; Lechleitner, 1958) that black-tailed jackrabbits appear to favor habitats which provide an interspersion of tall cover with open spaces.

These observations suggest that there might be a tendency for jackrabbit grazing to be concentrated near the edges of seedings. It was thought that if this effect could be quantified, implications might become apparent for the sizes and shapes of seedings which would most effectively limit jackrabbit use.

It was also of interest to know whether the extra food supplied by the seeding would support a larger jackrabbit population around its borders than elsewhere.

Thus the objectives of the work described here were (1) to describe any decrease in the intensity of jackrabbit use with distance into the seeding from its edge; (2) to test whether jackrabbit populations tend to be larger in the immediate vicinity of the seeding than at a distance from it; (3) to try to estimate whether jackrabbit utilization of the seeding might remove an important fraction of its yield.

Study Area and Methods

The seeding studied is in the southern half of Curlew Valley on the Utah-Idaho

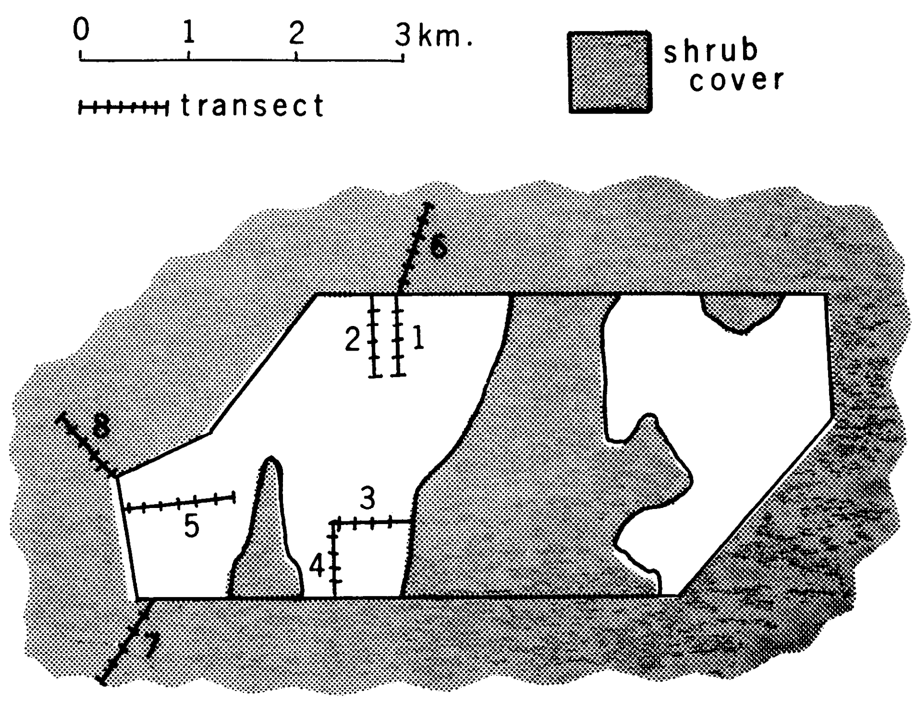

Fig. 1. *Schematic map of the study area, showing the locations of sampling transects.*

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border. It was ploughed and seeded in 1965 and is roughly 7 km by 3 km (Fig. 1). Annual mean precipitation is about 20 cm. The surrounding native shrub vegetation is of several types, lying in a broad transition zone between big sagebrush (*Artemisia tridentata* Nutt.) and the more halophytic shadscale (*Atriplex confertifolia* (Torr. and Frem.) S. Wats.). The black-tailed jackrabbit is the only *Lepus* species found on the study area. A count of the standing crop of pellets per unit ground area was used as an estimator of jackrabbit grazing pressure at each location. All pellets still recognizable as such were counted within 1/4 m^2 circular quadrats; eight such quadrats were positioned randomly at each "location." Locations were placed at intervals of 160 m along arbitrarily chosen transects oriented perpendicularly into the field from its edge. Transects were also situated along roads leading away from the seeding; in these cases the eight quadrats were placed after walking 50 paces to one side of the road. A further transect was run through a 1-square-mile site located about 6 km west of the western end of the seeding. This site is regularly used for estimates of the absolute density of jackrabbits. The animals are estimated by "jackrabbit drives" (Gross, 1967), as part of continuing studies of jackrabbit demography (Stoddart, 1971).

All pellet counts were completed between March 25 and April 10, 1972.

Results

Patterns of Use

The locations of the transects taken are shown in Figure 1. Transects 1–4 show a similar pattern, and these results have been pooled. The trend of pellet density with distance into the field for these pooled results is shown by line *A* in Figure 2. Under the conditions represented by these transects, about 70% of the total pressure of jackrabbit use on the field is concentrated in a 300-meter band around its edge.

Transect 5 represents a different situation (line *B* in Fig. 2). This transect occurs close to a corner of the field and at its end reaches the tip of a tongue of invading shrubs; so hares feeding at locations more than about 400 m along this transect would have access to cover closer than the beginning of the transect. This presumably accounts for the failure of the pellet density to fall to near-zero values. The absolute densities of pellets may be higher because hares are entering the field from more than one direction. There is no evidence of a higher population in the native vegetation adjacent to this particular transect; that is, transect 8 does not show higher pellet counts than transect 7 and 6 (Table 1).

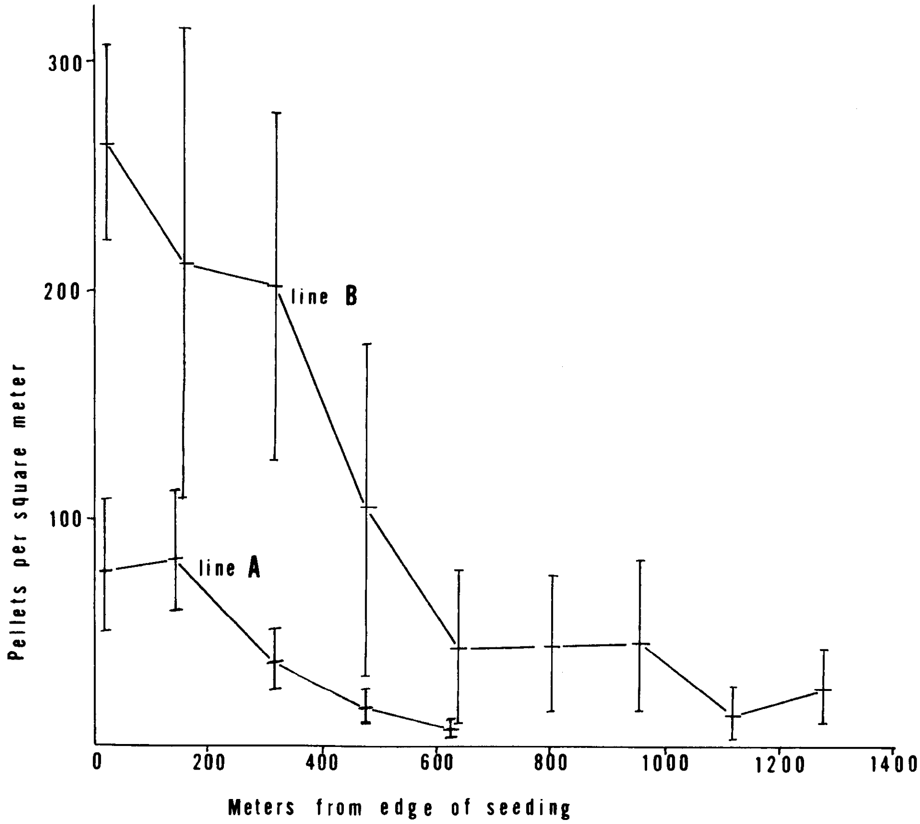

Fig. 2. *Number of pellets per m² (mean and 95% confidence limits) at various distances into a field. Pooled results from transects 1–4 (line A), and results from transect 5 (line B).*

There is no obvious trend toward higher populations in the native vegetation immediately adjacent to the wheatgrass field, compared to those up to 900 m away (Table 1). The low values in the first two locations on transect 6 come from open patches dominated by the annuals *Lepidium perfoliatum* L. and *Halogeton glomeratus* (Bieb.) L. A. Meyer rather than from shrub vegetation.

Assumptions

Three assumptions are necessary to the calculations which follow.

The first is that the pellets found represent at least one whole year's history of pellet deposition. This assumption is necessary because the calculations which follow compare the demography research area, where jackrabbits are present year-round, to the seeding, which they use seasonally; the calculations would be wrong if the pellet counts in the seeding were heavily weighted by any one season. Arnold and Reynolds (1943) give an average daily pellet count of 531 ± 27 for a jackrabbit, irrespective of age, sex, size, or species. Cochran and Stains (1961) found comparable values for cottontails (*Sylvilagus audubonii*) on natural diets, ranging down to 100 on various artificial diets. The value of 531 is probably near the upper end of the likely range. In the autumn of 1971 there were estimated to be 691 hares per square mile, or 2.7/ha, on the jackrabbit demography research area (F. H. Wagner and L. C. Stoddart,

Table 1. Number of pellets per m² (mean and 95% confidence limits) at various distances along transects leading away from the field.

	Distance (m) along transect from seeding's edge						
Transect number	16	160	320	480	640	800	960
6	69 ± 32	49 ± 20	82 ± 39	240 ± 113	154 ± 52	155 ± 35	
7	123 ± 108		66 ± 36		104 ± 87		83 ± 64
8	101 ± 47		104 ± 62		86 ± 41		

unpublished datum[1]). (The number of rabbits in autumn probably overestimates the year-round mean.) If each animal is depositing 531 pellets/day, this implies a yearly deposition of about 52 pellets/m^2. This yearly deposition is well below the actual measured density of $143 \pm 76/m^2$, so that pellets are apparently persisting for at least a year after deposition.

Secondly we assume that the number of pellets found at a location is proportional to the pressure of the jackrabbits on the vegetation there. This can be divided into three subsidiary assumptions. First, animals on a natural diet produce pellets predominantly while feeding, and at a reasonably constant rate (Lechleitner, 1957; Flux, 1967). Second, pellets are not moved after deposition over distances (hundreds of meters) great enough to account for the distributions observed. There is no evidence of movement by wind or water; pellets are not found in aggregations against natural wind-breaks, and the absence of any system of channels shows that there is little net water movement on the study area. Third, any variation in the rate at which pellets disintegrate and become unrecognizable is insufficient to account for the distribution pattern observed. Flux (1967) has observed a six- to ten-fold variation in that rate, but the variation was strongly correlated with an altitudinal gradient. In his opinion, pellets do not normally break up until they are overgrown by vegetation. If so, there should be little systematic variation in the rate of disappearance of pellets inside the field. The difference between the rate inside the field and that in shrub vegetation should not be great, since the species composition of the herb layer, the elevation, and probably precipitation and temperature, are similar for the two situations.

A third assumption is that jackrabbits waste little or no material when eating the leaves of perennial grasses (Vorhies and Taylor, 1933; Arnold, 1942; Currie and Goodwin, 1966). This is in contrast to their behaviour when eating shrubs or tall crops, when they may waste as much as or more than they actually consume. Serious wasting of grass leaves could occur if a situation arose in which the bases of stems or leaves remained green and succulent while the leaves were dry.

Estimation of Impact

All samples from transect 9, situated on the jackrabbit demography research area, have been pooled. The mean number of pellets per square meter is 143 ± 76 (95% confidence limits).

There is good agreement in the literature that the adult *Lepus californicus* consumes 100–130 grams of "native air-dry forage" per day (Arnold, 1942; Arnold and Reynolds, 1943; Haskell and Reynolds, 1947; Currie and Goodwin, 1966). Two and seven-tenths (2.7) individuals/ha, working year-round, would consume about 108 kg/ha/yr of native air-dry forage. This is the situation which is found on the jackrabbit demography site, where the pellet density is 143/m^2. If we can assume that pellet density is proportional to grazing pressure, then 143 pellets/m^2 represents removal of 108 kg/ha/yr, or 10 pellets/m^2 represents removal of $108/14.3 = 7.5$ kg/ha/yr.

Mean pellet density in the 300 m at the perimeter of the field where jackrabbit use is concentrated is about 80/m^2 (Fig. 2, line *A*). The pressure on this area is therefore about $80/10 \times 7.5 = 60$ kg/ha/yr.

Hull and Klomp (1966) give a total of 108 years of yield records for eight different crested wheatgrass seedings in southern Idaho. The mean yield is 1305 kg/ha, with a range of 347-3080. Only 5 years of the 108 have yields less than 600 kg/ha. The highest grazing pressure exerted by jackrabbits on the field, then, near its edge, by what is a 10-year-high population density of jackrabbits (Stoddart, 1971), corresponds to less than 10% of the yield of comparable seedings in all but the very poorest years.

This estimate has dealt with values for entire years; it is possible that if all 60 kg/ha were removed at the very beginning of the growing season the damage might be severe. However, use of the seeding is spread through the whole period during which there are green leaves on the plant (R. D. Anderson, unpublished observations). This low estimate of grazing impact agrees with the subjective observation that there is no striking diminution in vigor of the grass toward the periphery of the field.

Although the current jackrabbit density is as high as any since 1962, there are anecdotal reports of much higher densites at earlier peaks such as that in 1958. Actual measurements of densities reported in the literature, however, range from 0.7 to 2.7 hares/ha (Stoddart, 1972).

Conclusions and Management Implications

1) About 70% of the total forage removal by jackrabbits from the field is concentrated in a band 300 m wide around its edge.

2) There is no obvious tendency for jackrabbit densities to be higher in the immediate vicinity of the field than at distances 500 to 900 m from it.

3) Within the band 300 m wide at the field's perimeter where most grazing is concentrated, the forage removed by the highest density of jackrabbits for at least a decade is on the order of 60 kg/ha/yr. This is less than 10% of all but the very lowest yields recorded from comparable seedings, which suggests that jackrabbits do not damage established seedings even near their edges.

A jackrabbit population density such as the one currently being experienced in Curlew Valley could conceivably affect the establishment of a new wheatgrass seeding in its first year. It may be advisable to seed, when possible, during periods of low jackrabbit density.

Since the pressure of jackrabbit use is concentrated around the edges of seedings, the mean pressure over the field as a whole will be reduced by making fields as large and as circular as possible and by taking action to destroy shrub invasions. However, these results also indicate that jackrabbit grazing pressure is not so heavy as to make this an important criterion in the design of new seedings.

Damage due to jackrabbits in arable crops could conceivably be very much more severe. This is partly because they may be willing to penetrate more deeply into a field in which the crop provides more cover, and partly because the wastage may become very high when jackrabbits are eating tall crops (Arnold, 1942).

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[1] Estimated by methods described in Stoddart (1972).

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