Townsend Ground Squirrel Diets in the Shrub-Steppe of Southcentral Washington

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Abstract

Microscopic study of fecal pellets from Townsend ground squirrels occupying the shrub steppe region of southcentral Washington showed that squirrels preferred to feed on bluegrass (*Poa* sp.) and forbs (*Descurainia pinnata* and *Lupinus laxiflorus*); phlox (*Phlox longifolia*) may also be a favored food item. Bluebunch wheatgrass (*Agropyron spicatum*), six-weeks fescue (*Festuca octoflora*), and lomatium (*Lomatium macrocarpum*) were avoided. No significant differences between diets of ground squirrels occupying grazed and ungrazed study areas or between diets of male and female or adult and subadult ground squirrels were found.

Ground squirrels are prevalent in most shrub-steppe communities of the western United States. The Townsend ground squirrel (*Spermophilus townsendii*) generally makes its first appearance aboveground during late January or early February (Scheffer 1941). After emergence, the squirrels remain active until enough body fat has been stored to sustain them through the long summer aestivation and winter hibernation periods. Dormancy begins between May and July, and depending on age and sex, normally lasts until the following winter (Burt and Grossenheider 1976; Hall and Kelson 1959).

Townsend ground squirrels are known to consume a wide variety of plant materials as food items. Alcorn (1940) reported that Townsend ground squirrels subsist mainly on green vegetation. Davis (1939) listed some food items of an Idaho ground squirrel (*Spermophilus idahoensis* = *S. burnneus*) that included blue grass (*Poa* sp.), peppergrass *Lepidium* sp., shepherd's purse (*Capsella* sp.), and white clover (*Trifolium repens*). He also collected specimens gorged with June grass (*Koeleria* sp.). Johnson (1977) identified 14 food items from stomach contents of ground squirrels on the Arid

Lands Ecology (ALE) Reserve.

Dietary information provides an important parameter for clarifying several ecological phenomena, including niche boundaries, competitive relationships, energy transfer patterns, and nutrient cycling processes. The purpose of this study was to compare the age- and sex-specific food habits of ground squirrel populations inhabiting adjacent grazed and ungrazed habitats. Work was done on the Arid Lands Ecology (ALE) Reserve, located on the Department of Energy's Hanford site in southcentral Washington.

Study Site and Methods

The ALE Reserve is situated on the gently sloped east face of the Rattlesnake Hills near Richland, Wash., approximately 365 m (1,200 ft) above sea level. The vegetation is typical of the sagebrush/bunchgrass (*Artemisia tridentata*/*Agropyron spicatum*) community described by Rickard et al. (1975). Grazed and ungrazed study areas (9 ha each) were established in homogeneous plant communities in 1971 to ascertain the effects of cattle grazing on a shrub-steppe ecosystem (Uresk and Rickard 1976). A lightning-induced wildfire occurred during August 1973 and burned through the ungrazed area, but a roadway prevented the fire from burning through the grazed study plot.

Small mammal live trapping studies were conducted to measure the response of ground squirrel populations to both grazed and ungrazed conditions. During these studies we noted that the animals usually defecated during handling. We collected fecal pellets during peak months of ground squirrel activity (March through May) for dietary analysis in 1974. Excreta were collected directly in a small plastic vial or from the plastic bag used to contain the squirrels after their removal from the live trap. Vials containing fecal pellets were marked in the field with the individual ground squirrel's identification number, sex and age class (adult or subadult). We based our age determinations on body size, pelage and general appearance and released the animals unharmed following normal data recording activities. Fecal samples were oven-dried for 48 hr at 65°C and ground in a Wiley mill over a 1-mm screen. Two microscope slides were prepared for each sample and 20 fields analyzed per slide. Plant food items were identified by examination of cellular characteristics (Sparks and Malcechek 1968, Rogers and Uresk 1974).

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Plant habitat frequencies were determined from sixteen 0.5-m² quadrats sampled on a monthly basis within each study period. Comparisons of ground squirrel diets were made using rank correlation analysis (Dixon and Massey 1969) and similarity index values (Oosting 1956). Similarity values compare amounts while rank correlation compares the proportions of consumed food items.

Results and Discussion

During our study, fecal pellets from 72 ground squirrels were examined and 15 plant taxa identified. The most commonly occurring food items in their diets were bluegrass (*Poa sp.*) and the forbs tansy mustard (*Descurainia pinnata*) and lupine (*Lupinus laxiflorus*, see Table 1). The habitat frequencies of these three heavily foraged species were substantially less than diet frequencies, an indication that the ground squirrels actively search these plants out. Bluebunch wheatgrass (*Agropyron spicatum*), six weeks fescue (*Festuca octoflora*) and lomatium (*Lomatium macrocarpum*) had frequencies of 8% to 17% in the habitat and <1% in the diets, indicating that the squirrels were avoiding these plant species as food items. Phlox (*Phlox longifolia*) occurred with habitat frequencies of 1% and 2% and diet frequencies of 6% and 5% in the grazed and ungrazed areas respectively, indicating that it may be a preferred food item. The low frequency of big sagebrush (*Artemisia tridentata*) in the pellets (2%) approximated its occurrence in the grazed area (3%), indicating that it may neither be selected nor avoided

Table 1. Relative frequency of plant species in the habitats and diet of Townsend ground squirrels.

Plant species	Grazed area		Ungrazed area	
	Habitat	Diet	Habitat	Diet
Grasses				
<i>Agropyron spicatum</i>	13	<1	17	<1
<i>Bromus tectorum</i>	3	0	4	0
<i>Festuca octoflora</i>	8	0	11	0
<i>Poa spp.</i>	13	26	18	29
<i>Stipa thurberiana</i>	1	<1	<1	1
Total	38	26	50	30
Forbs				
<i>Amsinckia lycopoides</i>	1	0	0	0
<i>Antennaria dimorpha</i>	2	1	2	<1
<i>Astragalus purshii</i>	<1	<1	<1	4
<i>Calochortus macrocarpus</i>	8	0	7	0
<i>Chenopodium album</i>	0	0	0	<1
<i>Crepis atrabarba</i>	10	0	1	0
<i>Descurainia pinnata</i>	13	15	16	33
<i>Draba verna</i>	1	0	2	0
<i>Erigeron filifolius</i>	7	0	2	0
<i>Eriophyllum lanatum</i>	0	<1	0	<1
<i>Holosteum umbellatum</i>	<1	0	<1	0
<i>Lappula redowskii</i>	<1	0	0	0
<i>Lepidium perfoliatum</i>	0	4	3	1
<i>Lomatium macrocarpum</i>	9	0	12	0
<i>Lupinus laxiflorus</i>	1	25	<1	11
<i>Microsteris gracilis</i>	<1	0	0	0
<i>Plantago purshii</i>	2	0	2	0
<i>Salsola kali</i>	0	0	0	<1
<i>Sisymbrium altissimum</i>	2	0	3	0
<i>Townsendia florifer</i>	0	3	0	<1
Total	56	48	47	49
Shrubs and Half Shrubs				
<i>Artemisia tridentata</i>	3	2	0	0
<i>Eurotia lanata</i>	0	<1	0	0
<i>Phlox longifolia</i>	1	6	2	5
Total	4	8	2	5

Table 2. Comparison of male versus female and adult versus subadult food habits.

	Grazed		Ungrazed	
	<i>R_s</i>	<i>SI</i>	<i>R_s</i>	<i>SI</i>
Male versus female	0.73	0.78	0.91	0.87
Adult versus subadult	0.79	0.71	0.66	0.76

R_s = rank correlation.

SI = similarity index.

as food. Big sagebrush was eliminated by fire and did not occur in the diets of ground squirrels from the ungrazed area. The frequency of occurrence of the other plant species was not significantly different ($\alpha = 0.5$) within the study pastures, indicating that neither grazing nor burning adversely affected that habitat frequencies shown in Table 1. Some miscellaneous food items from the grazed and ungrazed areas (respectively) included insects (14% and 9%), seeds (5% and 6%), and pollen (<1% and 0%).

Rank correlation (*R_s*) and similarity index (*SI*) values both indicate equivalency between the diets of ground squirrels from the grazed and ungrazed study areas (*R_s* = 0.69, $\alpha = 0.05$; *SI* = 0.73). This indication that the moderate rate of cattle grazing imposed on the study site has had little impact on the diets of resident ground squirrels is further strengthened by an earlier study of cattle diets on the grazed pasture. Uresk and Rickard (1976) found that cattle primarily selected bluebunch wheatgrass, Cusick bluegrass (*Poa cusickii*), Thurber needlegrass, and hawksbeard (*Crepis atrabarba*) for grazing. The only one of these taxa frequently selected by the ground squirrels was the bluegrass; however, it is likely that ground squirrels mostly consume Sandberg bluegrass (*Poa sandbergii*) as reported by Johnson (1977) rather than Cusick bluegrass. No distinction was made between Cusick and Sandberg bluegrass fragments contained within fecal pellets during this study.

Comparison of the diets of male versus female and adult versus subadult ground squirrels clearly shows their diets to be equivalent for populations occupying both grazed and ungrazed habitats (Table 2). This is not surprising since these ground squirrels are active aboveground only during the late winter and spring months when the availability of green plant material is high. They remain below-ground in a torpid condition the rest of the year when green forage is scarce, thereby precluding intense competition for food and the necessity for the different sexes or age groups to specialize on particular food items.

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