HABITAT AND DISTRIBUTION OF PYGMY RABBITS (*SYLVILAGUS IDAHOENSIS*) IN OREGON

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Abstract.— An investigation to determine the location and extent of populations of pygmy rabbits (*Sylvilagus idahoensis*) in Oregon, and to describe several biotic and physical components within communities that include pygmy rabbits, was conducted from October 1981 to September 1983. Of 211 sites suspected of supporting the species based on interpretation of museum records, aerial photographs, soil maps, and interviews with biologists and area residents, 51 exhibited evidence of being inhabited when examined in summer 1982. Soil and vegetation components were sampled at 15 sites occupied by pygmy rabbits and 21 sites adjacent thereto. At inhabited sites, mean soil depth (51.0 ± 2.3 cm), mean soil strength of surface (0.8 ± 0.2 kg/cm^2) and subsurface (3.8 ± 0.3 kg/cm^2) horizons, shrub height (84.4 ± 5.8 cm), and shrub cover (28.8 ± 1.4%) were significantly greater ($P < 0.05$) than at unoccupied adjacent sites, but percent basal area of perennial grasses (3.7 ± 0.9%), density of annual grasses ($5.2 \pm 2.1/1{,}000$ cm^2), density of forbs ($3.4 \pm 0.6/1{,}000$ cm^2), and cryptogam cover (2.4 ± 0.5%) were not. Except for the clay component of subsurface soils, texture of surface and subsurface soils were not significantly different between sites occupied by pygmy rabbits and adjacent sites. The affinity of pygmy rabbits for areas with greater shrub cover, shrub height, soil strength, and soil depth, and, to a small degree, coarser soil texture possibly was related to availability of forage, security from predation, and ease of burrow construction. Analysis of 472 samples of sagebrush (*Artemisia tridentata*) collected at and near sites inhabited by pygmy rabbits indicated their distribution was not dependent upon the presence of specific subspecies of sagebrush. A marked decrese in evidence of occupancy of sample sites and of pygmy rabbit activity at occupied sites in 1983 indicated that populations of pygmy rabbits were susceptible to rapid declines and possible local extirpation. Fragmentation of sagebrush communities poses a potential threat to populations of pygmy rabbits, but the severity of the threat presently is unknown.

Pygmy rabbits (*Sylvilagus idahoensis*), the smallest leporid, are endemic to the Great Basin and adjacent intermountain areas of the western United States (Green and Flinders 1980a). The distribution of this species is disjunct within a geographic range that reaches its westernmost extent in Oregon (Hall 1981). In Oregon pygmy rabbits occur in seven counties south and west of the approximate line connecting Klamath Falls, Fremont, Redmond, and Baker (Olterman and Verts 1972). These rabbits typically are associated with clumped stands of big sagebrush (*Artemisia tridentata*) (Anthony 1913, Davis 1939, Orr 1940, Bradfield 1975), where soils usually are deep and friable (Orr 1940, Janson 1946, Campbell et al. 1982). Where habitat requirements are met, pygmy rabbits dig relatively shallow burrows, usually in aggregations (Janson 1946). Because *S. idahoensis* is the only native leporid to excavate its own burrows (Janson 1946), the influence of soil characteristics upon its distribution likely is unique among rabbits and hares of this continent. Associations between pygmy rabbits and habitat types, however, are based primarily on natural histories; quantitative descriptions of soil characteristics at sites occupied by pygmy rabbits do not exist, and quantitative descriptions of vegetation components at sites inhabited by pygmy rabbits are known from a single study conducted in Idaho (Green and Flinders 1980b). Because large areas of sagebrush land are undergoing renovation for grazing or conversion to irrigated agriculture (Green and Flinders 1980b), and because the current status of pygmy rabbits in Oregon is undetermined (Olterman and Verts 1972), information regarding habitats occupied by *S. idahoensis* should be of special interest to biologists and managers. The objectives of this study were to determine the location and extent of populations of pygmy rabbits in Oregon, and to describe several biotic and physical components of habitats occupied by pygmy rabbits.

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Methods

Location of Areas Occupied by Pygmy Rabbits

The search for pygmy rabbits was conducted in areas where pygmy rabbits were collected previously. Olterman and Verts (1972) reported that museum collections contained S. *idahoensis* from 37 sites in Oregon (Fig. 1A), but locality descriptions obtained from these records lacked precision needed to locate populations. Interpretation of aerial photographs and information obtained from soil maps were used to narrow the search for pygmy rabbits within general areas identified from locality descriptions for museum records. In cooperation with the Environmental Remote Sensing Applications Laboratory at Oregon State University, stereoscopic surveys of U-2 high-altitude infrared photographs were used to locate areas most likely to support the species. Locations of areas with photographic characteristics similar to sites with known populations of pygmy rabbits were recorded on U.S. Geographic Survey 1:250,000 topographic maps. Soil maps and soil descriptions (Oregon Water Resource Board 1969) were used to identify deep, friable, sandy-loam soils in southern and eastern Oregon. Correspondence and interviews with biologists and field personnel from state and federal agencies and local residents provided locations of known or suspected areas occupied by pygmy rabbits; these areas also were examined.

The search for sites occupied by pygmy rabbits was conducted from June to October 1982. Two people on foot searched for evidence of pygmy rabbits at each site for approximately 30 min; areas inhabited by pygmy rabbits were identified by presence of burrows and fecal pellets or by sighting of individuals. Distribution, degree of weathering, and abundance of fecal pellets provided a basis for distinguishing burrows used by pygmy rabbits and were an aid in estimating the limits of sites occupied by the species. We considered a pygmy rabbit burrow to include all burrow entrances associated with it.

Sites at which pygmy rabbits occurred and at which habitats were sampled in 1982 were examined during summer 1983 to ascertain continued use by pygmy rabbits. Presence of open burrows and recently deposited fecal pellets were criteria used to establish continued occupancy of sites.

Fig. 1. A. Thirty-seven sites at which museum specimens of pygmy rabbits were collected in Oregon. (Map modified after Olterman and Verts [1972]. One map location without accompanying record of locality was deleted.) B. Two hundred eleven sites examined for evidence of pygmy rabbits, Oregon, 1982. C. Fifty-one sites at which evidence of occupancy by pygmy rabbits was found, Oregon, 1982. Triangles indicate those sites at which soil and vegetation were sampled; circles indicate those sites that did not meet criteria for sampling.

Sampling of Soil and Vegetation

Biotic and physical properties of sites inhabited by pygmy rabbits were sampled from July to October 1982. Sampling was conducted at a site if evidence of recent activity of *S. idahoensis* was observed and four or more burrows occurred with a maximum distance of 200 m between burrows.

Three parallel line-transects 30 m long and 10 m apart were established at randomly selected starting points at each site sampled. At one site (site 12), sampling was repeated because of apparent vegetative heterogeneity. Transects were located parallel to contours of slopes when present. Shrub height and shrub cover were measured along line transects (Pieper 1978), and clippings from all *Artemisia tridentata* plants that intercepted the transects were collected. Ten 20 by 50 cm plots were placed uniformly along each transect to estimate basal areas of perennial grasses, densities of annual grasses and forbs, and cryptogam cover (Daubenmier 1959). Soil samples were collected at the surface and at 40 cm below the surface (soil depth permitting) at five uniformly spaced stations along each transect; samples from a common depth were combined to obtain a single sample for each transect. Soil depth to 60 cm was recorded and soil strength at the surface and at 40 cm below the surface (soil depth permitting) was measured at each of the five stations with a Soil Test Model CL-700 pocket penetrometer. When soil strength exceeded the limits of the penetrometer, 5.0 kg/cm^2, the maximum value was recorded. A clinometer was used to measure ground slope in the immediate vicinity of each rabbit burrow, and the number of entrances to each burrow system was recorded.

Procedures for sampling soil and vegetative characteristics at sites occupied by pygmy rabbits were repeated at adjacent shrub communities where pygmy rabbit burrows were not found. The sampling of adjacent shrub communities was restricted to areas less than 100 m from a peripheral pygmy rabbit burrow. Pygmy rabbits were presumed to have had access to these sites because *S. idahoensis* reportedly traveled 100 m or more from their burrows in winter and summer (Bradfield 1975, Wilde et al. 1976). Because pygmy rabbit burrows often were distributed along the contours of slopes, adjacent shrub communities were sampled above and below sites occupied by the species. Adjacent communities were not sampled if the shrub component was absent or if evidence of recent habitat disturbance was detected.

Soil texture (Bouyoucos 1962) and subspecific identity of *A. tridentata* were determined (Winward and Tisdale 1969, Shumar et al. 1982) upon return of samples to Oregon State University. Alcohol-leaf extracts from five randomly selected samples of *A. tridentata* from those collected along each transect were examined under long-wave ultraviolet light for blue fluorescence to identify *A. t. vaseyana*. Spectrophotometric analysis of remaining extracts was used to separate *A. t. wyomingensis* from *A. t. tridentata*.

Two-tailed paired t tests were used to determine the probability that mean differences of the same habitat variables sampled at sites occupied by pygmy rabbits and adjacent sites were greater than zero. For sites occupied by pygmy rabbits at which more than one adjacent site was sampled, data from adjacent sites were averaged for analysis. Square-root transformations were performed on all variables measured as percents, but, because inferences drawn from analysis of transformed and nontransformed data did not differ, nontransformed data are reported herein. Discriminant analysis (Klecka 1975) was used to identify habitat components that best distinguished sites occupied by pygmy rabbits from adjacent sites. Habitat variables used in discriminant analysis were shrub cover, shrub height, surface and subsurface soils strengths, soil depth, percent basal area of perennial grasses, density of annual grasses, density of forbs, and percent sand in surface and subsurface soils. Interpretation of the discriminant function was based on pooled within-group correlations between the canonical discriminant function and habitat variables. Pearson correlation coefficients were calculated for habitat variables measured at all sites. Stepwise-multiple regression was used to examine the relationship among number of burrow entrances and soil variables measured at inhabited sites. For all statistical analyses, we accepted $P < 0.05$ as being significant.

RESULTS

Evidence of pygmy rabbits was observed at 51 of 211 sites examined (Figs. 1B and 1C). Fifteen areas occupied by pygmy rabbits met criteria for sampling (Table 1). Twenty-one areas adjacent to 13 sites occupied by pygmy rabbits also were sampled.

Shrub height, shrub cover, and soil depth were significantly greater at 13 sites occupied by pygmy rabbits than at 21 adjacent sites (Table 2). In contrast, percent basal area of perennial grasses, density of annual grasses, density of forbs, and cryptogam cover were not significantly different between occupied and adjacent sites. Soil strengths at surface and subsurface horizons were significantly less at sites occupied by pygmy rabbits than at adjacent sites (Table 2). With exception of percent clay for subsurface soils, components of soil texture were not significantly different at occupied and adjacent sites (Table 2).

Green and Flinders (1980b) also reported shrub height and shrub cover at six sites inhabited by pygmy rabbits in Idaho were significantly greater than in areas that represented 30 small rodent, yellow-bellied marmot (*Marmota flaviventris*), and Uinta ground squirrel (*Spermophilus armatus*) habi-

TABLE 1. Legal description, elevation, ownership, and description of burrows at 15 sites occupied by pygmy rabbits at which characteristics of soil and vegetation were sampled, Oregon, 1892.

Site number	County	Location*	Elevation (m)	Ownership or managing agency	Number burrows	$\bar{X}$ number entrances/ burrow	$\bar{X}$ slope at burrows (%)
1	Lake	T38S, R28E, sec. 34	1585	Private	16	2.3	5.1
2	Lake	T37S, R28E, sec. 14 & 15	1675	Bureau of Land Management	10	1.3	1.5
3	Lake	T39S, R27E, sec. 2	1570	National Wildlife Refuge	7	2.6	3.4
4	Lake	T40S, R27E, sec. 36	1500	State of Oregon	8	2.6	1.2
5**	Lake	T39S, R25E, sec. 33	1400	Bureau of Land Management	7	1.4	7.4
6**	Lake	T35S, R26E, sec. 28	1830	National Wildlife Refuge	9	1.9	16.5
7**	Lake	T34S, R26E, sec. 36	1615	National Wildlife Refuge	5	1.7	5.0
8**	Lake	T38S, R26E, sec. 9	1830	Private	7	1.0	12.3
9**	Lake	T28S, R15E, sec. 22	1380	Bureau of Land Management and Private	12	2.3	2.4
10**	Lake	T26S, R14E, sec. 22	1325	Bureau of Land Management	9	3.9	4.0
11**	Harney	T29S, R29½E, sec. 26	1540	Bureau of Land Management	5	1.6	0.0
12	Harney	T24S, R34E, sec. 18	1280	Private	8	1.9	0.0
13**	Grant	T18S, R32E, sec. 29	1385	Bureau of Land Management	5	1.4	13.0
14**	Grant	T16S, R31E, sec. 6	1450	Private	45	1.2	17.8
15**	Grant	T16S, R31E, sec. 28	1430	Private	10	1.2	8.8

*Localities obtained from Bureau of Land Management 30-min series maps
**No evidence of occupancy by pygmy rabbits detected in 1983

tats and one livestock exclosure. However, mean shrub cover in areas occupied by pygmy rabbits in Oregon (28.8 ± 1.4%) was much less than the 46% in Idaho, and mean shrub height in Oregon (84.4 ± 5.8 cm) was significantly greater than the 56 ± 2.8 cm in Idaho (Green and Flinders 1980b). We suspect that observed differences in shrub cover, in part, were the result of different methods used to make the estimates. The significant difference in shrub height possibly resulted from our decision to delimit occupied areas to within 100 m of peripheral burrows, because mean shrub height at occupied and adjacent sites combined was 65.5 ± 5.0 cm, not significantly different from that reported in Idaho (Green and Flinders 1980b).

There was relatively little overlap for sites occupied by pygmy rabbits and adjacent sites based on measurements of vegetative and soil characteristics (Fig. 2). Correlations between 10 habitat variables used in discriminant analysis and the discriminant function showed that shrub cover best distinguished sites occupied by pygmy rabbits from adjacent sites (r = 0.71), followed by soil depth (r = 0.48), mean shrub height (r = 0.46), soil strength at surface (r = 0.27), and subsurface horizons (r = 0.19). Percent basal area of perennial grasses, density of annual grasses, density of forbs, and components of soil texture contributed little to the separation of occupied and adjacent habitats (]r[< 0.13). Pearson correlation coefficients calculated for habitat variables measured at sites occupied by *S. idahoensis* and adjacent sites showed soil depth was correlated positively with shrub cover (r = 0.64) and shrub height (r = 0.71) and negatively with soil strengths of surface (r = -0.48) and subsurface (r = -0.57) horizons.

The mean number of entrances per burrow at each of the 15 occupied sites sampled was the dependent variable used in stepwise-multiple regression; soil depth, percent slope, strengths of surface and subsurface soils, and percent sand and percent silt at surface and subsurface soil horizons were dependent variables (Tables 1 and 2). The best model (Neter and Wasserman 1974) showed number of burrow entrances varied inversely with slope and subsurface soil strength (R^2 = 0.55).

Of 427 samples analyzed to identify subspecies of *Artemisia tridentata*, 120 were *A. t. vaseyana*, 101 were *A. t. tridentata*, and 167 were *A. t. wyomingensis*; 84 could not be

TABLE 2. Means, standard errors of means, and ranges of habitat variables measured at 13 sites occupied by pygmy rabbits and 21 sites adjacent thereto, Oregon, 1982.

Habitat variable	Occupied sites $\bar{X}$ ± S.E.	Occupied sites Range	Unoccupied sites* $\bar{X}$ ± S.E.	Unoccupied sites* Range
Shrub cover (%) **	28.8 ± 1.4	21.0–36.2	17.7 ± 1.2	13.9–27.1
Artemisia spp. cover (%)**	23.7 ± 1.4	16.3–33.2	14.8 ± 1.5	3.3–26.6
Shrub height (cm)**	84.4 ± 5.8	55.8–115.2	52.7 ± 5.3	24.2–86.9
Artemisia spp. height (cm)**	90.8 ± 5.8	67.7–126.6	56.9 ± 6.1	26.2–103.7
Perennial grasses				
percent basal area	3.7 ± 0.9	0.0–9.8	4.2 ± 0.7	0.0–9.4
Annual grasses				
density (n/1,000 cm^2)	5.2 ± 2.1	0.0–20.6	5.6 ± 3.6	0.0–46.2
Forb density (n/1,000 cm^2)	3.4 ± 0.6	0.2–6.3	4.3 ± 1.0	0.2–11.4
Cryptogam cover (%)	2.4 ± 0.5	0.1–5.4	2.3 ± 0.4	0.0–4.5
Soil depth (cm)**	51.0 ± 2.3	36.2–60.0	31.0 ± 3.1	16.3–52.6
Soil strength (kg/cm^2)				
Surface **	0.8 ± 0.2	0.2–2.4	1.9 ± 0.4	0.3–4.7
Subsurface (40 cm)**	3.8 ± 0.3	1.2–5.0	4.6 ± 0.2	2.0–5.0
Soil texture (surface)				
Sand (%)	51.1 ± 2.7	35.7–71.1	48.8 ± 3.2	25.5–65.8
Silt (%)	30.4 ± 2.1	16.6–44.7	31.8 ± 2.3	20.7–45.3
Clay (%)	18.5 ± 1.5	10.5–26.1	19.9 ± 2.2	13.0–41.2
Soil texture (subsurface)				
Sand (%)	50.2 ± 3.9	32.5–81.2	43.0 ± 4.6	24.8–68.8
Silt (%)	27.0 ± 2.1	12.0–35.8	26.4 ± 2.3	16.6–44.1
Clay (%)**	22.8 ± 2.7	6.8–36.9	30.5 ± 3.5	10.8–48.2

*Represents average where more than one area was sampled adjacent to occupied site

**Two-tailed paired t test indicated means of differences of occupied and adjacent sites were significantly different ($P < 0.05$) from zero

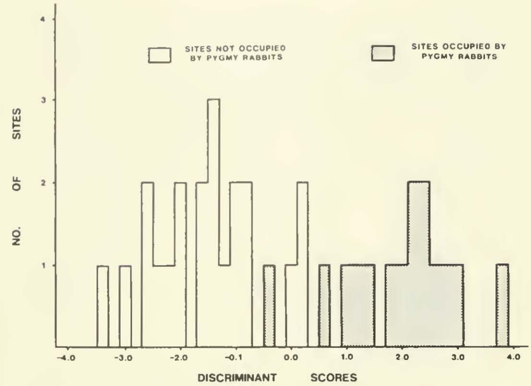

Fig. 2. Frequency histogram of discriminant scores of 15 sites occupied by pygmy rabbits (centroid = 1.96), and 21 adjacent sites not occupied by pygmy rabbits (centroid = -1.47), Oregon, 1982.

identified by criteria of Shumar et al. (1982). Shrubs associated with four sites occupied by *S. idahoensis* were pure stands of *A. t. vaseyana* (Table 3). At remaining sites, stands were mixtures of *A. t. tridentata*, *A. t. wyomingensis*, and unidentified subspecies (possibly hybrids). Two sites had high densities of *A. t. tridentata* and at two sites *A. t. wyomingensis* was predominant (Table 3).

No evidence of recent activity of pygmy rabbits was evident at 10 of 15 sites occupied in 1982 when reexamined in April and July 1983 (Table 1). Of 51 burrows at five sites occupied in 1982, 19 were open in July 1983, and only 8 had relatively fresh fecal pellets of pygmy rabbits in the vicinity.

Discussion and Conclusions

This study, the first attempt to quantify both soil and vegetative characteristics at sites occupied by pygmy rabbits, demonstrated that *S. idahoensis* in Oregon inhabited areas where soils were significantly deeper and looser than at adjacent sites. Soil depth and soil strength, more than soil texture, were physical properties of soil that distinguished sites occupied by pygmy rabbits from adjacent sites, and probably were related to excavation of burrows. Mean soil depth at 13 sites occupied by pygmy rabbits in Oregon (Table 2) approximated depths of burrows reported elsewhere (Grinnell et al. 1930, Bailey 1936, Bradfield 1975), supporting the belief that pygmy rabbits burrowed only where soil depth was sufficient (Wilde 1978). In Oregon, the inverse relationship between number of burrow entrances and soil strength indicated that softer soils facilitated burrow construction. However, the significant inverse relationship between number of burrow entrances and percent slope cannot be explained on the basis of the present knowledge of the biology of the species.

Initially we hypothetized that distribution of pygmy rabbits was determined, in part, by relative abundances of various subspecies of *Artemisia tridentata*. The shrub constituted a major portion of the diet of *S. idahoensis* in Idaho (Wilde 1978, Green and Flinders 1980b), and preliminary observations by Green and Flinders (1980b) indicated that specific subspecies were consumed. Our findings did not support the hypothesis; additional evidence that the distribution of *S. idahoensis* was not linked to specific subspecies of *A. tridentata* was provided by feeding trials of captives in which consumption of *A. t. tridentata* and *A. t. vaseyana* was not significantly different (White et al. 1982).

Although abundance of grasses and forbs were not primary factors that distinguished sites occupied by pygmy rabbits from adjacent sites in Oregon (Table 2) or in Idaho (Green and Flinders 1980b), areas with dense stands of cheatgrass (*Bromus tectorum*) seemingly were avoided because only 2 of 51 sites occupied by *S. idahoensis* in Oregon contained appreciable stands; both were adjacent to asphalt highways. In areas where cheatgrass and other annual grasses were dense, our ability to observe rabbits, burrows, and fecal pellets possibly was reduced. Green and Flinders (1980b) reported that mean biomass of forbs was significantly greater and that of grasses significantly less at sites where *S. idahoensis* was most abundant, and concluded that differential consumption of grasses and forbs by the species was responsible. In Oregon, low density of cheatgrass at sites occupied by pygmy rabbits was not the result of foraging by rabbits; densities of annual grasses were not significantly different between occupied and adjacent sites. We suspect that annual grasses restricted movements or vision of pygmy rabbits and were avoided to improve chances of escaping from predators (Yahner 1982).

The affinity exhibited by pygmy rabbits for areas with greater shrub cover and height possibly also was related to predator avoidance because, compared with larger leporids, pygmy rabbits are relatively slow and vulnerable in open habitats (Bailey 1936, Orr 1940). However, they are better able to elude pursuers amidst shrubs (Anthony 1913, Bailey 1936, Orr 1940, Severaid 1950, Wilde 1978). In addition, greater shrub cover represents additional food resources because pygmy rabbits forage extensively on sagebrush, even climbing the shrubs to do so (Janson 1946). Similar conclusions regarding association with shrubs for avoidance of predators and for increasing the resource base were provided for other small desert mammals (Rosenzweig et al. 1975, Beatley 1976, Hallett 1982, Thompson 1982). Shrub cover may be especially critical in winter for a species poorly adapted for climbing when 99% of the diet of S. *idahoensis* is sagebrush (Green and Flinders 1980a) and snow accumulations may cover other food resources but permit easy access to distal parts of shrubs (Bradfield 1975).

A marked decline in evidence of pygmy rabbits at sample sites in 1983 demonstrated that populations were susceptible to rapid declines and possibly local extirpation. Other researchers detected similar declines in populations of pygmy rabbits (Janson 1946, Bradfield 1975, J. T. Flinders, pers. comm.), but Wilde (1978), after a 2.5-year study of a population in Idaho, concluded that S. *idahoensis* was a "high inertia" species with reduced capacity for rapid increase in density. The term *high inertia* was used by Murdoch (1970) to describe *K*-selected species; although not explicitly stated by Wilde (1978), the tendency for density of pygmy rabbit populations to be relatively stable could be inferred from his report. Our observations did not support such an inference, nor was it supported entirely by those of Wilde (1978), who abandoned one of three study sites when number of active burrows and trapping success declined.

Analysis of vegetation and soil characteristics at areas associated with pygmy rabbits in Oregon substantiated previous observations that this species inhabited islands of

TABLE 3. Subspecific identity of 472 samples of *Artemisia tridentata* collected at sites occupied by pygmy rabbits and adjacent sites not occupied by pygmy rabbits, Oregon, 1982.

	Occupied sites				Unoccupied sites			
Site number	*A. t. tridentata*	*A. t. wyomingensis*	*A. t. vaseyana*	Unknown	*A. t. tridentata*	*A. t. wyomingensis*	*A. t. vaseyana*	Unknown
1	15				10	5		
2	10	4		1	1	11		3
3°	6	9			11			4
					1	(14)		
4°	7	5		3	5	7		3
					(4)	(3)		(3)
5	4	9		2		14		1
6			15				15	
7°		13		2		14		1
						(12)		(3)
8	11	1		3				
9		4		11				
10°		4		11				14
						(5)		(8)
11		13		2		14		1
12°	3	6		6				
	(13)			(2)				
13			15				15	
14			15				15	
15			15				15	
Totals	69	68	60	43	32	99	60	41

°Values in parentheses obtained from repeated sampling at site habitat (Dice 1926, Davis 1939, Orr 1940) where dense or clumped stands of sagebrush (Anthony 1913, Grinnell et al. 1930, Bailey 1936, Severaid 1950, Bradfield 1975) grew in deep (Davis 1939, Campbell et al. 1982), loose (Orr 1940, Janson 1946) soils. Because of the specific nature of requisite soil and vegetative conditions, and because populations seem subject to perturbation and even local extirpation, successful dispersal of individuals from less affected populations into favorable habitats becomes crucial if pygmy rabbits are to persist as a component of the fauna of Oregon. Although their dispersal abilities are not understood clearly, pygmy rabbits are suspected of being reluctant or unable to cross open areas such as roads or lands cleared of sagebrush (Bradfield 1975, J. T. Flinders, pers. comm.); thus, dense stands of *A. tridentata* along streams, roads, and fencerows become avenues of dispersal (Green and Flinders 1980b). Concerns for pygmy rabbit populations traditionally have focused on habitat destruction associated with range and agricultural improvements (Green and Flinders 1980b, Holechek 1981). Fragmentation of sagebrush communities poses an additional threat to populations of pygmy rabbits by reducing the size of these communities and increasing their interstitial distances, but the severity of this threat cannot be assessed without better understanding the dispersal abilities of the species.

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