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## Effects of Volcanic Ash on Food Habits of Burrowing Owls at Moses Lake, Washington

### Abstract

Prey items from 200 Burrowing Owl (*Speotyto cunicularia*) pellets collected near Moses Lake, Washington, were identified and compared between the summer immediately following ash deposits from the 1980 Mount St. Helens eruption and the summer of 1981. During 1980, insects comprised 94 percent of prey items and 6 percent were mammalian. Insect prey decreased to 68 percent in 1981 and mammalian prey increased to 32 percent.

### Introduction

On 18 May 1980 a plume of volcanic ash from the eruption of Mount St. Helens passed over central Washington state depositing approximately 5 cm of fine ash near Moses Lake (Korosec *et al.* 1980). The rain that fell shortly afterward compacted much of the ash into a crust on the soil surface. Detailed descriptions and environmental impacts of the volcanic ash are reported by Fruchter *et al.* (1980) and Cook *et al.* (1981). The primary objective of this study was to determine the impact of ash deposition on food habits of burrowing owls.

### Study Area and Methods

The study area was located in central Grant County and western Adams County, Washington. Owl pellets were collected at numerous active nest burrows immediately adjacent to Interstate 90 between Moses Lake and George and adjacent to State Route 17 between Moses Lake and Othello. Interstate 90, with its accompanying frontage roads, and State Route 17 are the major roads located on the study area. Farm crops are grains, potatoes, alfalfa, and hay pastures. The road right-of-ways and irrigation canal banks, which provide much of the available habitat for nest burrows, have been planted to various grass species, mainly crested wheatgrass (*Agropyron cristatum*), tall wheatgrass (*A. elongatum*) and Sherman's bluegrass (*Poa ampla*). Most nest burrows appear to be modified badger (*Taxidea taxus*) holes, although some small road culverts were also utilized.

Native plant communities have been severely affected by development of trans-

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portation corridors and irrigated agriculture. Remaining vegetation is dominated by cheatgrass (*Bromus tectorum*) and grey rabbitbrush (*Chrysothamnus nauseosus*). Although, some remnant patches of bigsage (*Artemisia tridentata*)/bluebunch wheatgrass (*A. spicatum*), big sage/Sandberg's bluegrass (*P. secunda*) and bitterbrush (*Purshia tridentata*)/needlegrass (*Stipa comata*) communities are scattered through the study area. The largest block of native vegetation is located west of Moses Lake and south of Interstate 90 within the Washington Game Department's Potholes Habitat Management Area.

The topography is basically a flat prairie but is dissected occasionally by shallow coulees. Soils are very sandy west of Moses Lake and loamy south into the Othello area. Mean annual precipitation is 20 cm, occurring mostly in winter as snow. Temperatures range from -28 C to 43 C.

Regurgitated burrowing owl pellets were collected weekly from burrows during June-August 1980 and June-August 1981. A total of 200 pellets were dissected and contents identified—100 from 1980 and 100 from 1981. Analysis of pellets generally followed methods of Errington (1930) and Marti (1974). Mammalian prey were identified and counted by examining skulls and dentaries. The insect prey were identified and counted with whole heads and mandibles. Other body parts such as legs and elytra were too fragmented to identify or count accurately. A chi-square contingency table was used to compare food habits between 1980 and 1981.

### Results and Discussion

Insects comprised the majority of prey of burrowing owls at Moses Lake, Washington, during the summer of 1980 and 1981 (Table 1). In 1980, 94 percent of the prey were insects and 6 percent were mammalian. Insects decreased to 68 percent of the prey in

TABLE 1. Comparison of Burrowing Owl prey immediately following the Mount St. Helens eruption (1980) with prey captured one year later (1981) at Moses Lake, Washington. Data from analysis of 100 pellets each year.

Prey	1980		1981	
	n	%	n	%
<b>Insects</b>				
Coleoptera				
Carabidae	235	31	29	10
Tenerionidae	168	22	29	23
Silphidae	23	3	5	2
Staphylinidae	2	tr*	—	—
Curculionidae	13	2	—	—
Unknown	73	10	77	26
Hymenoptera				
Formicidae	64	9	2	tr
Orthoptera				
Acrididae	118	16	4	1
Gryllacrididae	6	tr	16	5
Lepidoptera	3	tr	—	—
<b>Mammals</b>				
Peromyscus maniculatus	14	2	16	5
Perognathus parvus	10	1	49	16
Thomomys talpoides	3	tr	4	1
Microtus spp.	17	2	26	9
Mus musculus	3	tr	1	tr

\*tr=trace, less than 1 percent.

1981 while mammals comprised 32 percent. Beetles (Coleoptera) were the most commonly obtained insects especially those of the families Carabidae (31 percent of the total prey in 1980 and 10 percent in 1981) and Tenebrionidae (22 percent of the prey in 1980 and 24 percent in 1981). Mammals were important to the owls in 1981, particularly the Great Basin pocket mouse (*Perognathus parvus*) which comprised 16 percent of the prey. By comparison, in 1980 pocket mice comprised only 1 percent of the prey. Ants (Formicidae) were a common prey in 1980. Longhurst (1942) suggested that ants were ingested accidentally as they clung to other food items. This does not appear to be true in this case because ants rarely occurred individually but were represented in large numbers in single pellets. They may have been accidentally ingested, however, by owls eating ant-infested carrion or cached prey.

Insects were the most numerous prey eaten, but individuals contributed little to the biomass of the diet. One pellet contained 27 beetles while only 4 mice comprised a similar sized pellet. Grasshoppers and crickets (Orthoptera) have a larger biomass than beetles; one pellet contained approximately 10 grasshoppers.

Burrowing owls have been observed foraging along the ground (Marti 1974, Martin 1973, Thomsen 1971) and this behavior may account for the large number of insects in the diet. The owls are also opportunistic feeders and will become more dependent upon vertebrates when insect availability decreases (Marti 1974). Insects are usually more abundant and easier to capture than vertebrates. Errington (1935) suggested that older owls more commonly captured vertebrates, and that prey capture skills of younger owls were more limited to slow-moving insects.

Although pellet analysis methods for determining raptor food habits have been reported as fairly accurate, especially in small-sized owls (Errington 1930, Glading *et al.* 1943), some prey may have been overlooked or misidentified if remains were highly fragmented. Soft-bodied insects and carrion may not have been represented in the analysis of pellets. Pellets that are comprised entirely of insects have been reported to disintegrate upon drying (Marti 1974, Coulombe 1971). Thus, proportionally more mammalian pellets may have been collected, especially if a violent wind and/or rain storm occurred between collection periods. We have no reason to suspect these potential biases seriously affect our data.

A chi-square contingency table test revealed a significant difference between prey capture in 1980 vs 1981 ( $P < 0.05$ ). Insects comprised a much larger proportion of the diet in the summer of 1980 than 1981. A number of factors could be responsible for this difference: 1) Many insect populations suffered dramatic mortality from the volcanic ash (Akre *et al.* 1981, Brown and Hussain 1981, Shanks and Chase 1981). Large numbers of insects were reported lying on top of the ash layer in several affected regions (R. D. Akre, personal communication). Owls may have foraged along the ground, easily picking up the dead or dying insects. Since burrowing owls are opportunistic feeders and the insect prey was easily obtainable, few mammal prey were needed or sought; 2) The ash may have covered the ground and vegetation enough to make the insects more visible to the owls, creating easy foraging; and 3) The ash may have been detrimental to the mammals by fouling the respiratory tract or by abrasion to the eyes. Alopecia (hair loss) and palpebral (eyelid) swelling has been documented for *Peromyscus maniculatus* and *Microtus montanus* (Pyke 1984, in press). Small mammals may also have suffered from loss of food or other resources (Anderson 1982). Other un-

known factors may have caused mortality or behavioral changes that reduced availability of mammals to owls.

Our 1980 data were collected during a period of extreme environmental perturbation. The proportional representation of insects *vs* mammals, by our 1981 data set suggests that the presence of volcanic ash in 1980 may have caused a shift in food habits during this period (i.e., more insects and fewer mammals). However, our data sets from 1980 and 1981 are both within the general limits of previously published food habits data (Table 2). Consequently, ash from the 1980 Mount St. Helens eruption may have altered

TABLE 2. Comparison of the proportion of insects and mammals among selected<sup>a</sup> burrowing owl food habits studies.

Source	Percent insects	Percent mammals	Location
This study—1980 <sup>b</sup>	93	5	Washington
This study—1981 <sup>c</sup>	67	31	Washington
Maser et al. 1971 <sup>d</sup>	65	32	Oregon
Smith and Murphy 1973	87	11	Utah
Marti 1974 <sup>d</sup>	91	8	Colorado
Gleason and Craig 1979	79	8	Idaho
Fitzner et al. 1980	76	17	Washington

<sup>a</sup>Includes only studies with directly comparable analyses.

<sup>b</sup>Data collected immediately following the eruption of Mount St. Helens; study area had approximately 5 cm of volcanic ash.

<sup>c</sup>Data collected one year after the eruption of Mount St. Helens.

<sup>d</sup>Summer data only.

the diet of Moses Lake burrowing owls, but our data do not indicate unusual stress due to prey availability or composition during this period.

#### Acknowledgements

Sincere thanks to Tim Flint, Terri Gilmore, Tracy Lloyd, and Terry Thompson for assistance with collection of owl pellets. Leslie Ratti provided valuable editorial comments. We appreciate review comments from Tracy Fleming.

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Received 19 May 1983

Accepted for publication 1 September 1983