

FOOD HABITS OF WILD TURKEYS IN NATIONAL FORESTS OF NORTHERN CALIFORNIA AND CENTRAL OREGON

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ABSTRACT: We studied the diet of the Wild Turkey (*Meleagris gallopavo*) in five national forests in northern California and two national forests in central Oregon by collecting turkey droppings and analyzing them for specific food items. In all national forests the diet included insects; in all but one it included grasses. We analyzed the diet by sex and season and found that it varied seasonally and that females from California consumed more insects than did males. Seeds made up a small percentage of the diet in most national forests but constituted a majority of the diet in the Tahoe National Forest in California.

The Wild Turkey (*Meleagris gallopavo*) ranged historically from south-eastern Canada and the eastern and southwestern United States to northern Mexico (Kennamer et al. 1992). It is not native to California or Oregon, although a similar fossil species (*M. californica*) occurred prehistorically in California until about 11,500 years before present (Bochenski and Campbell 2006). Introductions by various agencies of three subspecies, the Rio Grande (*M. g. intermedia*), Eastern (*M. g. silvestris*), and Merriam's (*M. g. merriami*), to west coast states as early as 1877 and into the 20th century have proven successful, and the turkey's range and numbers in these states are increasing (Wunz 1992, Keegan and Crawford 1999, Delgado 2004, California Department of Fish and Game 2004).

The Wild Turkey is a generalist omnivore whose diet consists largely of plant material and insects (Hurst 1992). The literature on the food habits of the Wild Turkey in California and Oregon is limited, addressing mostly macro- and microhabitat selection for foraging (Delgado 2004). The single published study addressing the diet of the Wild Turkey in California, focusing on San Luis Obispo County on the central coast found that turkeys foraged primarily on grasses, forbs, and hardwood mast (Smith and Browning 1967). In southern California, turkeys select as macrohabitat grasslands, mixed coniferous, and hardwood forest; as microhabitat for feeding they use primarily meadows (Delgado 2004).

Because Wild Turkeys are not native to California and Oregon, the question whether they consume animals and plants of conservation concern has been raised (California Department of Fish and Game 2004, Oregon Department of Fish and Wildlife 2004). To date, there is no documentation of Wild Turkeys' potential effects on native species in California and Oregon, whether through direct consumption or indirect modification of habitat. In this study, we provide the first data on the diet of Wild Turkeys in previously

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unstudied areas of northern California and central Oregon. We describe the sexual and seasonal differences of the Wild Turkey's diet in selected national forests within this region.

METHODS

From 2003 through 2005, samples of turkey feces were collected opportunistically through the volunteer efforts of United States Forest Service personnel and independent researchers. Areas sampled in California were the El Dorado, Modoc, Plumas, Tahoe, and Mendocino national forests; those in Oregon were the Deschutes and Ochoco national forests (Figure 1). Samples were collected only when turkeys were observed in the area, ensuring that only fresh samples were collected and seasonal differences in diet composition could be estimated accurately. As many samples as possible were gathered at each site and stored in paper bags until analysis. When possible, sex of the turkey that deposited the sample was determined by direct observation. Typically, however, the sex of the bird that left the sample could not be identified, so we determined the sex from the shape and configuration of the sample itself, as feces of the sexes differ (Bailey 1956). In most cases, age class of the turkey could not be determined from the sample. Samples were collected during March, April, May, July, August, September, and October.

The samples were analyzed microhistologically for diet composition at the Wildlife Habitat Laboratory at Washington State University, under director Bruce Davitt, by the methods of Sparks and Malachek (1967). For quantitative analyses we examined both insect and vegetation matter similarly, though for lack of resources we were unable to classify insects more precisely than to the broad category "insects." We categorized the samples by sex, season, and site and calculated the percentage cover of each type of food item on microscope slides made with a subsample of the pooled sample of each category. For the purposes of this study, we defined spring samples as those collected in March, April, or May, summer samples as those collected in July, August, or September, and fall samples as those collected in October. Using NCSS (Kaysville, UT), we compared the percentages of various food items in the diet of males and females with paired *t* tests.

RESULTS

At least 435 individual droppings were analyzed for this study. Because we were uncertain how many individual droppings some collections included, we based quantitative analyses only on collections in which the total number of droppings was known. Collections of droppings in which the total number was unknown were used for descriptive analyses only.

In all the national forests the turkey's diet consisted of various combinations of the following general categories: grasses, sedges/rushes, forbs, coniferous trees, shrubs, mosses, seeds, roots, ferns, and insects. Within these groups, we distinguished only grasses, rushes/sedges, forbs, coniferous trees, and shrubs further, in most cases to genus (Appendix A). Some of the conifer and shrub parts were identified to species. A group consisting of agricultural

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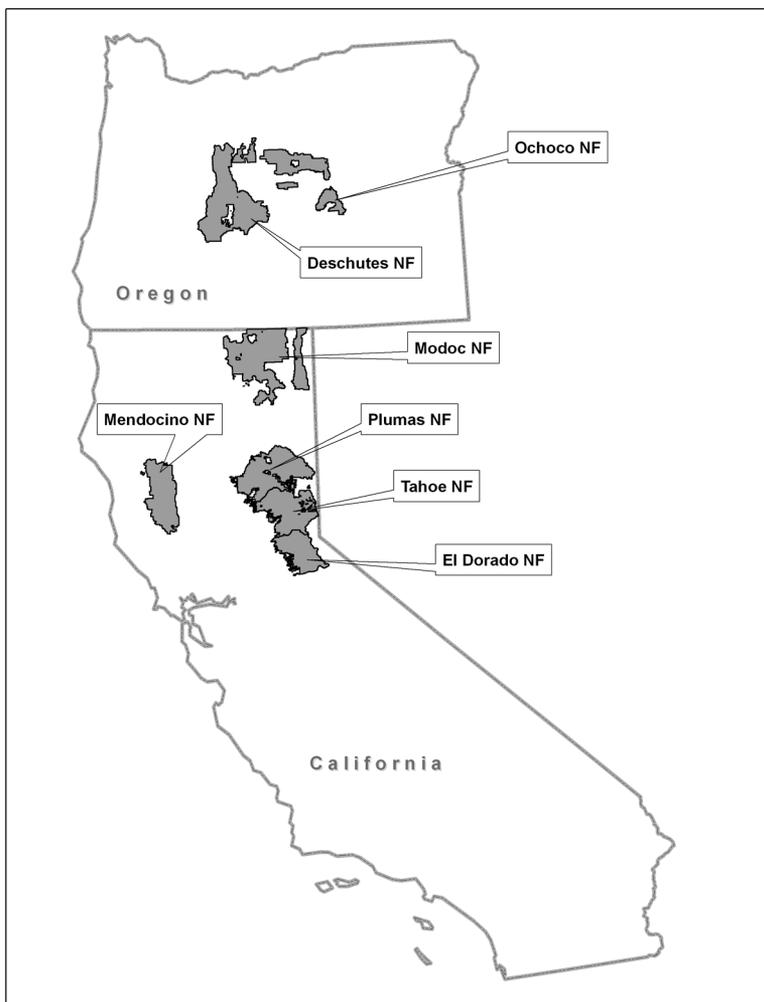


Figure 1. National forests in California and Oregon where feces of the Wild Turkey were sampled for this study of food habits, 2003–2005.

grains (barley and oats) were distinguished from grasses and forbs since the turkeys presumably obtained these foods from agricultural stocks rather than from grasses and forbs growing in the wild. For the plant foods listed (Appendix A), most of the parts found in the droppings were from seeds and flowers rather than from stems, roots, or leaves.

Grasses were present in fecal samples from all national forests except Tahoe and ranged from 1.3% of the diet in spring droppings from males

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in the Modoc National Forest (NF) to 66.8% in summer droppings from males in the Plumas NF. Insects were present in samples from all national forests and ranged from 0.6% in spring droppings from the Modoc NF to 39.9% in summer droppings from the Ochoco NF. Agricultural grains were only found in droppings from the Plumas NF (a maximum of 36.3% of food items in fall droppings from females), Deschutes NF (maximum 32.7% in spring droppings from males), and Mendocino NF (maximum 0.6% in fall droppings from females). Conifer seeds and "berries" constituted a majority of food items found in droppings from spring males in the El Dorado NF (61.9%) and from spring females in the Deschutes NF (79.9%). In most areas rushes/sedges made up a small percentage of food items, with a maximum of 9.0% in fall droppings from females in the Modoc NF. Forbs were found in samples from all areas and consistently made up a large proportion of food items found in droppings, from 3.3% in summer males in the Plumas NF to 95.8% in spring males in the Modoc NF.

Mosses were present in samples from a few national forests but always in low proportions (maximum 2.7% in summer droppings from males in the Modoc NF). Ferns were present in samples from only Modoc NF and Plumas NF, always in small proportions (maximum 1.4% in fall samples from females in the Plumas NF). Roots were uncommon in fecal samples and were not found in those from the El Dorado NF, Tahoe NF, or Deschutes NF. The maximum percentage of roots was 4.4% in summer samples from the Modoc NF. In most areas seeds of unknown origin made up a small percentage of the diet ($\leq 5.6\%$), but in the Tahoe NF they constituted 88.9% of food items found in the samples. Finally, in many of the forests, material from shrubs made up a moderate percentage of food items in the samples, from 0.1% in spring females from the Ochoco NF to 29.4% in fall females from the Modoc NF.

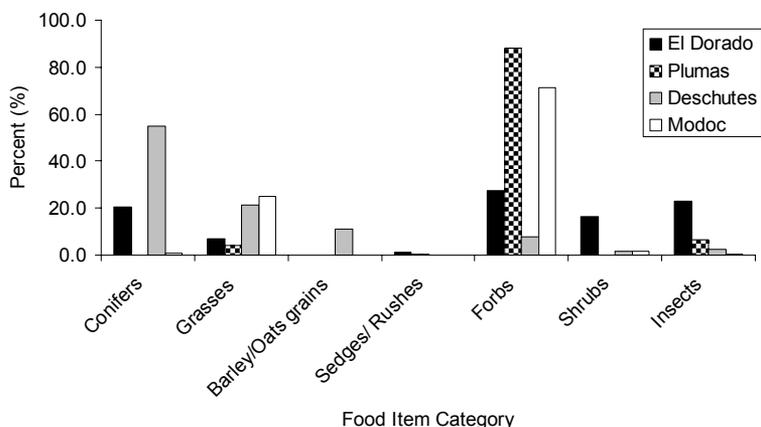
The turkeys' diet varied by season and site (Figure 2). The only national forest from which samples were collected in all three seasons (spring, summer, fall) was the Modoc NF. In this area, the percentage of forbs decreased from 71.5% to 47.3% to 45.0% from spring to summer to fall. The percentage of grasses fluctuated from 24.9% to 33.0% to 5.3% in spring, summer, and fall, respectively. In fall, shrubs were important in the diet at 29.4% but contributed only 1.7% and 2.0% in the spring and summer, respectively. Sedges/rushes were less common in the spring diet (0.1% of droppings) than in the summer (8.6%) and fall (9.0%). At all seasons conifers, mosses, seeds, roots, ferns, and insects each constituted a small percentage of the diet; of these the maximum percentage was for insects at 6.3% in the summer.

The only significant difference between the diets of the sexes was in the percentage of insects in California. In all California samples combined, by season, the mean percentage of fecal samples containing insects was greater for female turkeys ($7.3 \pm 2.9\%$) (mean \pm standard error) than for males ($4.2 \pm 2.2\%$, $t_6 = 3.3$, $P = 0.02$). But this relationship did not hold when samples from both California and Oregon were pooled ($t_7 = 1.7$, $P > 0.05$). For all other food items, the sexes' percentage composition of the fecal samples was not statistically different ($P > 0.05$).

Because of the large variation among the sites in habitat and anthropogenic influence, we did not analyze differences among the sites statistically; results would likely be biased by vastly different availabilities of food items.

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a)



b)

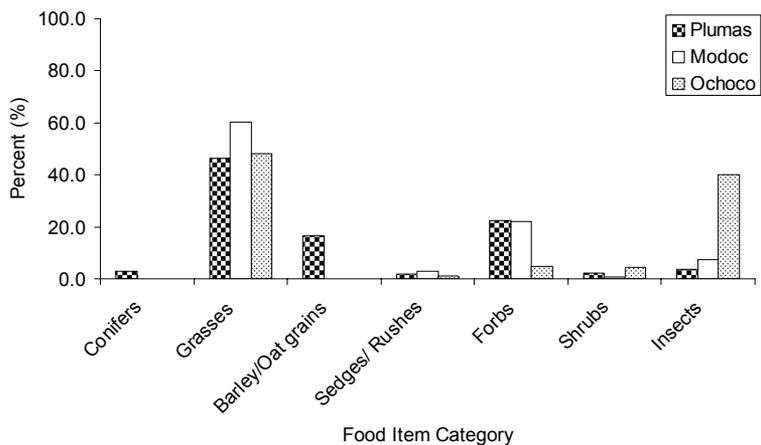


Figure 2. Percent composition of categories of food items in fecal samples from Wild Turkeys in various national forests in California and Oregon in (a) spring and (b) summer.

DISCUSSION

In the national forests of California and Oregon we studied, the Wild Turkey's diet is variable, by both season and sex, as found also in central California (Smith and Browning 1967) and other western states (Wakeling

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and Rogers 1996, York and Schemnitz 2003). Although we were unable to compare diet by season for most national forests in our study area, in the Modoc NF we found seasonal changes in percentages of certain food items, most notably forbs and shrubs. In central California, Smith and Browning (1967) reported changes in the volume and frequency of some of the most important items in the turkey's diet, including various species of oats and grass leaves. In Arizona York and Schemnitz (2003) found that the dominant constituent of the diet changed seasonally from fruits to certain types of grasses. In South Dakota the turkey's diet also shifts seasonally between green foliage and grass seeds (Rumble and Anderson 1996).

Between females and males, we found differences in percent composition of droppings only for insects. Other studies found differences between the sexes in other diet items; for example, in north-central Arizona the sexes differ in their winter diets (Wakeling and Rogers 1996). That study found fecal samples from females to be composed of large amounts of juniper (*Juniperus deppeana*) berries, those from males to have a high percentage of pinyon pine (*Pinus edulis*) seeds. These diets changed in the late winter, the sexes again differing (Wakeling and Rogers 1996). In our study, since samples from males and females were collected at the same sites, it is probable that the sexes were using similar habitats as well, so the differences (or lack thereof) we found were not likely confounded by habitat use.

Unfortunately, we were unable to assess variation in the turkeys' diet by age class. Other studies indicate that insect matter is important to juveniles and constitutes a good proportion of their diet (California Department of Fish and Game 2004). Furthermore, insect matter is an essential protein source for poults (Hurst 1992); it is likely that females' relatively high consumption of insects was associated with the learning of their broods (Appleby et al. 2004).

Future studies of the diet of the Wild Turkey in California and Oregon should follow a more systematic design in which fecal samples are collected repeatedly from the same sites throughout all seasons. Such a design would allow a more detailed analysis of the changes in diet with the seasons due to seasonal variation in the abundance of particular food items or to seasonal changes in the turkeys' preference or dietary requirements. A helpful addition would include a detailed analysis of the availability of various food items in the surrounding habitat that turkeys use, allowing comparison of the use versus the availability of food items, indicating actual food selection.

Given the recent concern over the possibility that Wild Turkeys prey on species of concern in California (California Department of Fish and Game 2004), a focus in the areas where these species and the Wild Turkey overlap could give insight to the validity of this concern. Furthermore, a future study should include molecular techniques, such as the polymerase chain reaction or stable-isotope analyses, which might increase the detectability of soft-bodied insects and vertebrates and other diet items typically under-represented in these types of studies. Species of concern should be surveyed concurrently with the analysis of the turkey's diet. Such a study will indicate the availability of these sensitive species and allow their presence or absence in the turkey's diet to be compared to their availability.

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Appendix A. Complete list of food items found in turkey droppings for the turkey food habits study on seven National Forests in California and Oregon, 2003–2005. Food items were identified to lowest taxonomic level possible, in most cases to genus.

Grasses	<i>Descurainia</i>	<i>Trifolium/Medicago/</i>
<i>Agropyron</i>	<i>Draba</i>	<i>Melilotus</i>
<i>Agrostis</i>	<i>Equisetum</i>	<i>Vicia</i>
<i>Alopecurus</i>	<i>Erigeron</i>	<i>Viola</i>
<i>Andropogon</i>	<i>Eriogonum</i> (leaf)	Unidentified composite
<i>Avena</i> (grain)	<i>Erysimum</i>	(flower)
<i>Bromus</i>	<i>Euphorbia</i>	Unidentified legume
<i>Bromus tectorum</i>	<i>Fragaria</i>	(pod, hair)
<i>Calamagrostis</i>	<i>Galium</i>	Unidentified flower
<i>Dactylis glomerata</i>	<i>Geranium</i>	Trees and Shrubs
<i>Danthonia</i>	<i>Geum</i>	<i>Acer</i> (seed)
<i>Deschampsia</i>	<i>Hackelia</i>	<i>Artemisia</i>
<i>Elymus</i>	<i>Hieracium</i>	<i>Berberis</i> (seed)
<i>Festuca</i>	<i>Hydrophyllum</i>	<i>Ceanothus</i> (leaf)
<i>Hordeum</i> (grain)	<i>Hypochaeris</i>	<i>Juniperus</i> (berry, needle)
<i>Koeleria</i>	<i>Lathyrus</i>	<i>Pinus ponderosa</i>
<i>Melica</i>	<i>Lomatium</i>	(needle, cone, seed)
<i>Phleum</i>	<i>Lotus/Lupinus</i>	<i>Pinus</i> sp. (nut/skin)
<i>Poa</i>	<i>Mirabilis</i>	<i>Prunus</i> (berry)
<i>Sitanion</i>	<i>Montia</i>	<i>Quercus</i> (stem, bud,
<i>Stipa</i>	Mustard (flower)	acorn)
Forbs	<i>Penstemon</i>	<i>Ribes</i> (seed)
<i>Achillea</i>	<i>Phacelia</i>	<i>Rosa</i> (hip)
<i>Allium</i>	<i>Phlox/Leptodactylon</i>	<i>Rubus</i> (berry)
<i>Arabis</i>	<i>Plantago</i>	<i>Vaccinium</i> (berry, seed)
<i>Arenaria</i>	<i>Polemonium</i>	Unidentified (leaf, stem)
<i>Aster</i>	<i>Polygonum</i>	Mosses (unidentified)
<i>Astragalus</i>	<i>Potentilla</i>	Ferns (unidentified)
<i>Borago</i>	<i>Ranunculus</i>	Other unidentified plants
<i>Brassica</i>	<i>Rumex</i>	(berry, nut, leaf, seed,
<i>Brodiaea</i>	<i>Saxifraga</i>	root)
<i>Cerastium</i>	<i>Senecio</i>	Insects
<i>Calochortus</i>	<i>Sisyrinchium</i>	
<i>Cirsium</i>	<i>Solidago</i>	
<i>Coreopsis/</i>	<i>Stellaria</i>	
<i>Leucanthemum</i>	<i>Taraxacum</i>	