



Ecology of Merriam's wild turkey in the Helena National Forest  
by Katharine Albrecht Holzer

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Fish and Wildlife Management  
Montana State University  
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**Abstract:**

This study was undertaken to determine why low population levels have been prevalent in the population of Merriam's wild turkey (*Meleagris gallopavo merriami*) north of Canyon Ferry Reservoir near Helena, Montana. Eleven turkeys were trapped in cannon nets and clover traps, and 7 of them were radio marked. They were followed throughout 1987 to determine food habits, seasonal and annual home range, movements and habitat use. Results showed turkeys consumed grass and forbs during the entire year, with a higher proportion during spring and summer, and seeds during fall and winter. The pooled annual home range for all 7 turkeys was 2883 ha. Males had larger mean annual home ranges than females. Movements between winter and summer ranges were 1.58 to >5.0 ha. Turkeys avoided disturbed mining areas and open fields and meadows.

Turkeys used climax ponderosa pine (*Pinus ponderosa*) and mixed Douglas fir (*Pseudotsuga menziesii*)/ponderosa pine more often than the other habitats. The habitat seemed adequate from nutritional and spatial standpoints, so another limiting factor is responsible for their low population levels. The possibility of low production, disease, and predation as limiting factors is discussed.

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of the requirements for the degree

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APPROVAL

of a thesis submitted by

Katharine Albrecht Holzer

This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

8/2/89  
Date

Robert J. Eng  
Chairperson, Graduate Committee

Approved for the Major Department

2 August 1989  
Date

Robert S. Moore  
Head, Major Department

Approved for the College of Graduate Studies

August 11, 1989  
Date

Henry J. Parsons  
Graduate Dean

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Date July 28, 1989

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## TABLE OF CONTENTS

	Page
APPROVAL.....	ii
STATEMENT OF PERMISSION TO USE.....	iii
VITA.....	iv
ACKNOWLEDGMENTS.....	v
LIST OF TABLES.....	vii
LIST OF FIGURES.....	ix
ABSTRACT.....	x
INTRODUCTION.....	1
STUDY AREA DESCRIPTION.....	3
METHODS.....	9
Capture and Monitoring.....	9
Food Habits.....	11
Home Range.....	12
Movements.....	12
Habitat Use.....	13
RESULTS.....	14
Relocations.....	14
Food Habits.....	14
Home Range.....	28
Movements.....	30
Habitat Use.....	32
DISCUSSION.....	38
REFERENCES CITED.....	43

## LIST OF TABLES

Table	Page
1. Sex, age, and weight of Merriam's turkeys trapped in Helena National Forest in 1987...	10
2. Estimated home range sizes (ha) for Merriam's wild turkey in the Helena National Forest...	29
3. Mean daily movements (km/day) of Merriam's wild turkey in the Helena National Forest. Movements should be used as an index of activity to compare among the turkeys, not as the actual distance travelled.....	30
4. Movements (km) of Merriam's wild turkey between winter (1987) and summer (1987) ranges.....	31
5. Description of cover types found on the study area in Helena National Forest.....	32
6. Winter habitat use by Merriam's turkey in Helena National Forest in 1987. Each value is the proportion of the total telemetry fixes in each habitat for each turkey during the season. Cover type code is in Table 5 (page 32).....	33
7. Spring habitat use by Merriam's turkey in Helena National Forest in 1987. Each value is the proportion of the total telemetry fixes in each habitat for each turkey during the season. Cover type code is in Table 5 (page 32).....	34
8. Summer habitat use by Merriam's turkey in Helena National Forest in 1987. Each value is the proportion of the total telemetry fixes in each habitat for each turkey during the season. Cover type code is in Table 5 (page 32).....	35

LIST OF TABLES--Continued

Table	Page
9. Fall habitat use by Merriam's turkey in Helena National Forest in 1987. Each value is the proportion of the total telemetry fixes in each habitat for each turkey during the season. Cover type code is in Table 5 (page 32).....	36
10. Annual habitat use by Merriam's turkey in Helena National Forest in 1987. Each value is the proportion of the total telemetry fixes in each habitat for each turkey during the year. Cover type code is in Table 5 (page 32).....	37

## LIST OF FIGURES

Figure	Page
1. Study area for Merriam's Turkey in Helena National Forest.....	4
2. January Food Habits for Merriam's Turkey in Helena National Forest.....	15
3. February Food Habits for Merriam's Turkey in Helena National Forest.....	16
4. March Food Habits for Merriam's Turkey in Helena National Forest.....	17
5. April Food Habits for Merriam's Turkey in Helena National Forest.....	18
6. May Food Habits for Merriam's Turkey in Helena National Forest.....	19
7. June Food Habits for Merriam's Turkey in Helena National Forest.....	20
8. Food Habits for an Incubating Female Merriam's Turkey in Helena National Forest....	21
9. July Food Habits for Merriam's Turkey in Helena National Forest.....	22
10. August Food Habits for Merriam's Turkey in Helena National Forest.....	23
11. September Food Habits for Merriam's Turkey in Helena National Forest.....	24
12. October Food Habits for Merriam's Turkey in Helena National Forest.....	25
13. November Food Habits for Merriam's Turkey in Helena National Forest.....	26
14. December Food Habits for Merriam's Turkey in Helena National Forest.....	27

## ABSTRACT

This study was undertaken to determine why low population levels have been prevalent in the population of Merriam's wild turkey (Meleagris gallopavo merriami) north of Canyon Ferry Reservoir near Helena, Montana. Eleven turkeys were trapped in cannon nets and clover traps, and 7 of them were radio marked. They were followed throughout 1987 to determine food habits, seasonal and annual home range, movements and habitat use. Results showed turkeys consumed grass and forbs during the entire year, with a higher proportion during spring and summer, and seeds during fall and winter. The pooled annual home range for all 7 turkeys was 2883 ha. Males had larger mean annual home ranges than females. Movements between winter and summer ranges were 1.58 to >5.0 ha. Turkeys avoided disturbed mining areas and open fields and meadows. Turkeys used climax ponderosa pine (Pinus ponderosa) and mixed Douglas fir (Pseudotsuga menziesii)/ponderosa pine more often than the other habitats. The habitat seemed adequate from nutritional and spacial standpoints, so another limiting factor is responsible for their low population levels. The possibility of low production, disease, and predation as limiting factors is discussed.

## INTRODUCTION

Merriam's wild turkey (Meleagris gallopavo merriami) originally ranged over Colorado, New Mexico, Arizona, and extreme west Texas (Ligon 1946, Schorger 1966). Numerous introductions in the 1940s through the 1960s have resulted in the establishment of Merriam's turkey populations in nearly every western state. Turkeys were originally introduced by private individuals into Montana as early as 1939 (Jonas 1966), although those released were pen-reared "wild" Eastern (M.g. sylvestris) or Rio Grande (M.g. intermedia) turkeys. The Montana Fish and Game Department first introduced Merriam's turkeys from Colorado into the Judith Mountains in 1954 after that subspecies had been successfully transplanted into South Dakota and Wyoming (Rose 1956). In 1955, 18 birds from Wyoming were introduced into the Long Pines of southeastern Montana (Rose 1956). These 2 transplants have provided a source for nearly every subsequent transplant in the state.

Many of these transplants, including my study population, consisted of relatively few birds, all taken from the same area which were placed in large isolated "islands" of habitat. Several of the populations inhabiting these isolated habitats apparently experienced

exponential growth for a few years followed by a "crash" resulting in long-term population lows. This phenomenon is not uncommon in Montana or in other western states, but it is unclear why it occurs.

The turkeys inhabiting my study area apparently came from releases made on the Hilger Ranch in 1959 (6 toms and 16 hens) and/or the Spokane Hills in 1964 (10 toms and 16 hens) near Helena, Montana (Greene and Ellis 1971).

Presently, 40-60 turkeys are estimated to inhabit the study area, a mere fraction of those present on the same area during the late 1960s to the early 1970s according to many long-time residents of the area. The population was sufficiently large to warrant a hunting season in the fall of 1965. However, there has not been a hunting season since then.

This study was undertaken to assess food habits, seasonal and annual home range, movements, and habitat use of the Merriam's wild turkey north of Canyon Ferry Reservoir in west-central Montana. Field work was done continuously from January 1987 through December 1987 and periodically from January 1988 to July 1988.

## STUDY AREA DESCRIPTION

The study area was located approximately 20 km east and 13 km north of Helena, Montana, and directly north of Canyon Ferry Reservoir in Lewis and Clark County (Figure 1). The area was composed of the Helena National Forest, Bureau of Land Management and private lands. Land uses included recreational, residential, limited (selective) logging, and 1 small agricultural operation which grazed cattle on the study area from June through October on National Forest land. No paved roads existed on the study area, and the topography was generally rough and rugged.

Nine stands which were earlier determined to be representative of the vegetation on the entire study area were examined by a range scientist (Olsen, pers. comm.) and were categorized into habitat types as per Pfister et al. (1977). A list of plant species on the area was also compiled using references by Taylor (1982), Stubbendieck et al. (1986), Spellenberg (1987).

On south-facing slopes the predominant habitat type was ponderosa pine/bluebunch wheatgrass (Pinus ponderosa/Agropyron spicatum), which is typical for this elevation and climate (Pfister et al. 1977). Ponderosa pine and Rocky Mountain juniper (Juniperus scopulorum) were the only

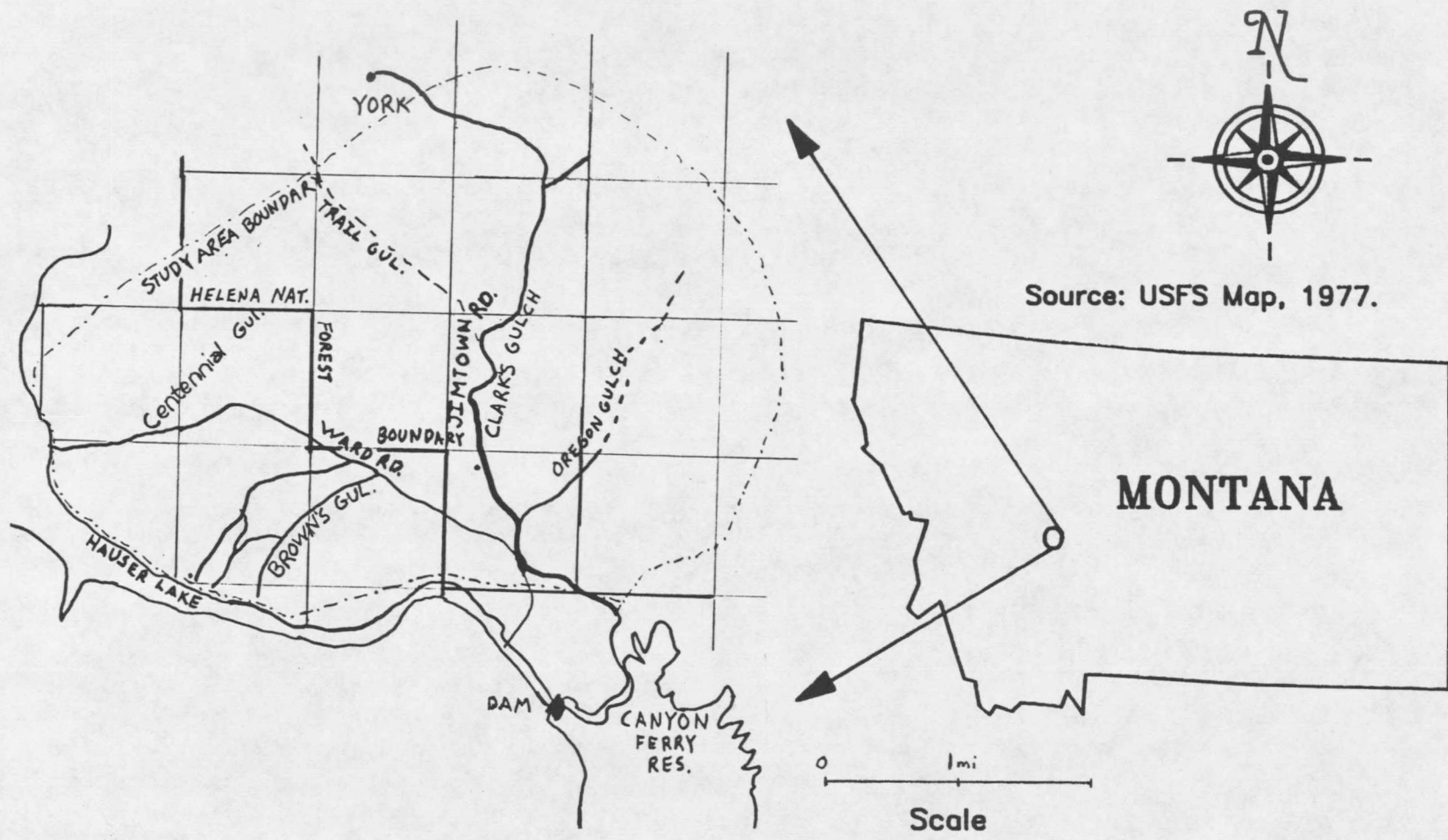


Figure 1. Study area for Merriam's wild turkey in Helena National Forest.

successful conifers on these sights. An occasional Douglas fir (Pseudotsuga menziesii) was found in areas with a more closed canopy. Shrubs and forbs included fringed sagewort (Artemisia frigida) in open areas, skunkbush sumac (Rhus trilobata), currant (Ribes sp.), arrowleaf balsamroot (Balsamorhiza sagittata), sedge (Carex sp.), hairy goldenaster (Heterotheca villosa), wild buckwheat (Eriogonum heracleoides), broom snakeweed (Gutierrezia sarothrae), cacti (Opuntia sp.), bluebunch wheatgrass, rough fescue (Festuca scabrella), needle-and-thread (Stipa comata), and red threeawn (Aristida longisetata). Pfister et al. (1977) found timber productivity to be low on this habitat type and the potential for livestock forage production to be moderate. Estimated production on these sites was 56 kg grass/ha (50 lbs grass/acre).

On north-facing slopes, the Douglas fir/rough fescue habitat type prevailed, a condition typical for the region (Pfister et al. 1977). Ponderosa pine seedlings were sparsely scattered in open areas. Russet buffaloberry (Shepherdia canadensis) was the dominant shrub with some Rocky Mountain juniper and common juniper (Juniperus communis) evident, as well as currant bushes. Forbs included nodding onion (Allium cernuum), chickweed (Cerastium arvense), Nuttall's pussytoes (Antennaria parvifolia), and prairie smoke (Geum triflorum). Grasses included mountain brome (Bromus marginatus) and rough

fescue. Production of grass was estimated to be 450-560 kg grass/ha (400-500 lbs grass/acre), which is considered excellent for domestic stock grazing (Pfister et al. 1983).

The habitat type on most east-facing slopes was Douglas fir/rough fescue with a bluebunch wheatgrass influence. Rocky Mountain juniper was the dominant shrub. Fringed sagewort and skunkbush sumac were common on these slopes as well. Penstemon (Penstemon sp.), Nuttall's pussytoes and prairie smoke were the prevailing forbs. Grasses included Idaho fescue, rough fescue, and basin wildrye (Elymus cinereus). Cacti were also represented. Estimated grass production was 56-112 kg grass/ha (50-100 lbs grass/acre).

Douglas fir/bluebunch wheatgrass was the predominant habitat type on west-facing slopes, although on some slopes there was a dense canopy of ponderosa pine. Rocky Mountain juniper was the dominant shrub along with skunkbush sumac. Understory included rough fescue, prairie junegrass (Koeleria pyramidata), and penstemon. Forage production was estimated to be 56-112 kg grass/ha (50-100 lbs grass/acre).

Three open grassland/shrubland areas were also examined. One area, thought to be in low condition from grazing and drought, was Idaho fescue/bluebunch wheatgrass habitat type. Grasses present included western wheatgrass (Agropyron smithii), prairie junegrass, and blue grama (Bouteloua gracilis). The shrubs, broom snakeweed and

fringed sagewort, were scattered sparsely throughout. Common forbs occurring in the meadow were scarlet globemallow (Sphaeralcea coccinea), curlycup gumweed (Grindelia squarrosa), salsify (Tragopogon dubius), western yarrow (Achillea millefolium), wavy-leaf thistle (Cirsium undulatum) and Nuttall's pussytoes. Grass production was estimated at 340 kg grass/ha (300 lbs/acre).

The other 2 areas were adjacent to each other, but because an underground spring fed one of them, they were markedly different. The stands were places turkeys were known to have frequented for many years. Both areas were severely disturbed sites, so habitat typing was not practical. The drier area was characterized by scattered fringed sagewort, rubber rabbitbrush (Chrysothamnus nauseosus), broom snakeweed, and skunkbush sumac. Forbs included spotted knapweed (Centaurea maculosa), penstemon, wild buckwheat, hairy goldenaster, and western yarrow. Grasses present were western wheatgrass, blue grama, needlegrass (Stipa sp.), and prairie junegrass. Cacti were also present. Estimated grass production was 450-560 kg grass/ha (400-500 lbs/acre).

At the moist area, Woods rose (Rosa woodsii) was the only shrub. Rocky Mountain iris (Iris missouriensis), clematis (Clematis sp.), and curlycup gumweed were the prevalent forbs. Grasses included foxtail barley (Hordeum jubatum), Kentucky bluegrass (Poa pratensis), basin

wildrye, redbtop (Agrostis stolonifera), cheatgrass (Bromus tectorum), and slender wheatgrass (Agropyron trachycaulum).

Cover types identified and their coverage of the study area (percentage) were 0-40 year old ponderosa pine (32.2%), 100-200 years post-fire ponderosa pine (26.5%), 300-plus years post-fire ponderosa pine (13.7%), climax to near climax stands of ponderosa pine (15.4%), 40-100 year old mixed Douglas fir and ponderosa pine (7.8%), fields or meadows (2.4%), and disturbed mining areas (2.0%) following the classification of Mattson and Despain (1985).

Although the study area was bounded by water on the east and south sides, very little permanent standing water existed within it. A small spring surfaced along Jimtown road and created a small pond. Another spring surfaced in the north part of the study area and formed a short stream. Ephemeral streams and puddles were available throughout the year.

## METHODS

Capture and Monitoring

Wild turkeys were baited with oats, sunflower seeds, wheat and barley hay in areas where they were known to frequent. On 29 January 1987, 8 turkeys (4 hens and 4 toms) were trapped with a rocket net trap on private land directly adjacent to Hauser Lake. From 19 February to 5 March 1987, 3 toms were trapped with a walk-in clover trap. Upon capture, each turkey was secured in a burlap sack. A black sock was placed over each turkey's head while it was sexed, aged (adult or yearling), weighed to the nearest 0.1 kilogram (kg) (Table 1), and tagged with 1 metal and 3 plastic color-coded leg bands. The hens from the first trapping and the last 3 toms trapped were fitted with radio transmitters. The radios were strapped to the back with 4 millimeter (mm)-wide bungee cord that looped under the base of each wing. The radios weighed approximately 119 grams (g) and measured 8 centimeters (cm) long, 3 cm high, with a 30 cm whip antenna extending along the tail. The radios were not visible on the turkeys except for the black antennas. Nenko and Healy (1979) found that radio packages similar to those used in this study did not introduce serious bias into the study of wild

turkey ecology. After processing, the turkeys were released together on the same capture site. No mortalities occurred during capture or processing.

Table 1. Sex, age, and weight of Merriam's turkeys trapped in Helena National Forest in 1987.

Turkey ID No.	Sex	Age	Weight(kg)
7104	F	adult	4.6
2	M	yearling	7.4
3	M	yearling	5.0
1122	F	adult	3.9
5351	F	adult	4.8
7152	F	yearling	3.6
7	M	yearling	4.8
8	M	yearling	4.7
1212	M	adult	7.7
8102	M	adult	7.9
8114	M	adult	7.8

Locations of radio-tagged birds were determined by triangulating 2 azimuths taken no more than 10 minutes apart at landmarks within the study area. Readings were taken using a hand-held 3-element Yagi antenna-receiver system. Sightings were used to supplement radio telemetry locations. As often as possible, I used the radio receiver to locate turkeys so that I could make observations of them for a period without their being aware of my presence. Walking to the turkeys was not always feasible because of the rugged topography and because of time limitations.

Food Habits

Wild turkey droppings found fresh or nearly fresh were picked up and put into bags labeled with date and location. The droppings were later sorted by month and combined. June had 2 samples because clocker droppings from an incubating radioed hen were collected near her nest from 1-9 June. For all other samples, sexes and ages were mixed. Although many droppings were collected from under trees where radioed birds roosted, some were found on the study area which were probably not from radioed birds.

The droppings were sent to Colorado State University Composition Analysis Laboratory to be classified by microhistological analysis (Hansen et al. 1974). In the analysis, samples were washed and strained through different sized screens. Five microscope slides were made from each sample, and 20 fields per slide were examined under high power. Results were sent back in the form of means and standard deviations of discerned plant fragments found on each slide. Slides were also examined under low power to identify the minimum number of individuals (insects) and number of seeds per slide.

### Home Range

Turkey locations were plotted by hand on 1:24,000 scale U.S. Geological Survey topographical maps of the area. Universal Transverse Mercator coordinates, elevations, and date and time, were then logged into the computer program TELDAY (Lonner and Burkhalter 1988), which calculated home ranges by the convex polygon method (Mohr 1947), rates of movements and geographic centers of activity. The procedure of Huntsberger and Billingsley (1987) was used to determine significant differences among home range sizes.

### Movements

The daily movements determined by TELDAY were presented as a maximum value, a minimum value and a mean value for kilometers moved in 1 day. The mean was taken to be the average daily movement. Annual and seasonal daily movements were determined for each turkey as well as for all 7 turkeys as a group. The daily movement value should be interpreted as an index to activity, not as actual distances travelled during a day.

Seasonal movements between winter and summer ranges were determined by measuring distances between geographic activity centers for winter and summer home ranges. Statistically significant differences were determined using the procedure of Huntsberger and Billingsley (1987).

## Habitat Use

Seasonal and annual habitat uses were determined for each turkey when possible. Telemetry locations were plotted by TELDAY on a 1:24,000 scale, printed out, and transparent overlays of the cover type maps were used to determine the proportion of total telemetry fixes that fell within each cover type. The procedures of Neu et al. (1974) and Byers et al. (1984) were used to determine if the observed use of habitats was proportional to the occurrence of habitats on the study area.

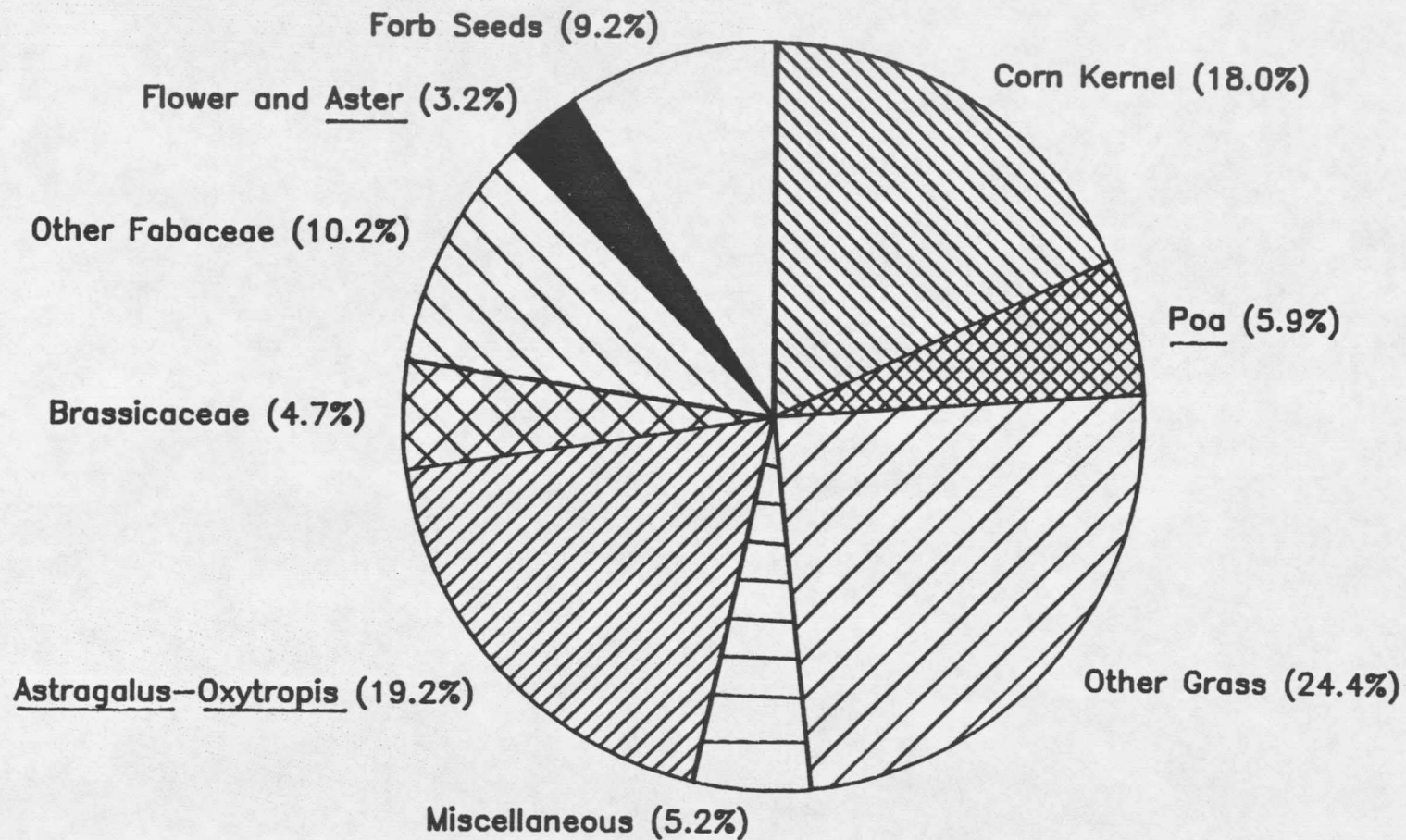
## RESULTS

### Relocations

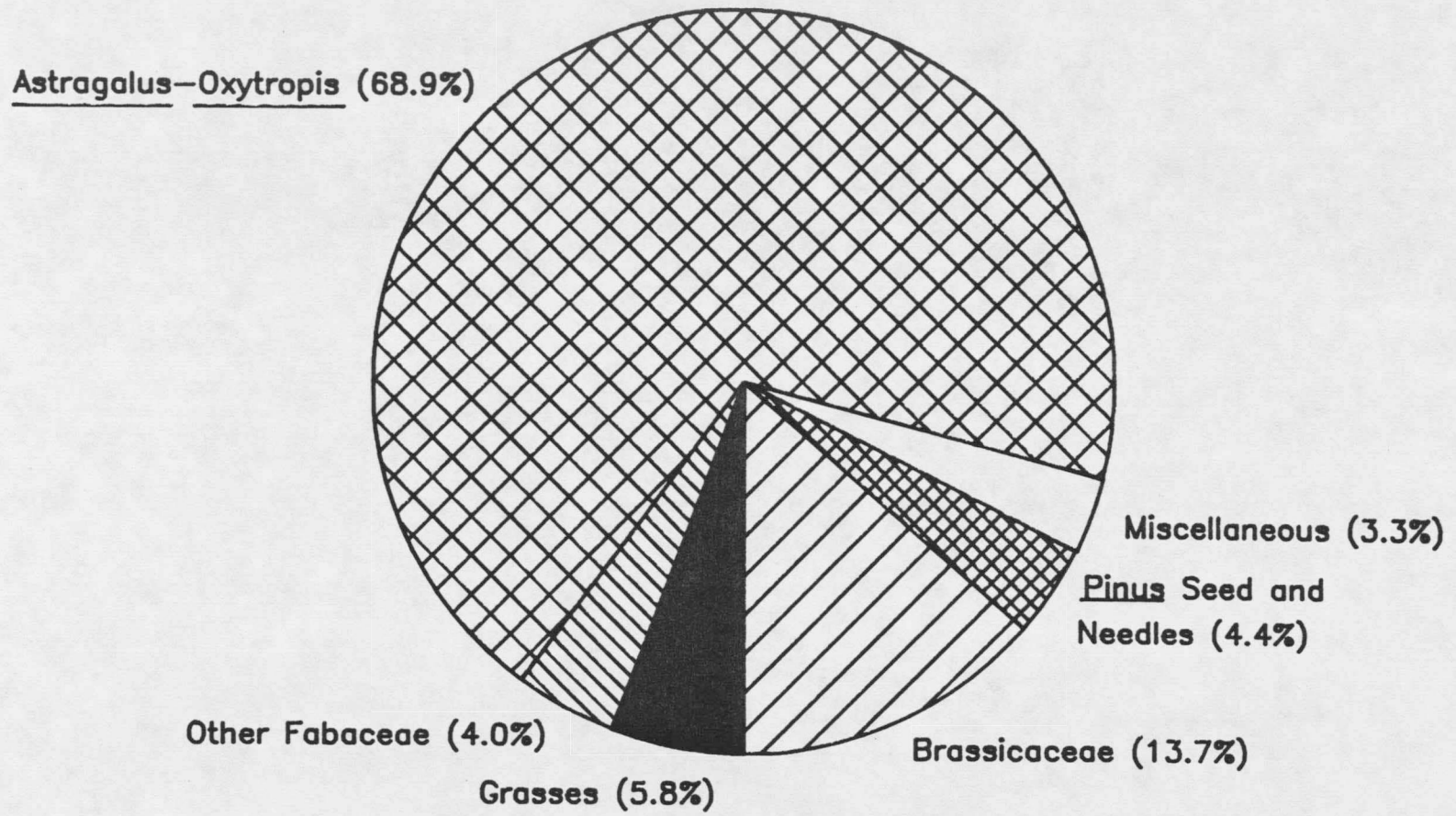
The captured turkeys marked with the colored leg bands were never positively identified again probably because of leg band loss. The radioed turkeys were followed and located regularly from January 1987 through December 1987 and subsequently located at less frequent intervals until June 1988. One hen turkey was lost in April 1987 due to radio failure, but she was later seen with the inactive radio intact in a winter flock in November and December 1987. One tom's radio ceased being received, and he was not seen again. One hen left the study area and went quite far north of the study area so that daily relocation of her was impractical.

### Food Habits

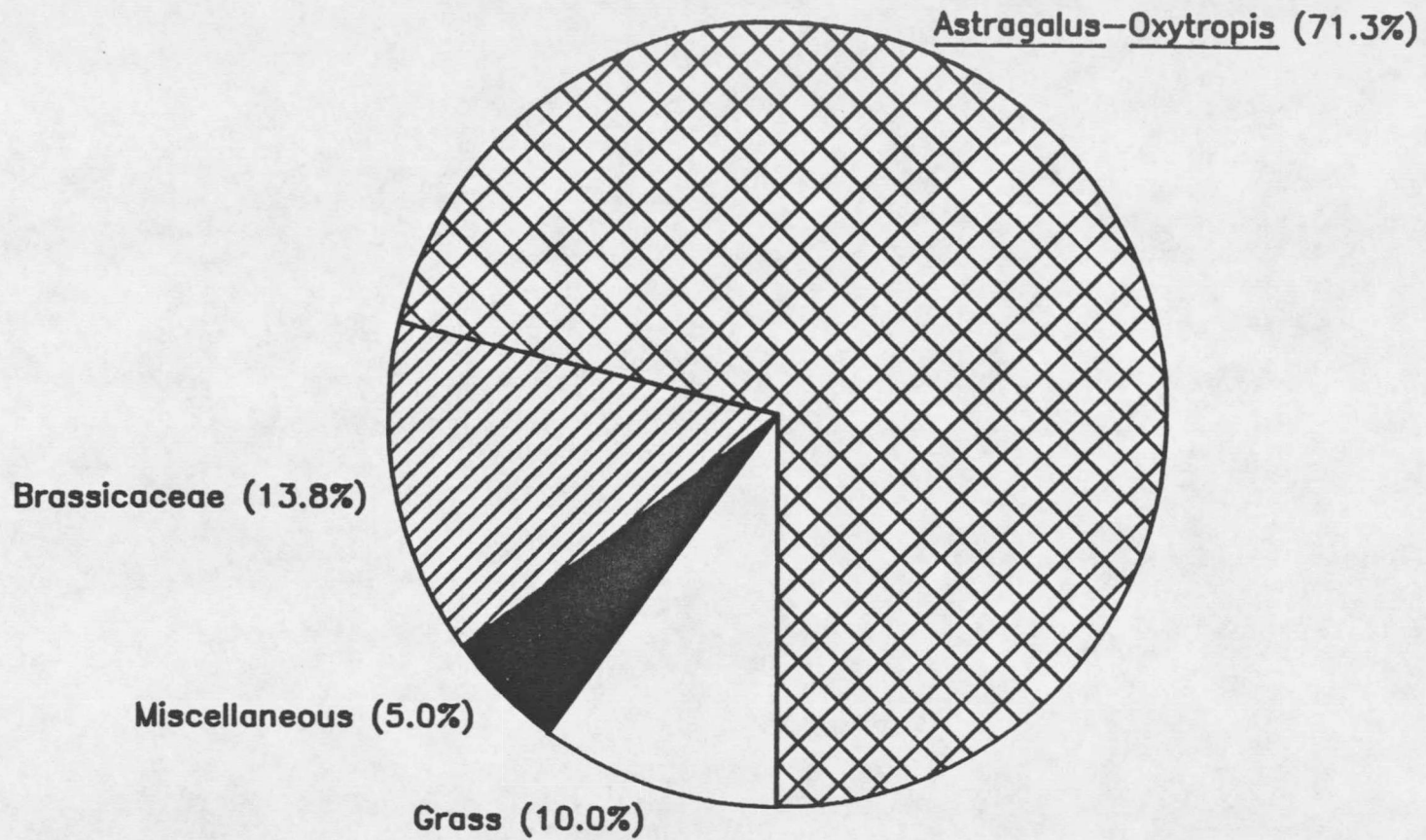
The monthly food habits results are presented in Figures 2-14. The Colorado State University Range Analysis Lab was able to identify most plants to the genus or family. Items not completely identifiable were classified as seeds, forbs, or grasses. Flower parts from different plants were classified simply as "flowers". The miscellaneous category included trace amounts of items such



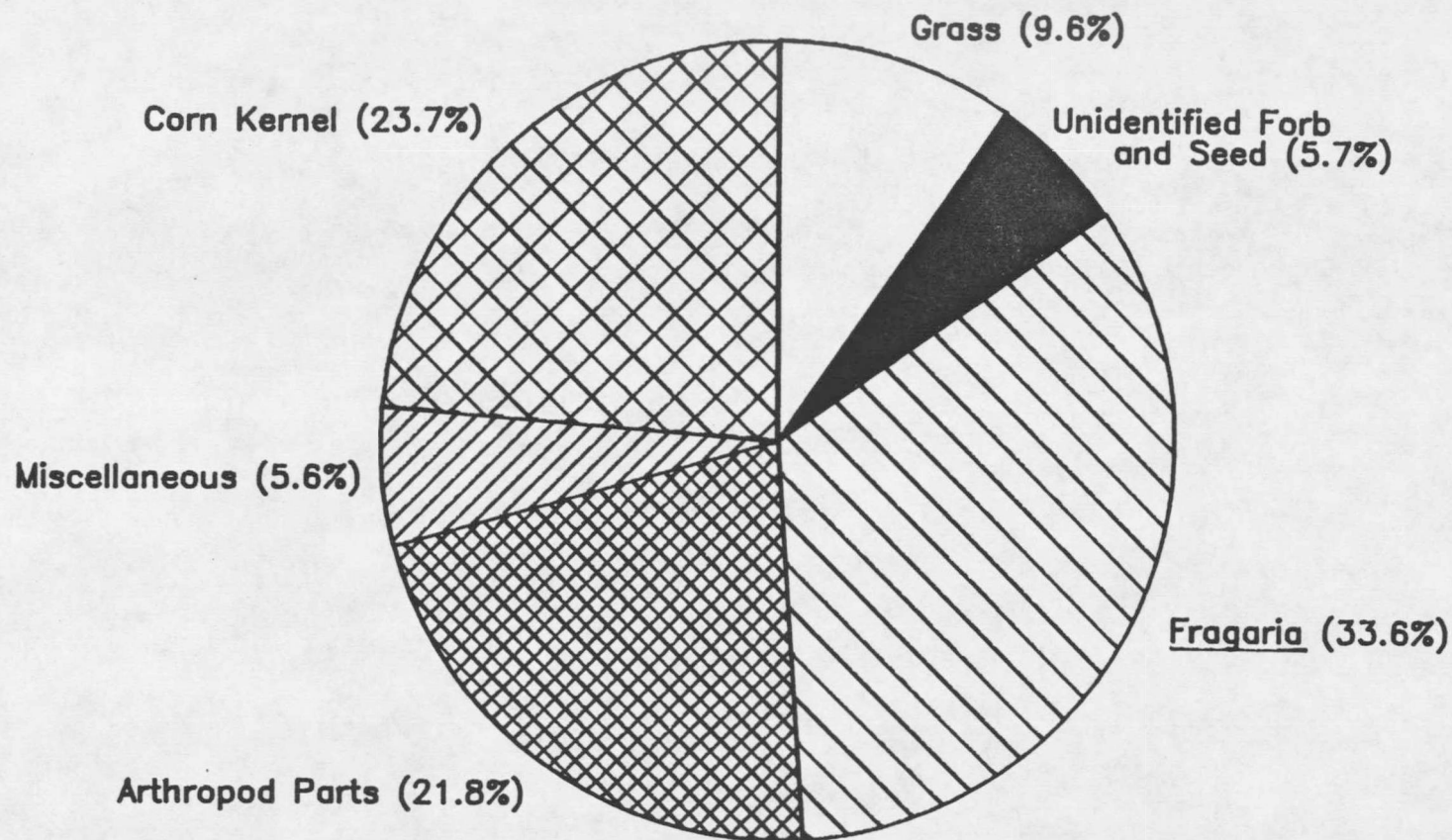
**Figure 2. January 1987 food habits for Merriam's turkey in Helena National Forest.**



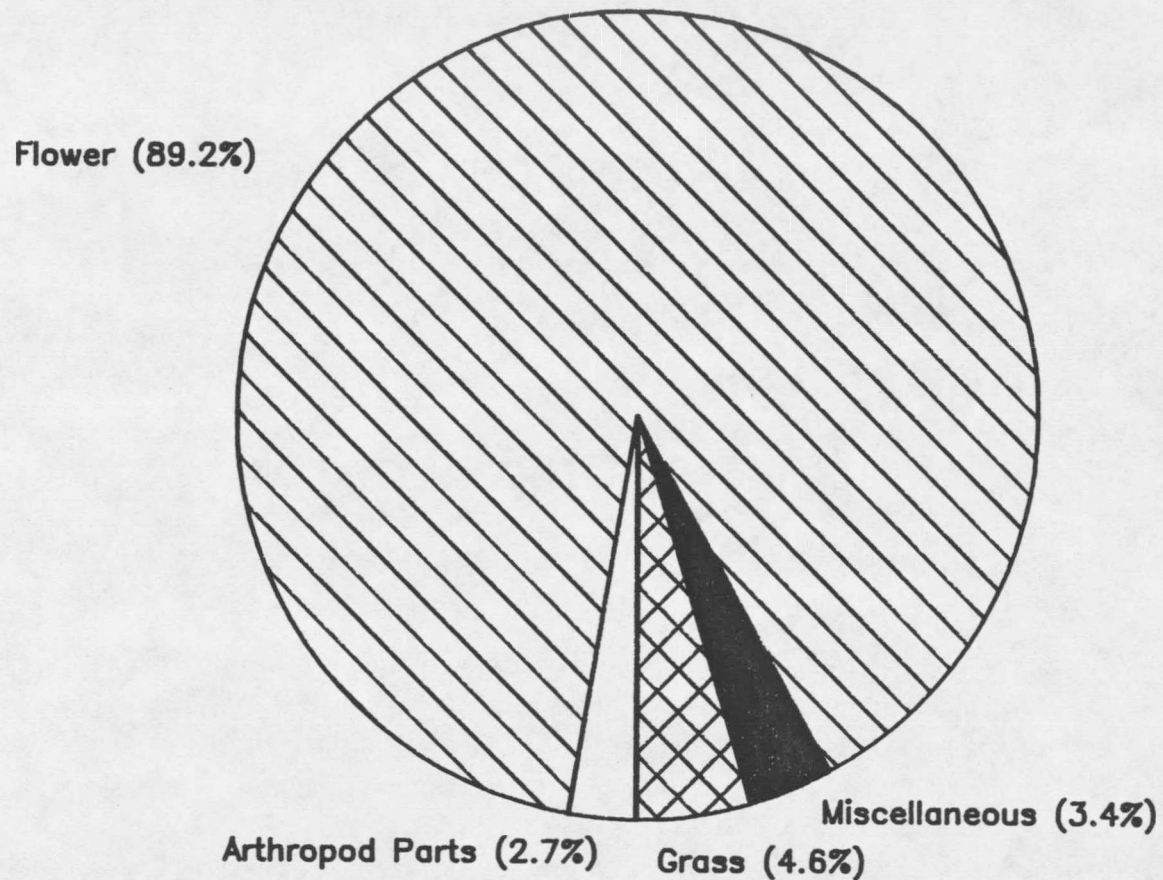
**Figure 3. February 1987 food habits for Merriam's turkey in Helena National Forest.**



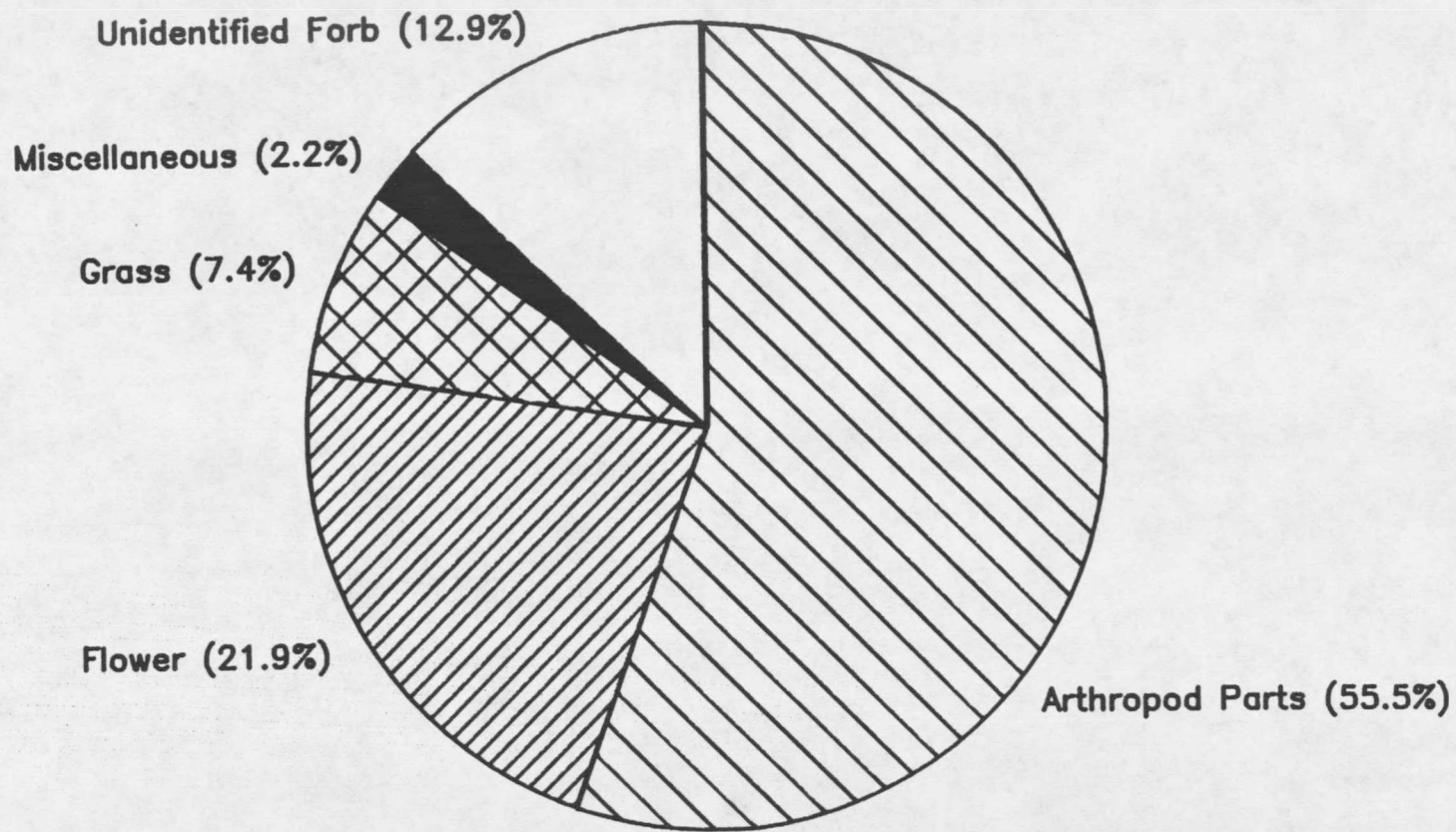
**Figure 4. March 1987 food habits for Merriam's turkey in Helena National Forest.**



**Figure 5. April 1987 food habits for Merriam's turkey in Helena National Forest.**



**Figure 6. May 1987 food habits for Merriam's turkey in Helena National Forest.**



**Figure 7. June 1987 food habits for Merriam's turkey in Helena National Forest.**

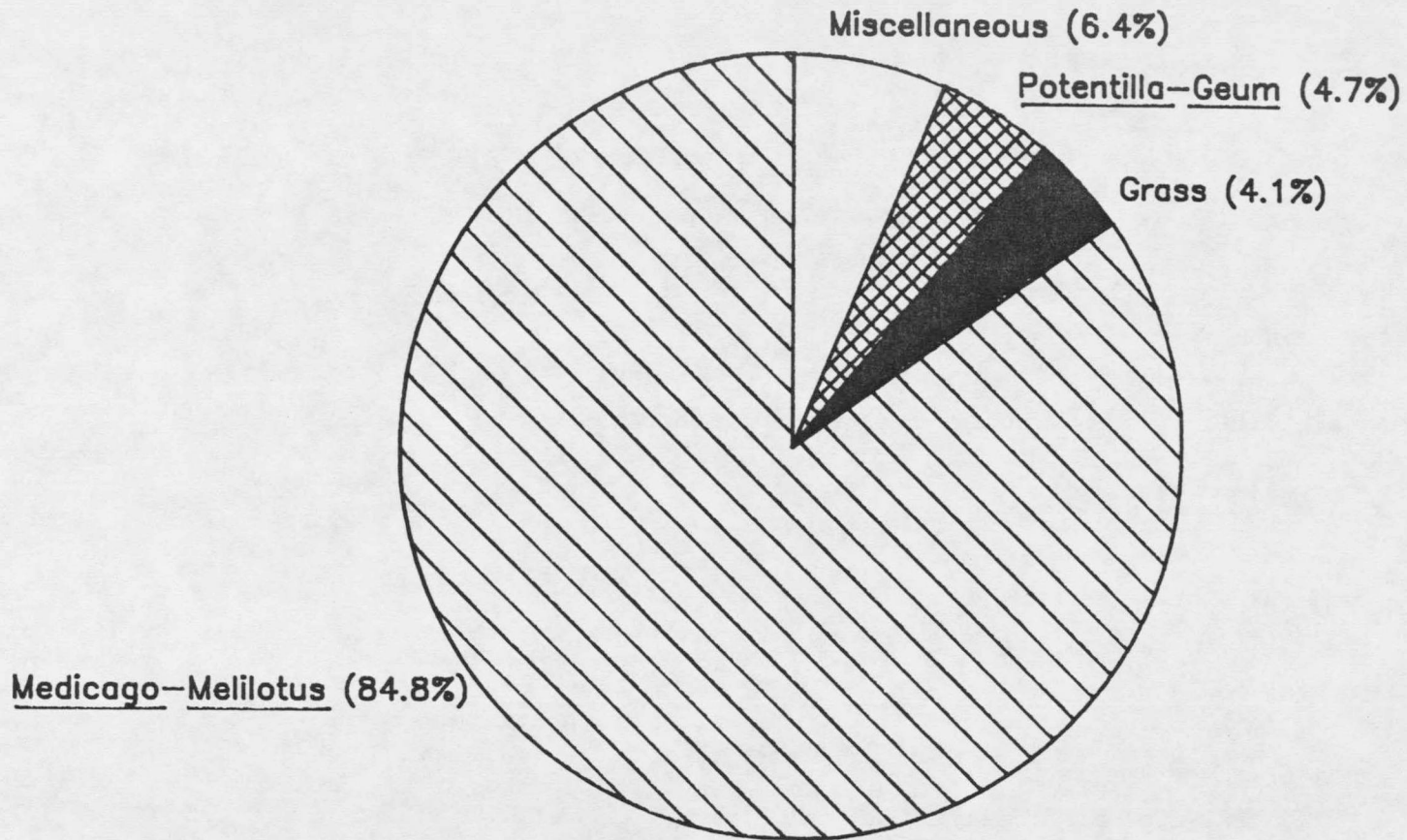
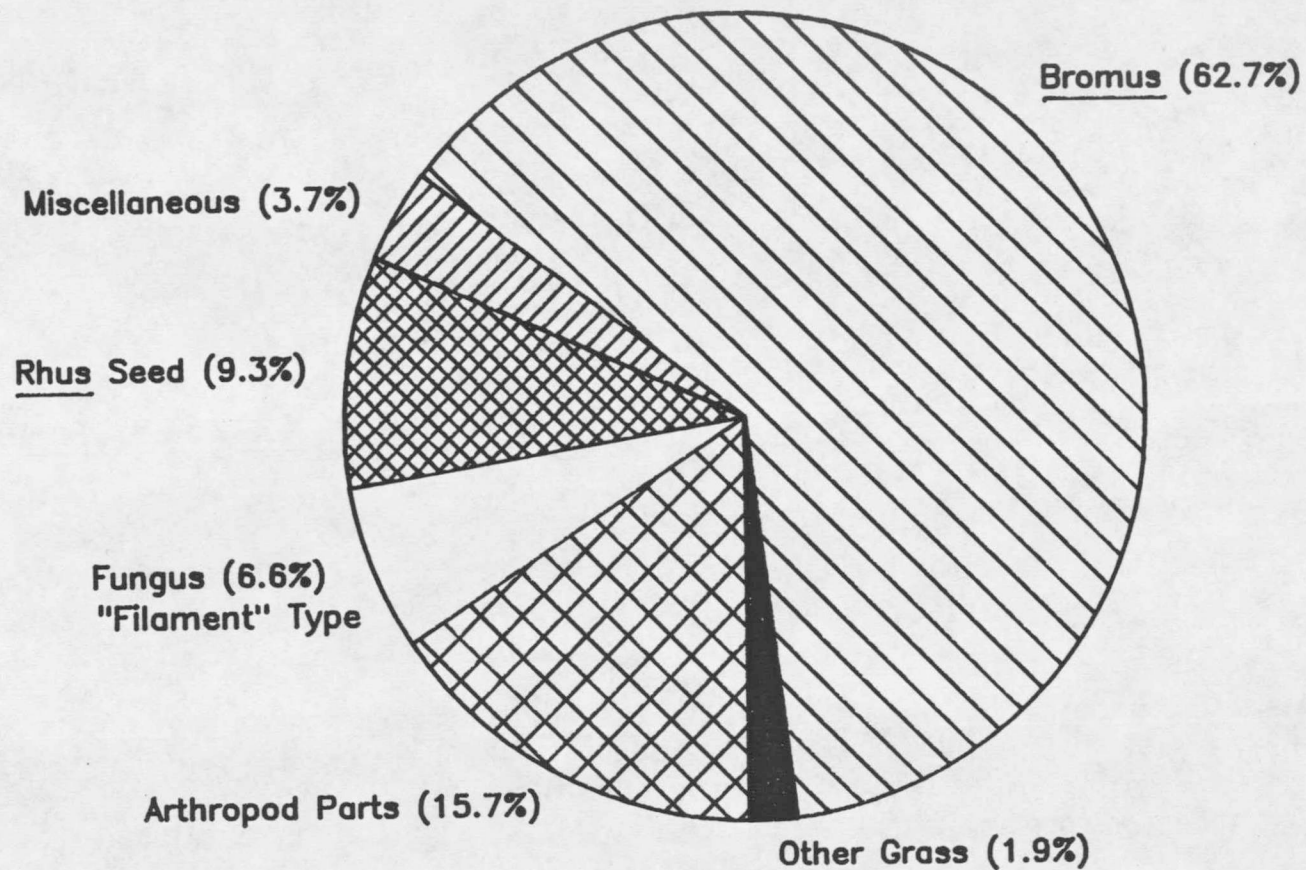
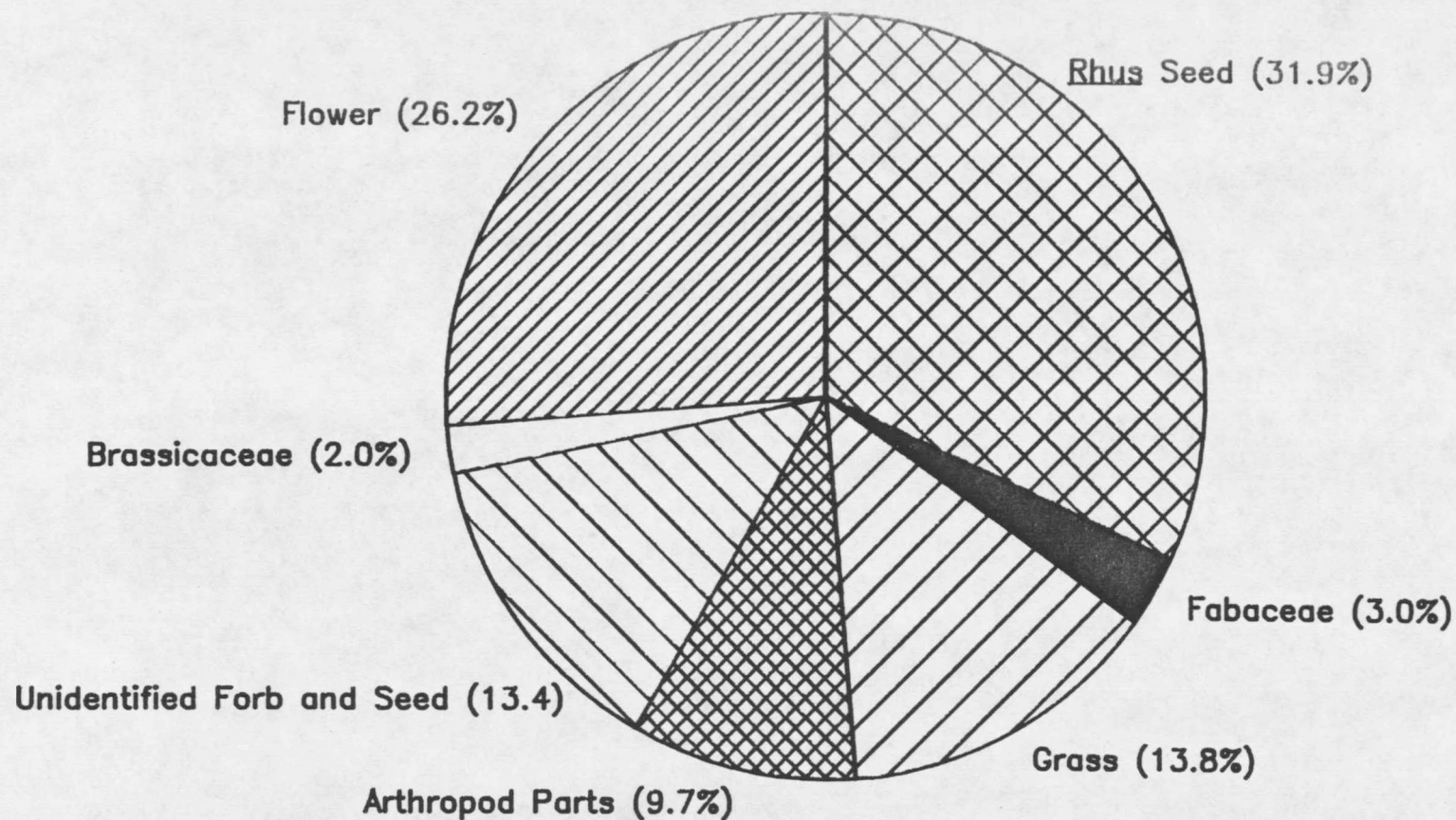


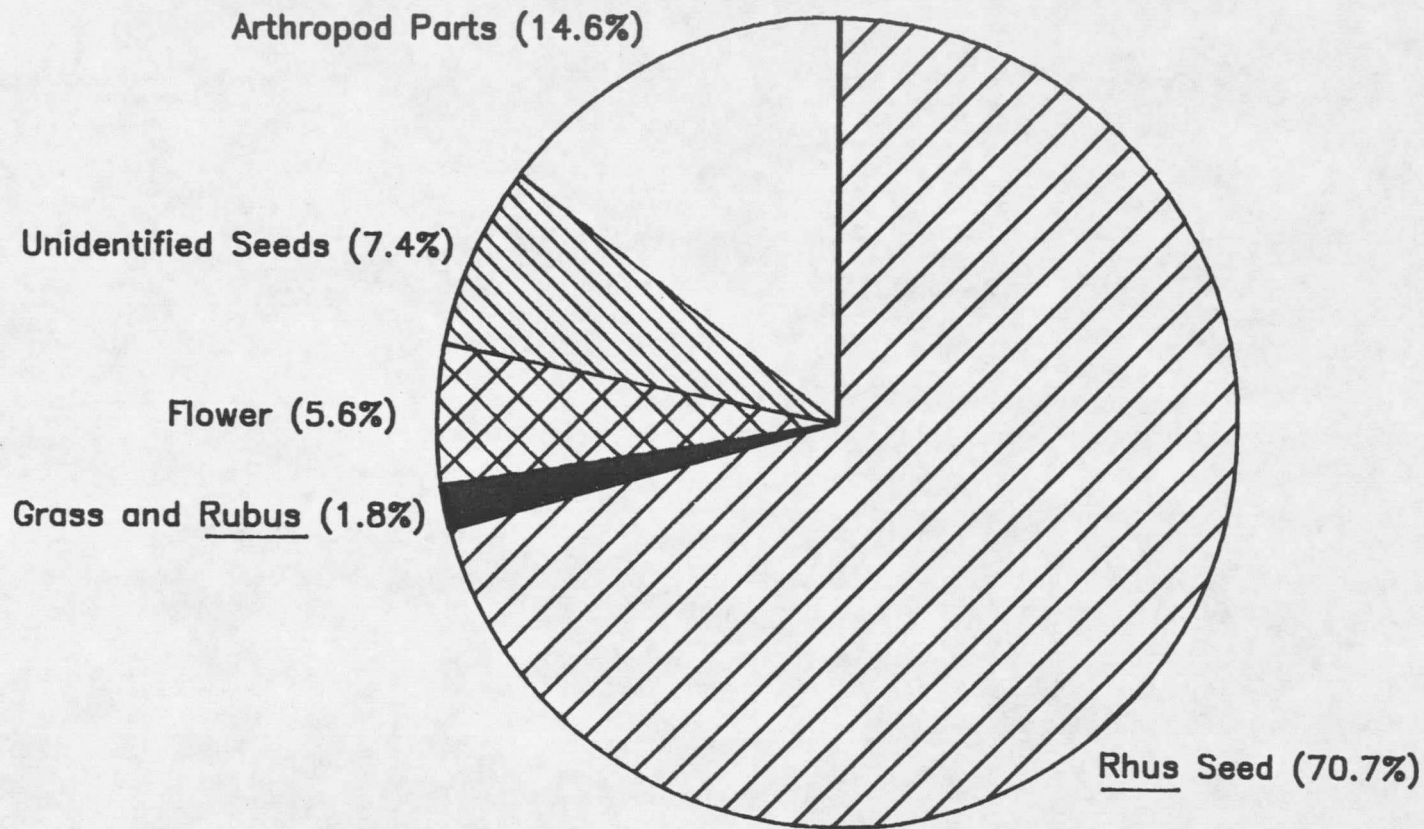
Figure 8. Food habits for an incubating female Merriam's turkey in Helena National Forest in 1987.



**Figure 9. July 1987 food habits for Merriam's turkey in Helena National Forest.**

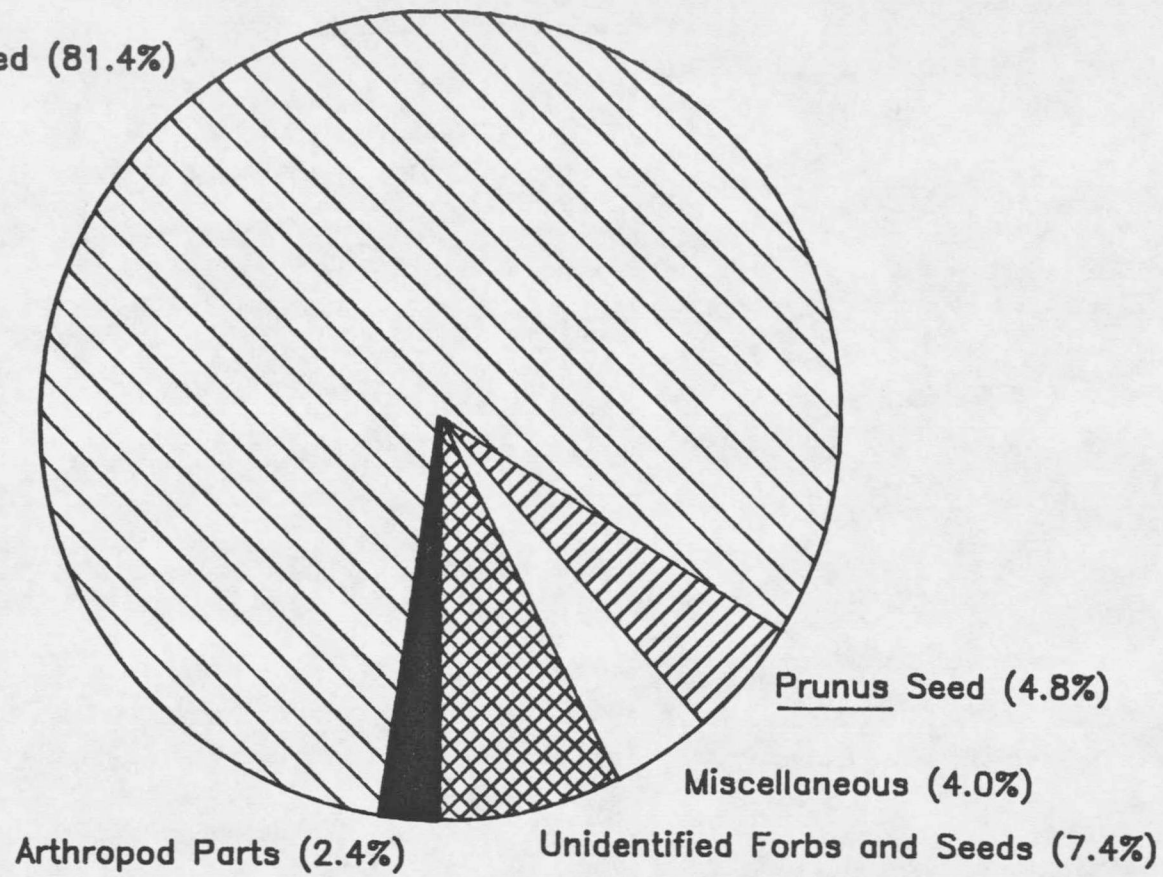


**Figure 10. August 1987 food habits for Merriam's turkey in Helena National Forest.**



**Figure 11. September 1987 food habits for Merriam's turkey in Helena National Forest.**

Rhus Seed (81.4%)



**Figure 12. October 1987 food habits for Merriam's turkey in Helena National Forest.**

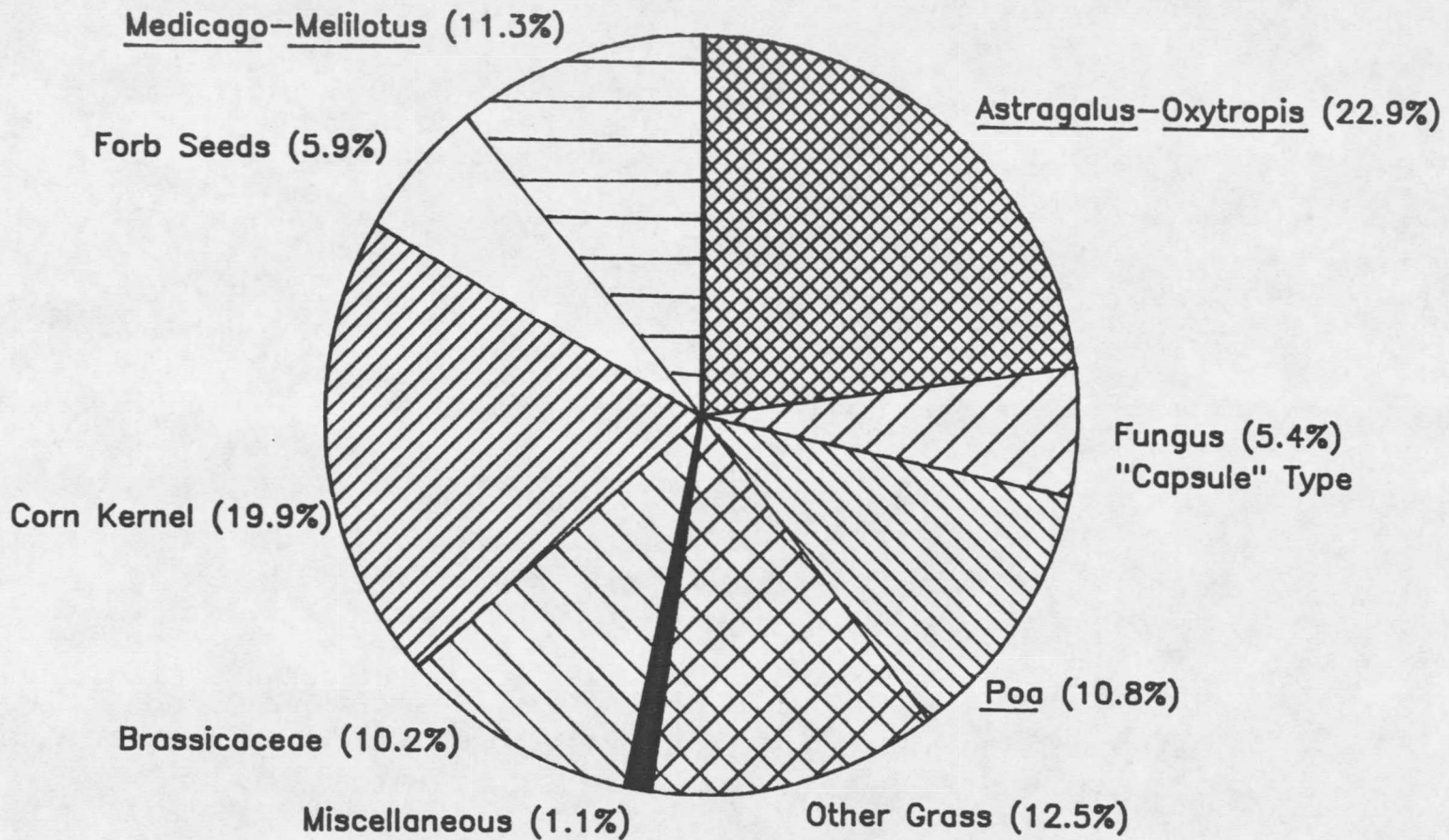
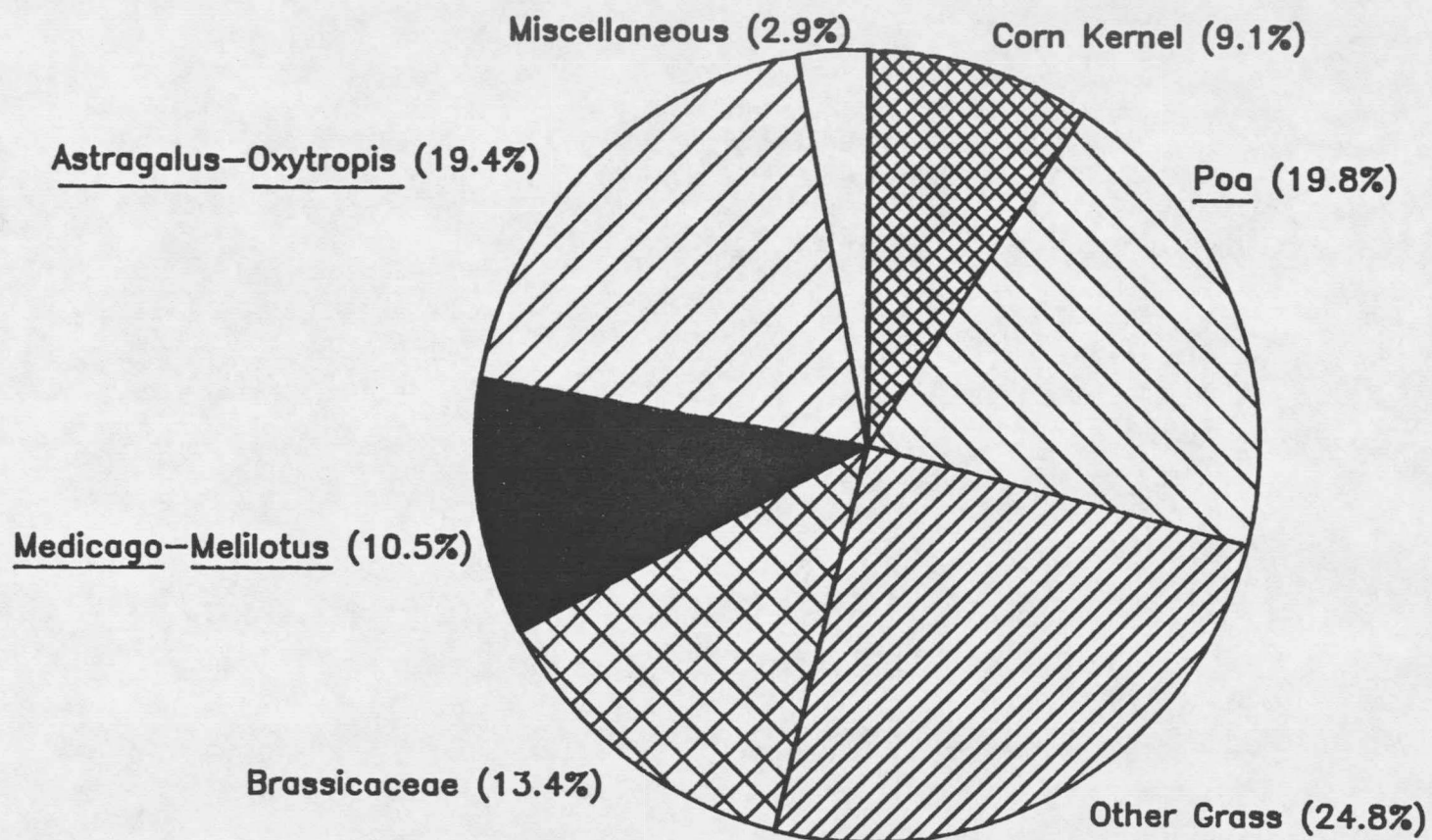


Figure 13. November 1987 food habits for Merriam's turkey in Helena National Forest.



**Figure 14. December 1987 food habits for Merriam's turkey in Helena National Forest.**

as bone, unknown forbs and seeds, arthropod parts, moss, Achillea millefolium, Aster, Senecio, Cerastium, Rhus (probably skunkbush sumac) seed, Prunus seed, Medicago or Melilotus (clovers), Liliaceae, Fabaceae, and Brassicaceae. Insects identified under low power included ants, beetles, grasshoppers, wasps, and caterpillars.

In winter the diet was more varied than in other seasons. Residents on the study area put cracked corn and bird seed out in their yards. Wild hay bales were also available to the turkeys, which could explain why there was such a large proportion of Astragalus or Oxytropis (legumes) in the February and March food habits results. Arthropod parts and flowers became major diet constituents during spring. The incubating hen, in early June, consumed a large proportion of Medicago or Melilotus during incubation and comparatively small amounts of other forbs, while non-nesting turkeys (hens and toms) relied heavily on arthropods during the same period.

For the entire summer season, diets consisted of a large proportion of arthropods, Bromus (brome grasses), Rhus seed, and flowers. Fall diets, however, consisted primarily of Rhus seed.

#### Home Range

A total of 617 locations was compiled for the turkeys. Their home range sizes determined from the locations are

presented in Table 2. Seasonal home ranges were determined only if there were 10 or more locations for a particular turkey during the season. Seasons were determined by observing the birds' habits as well as by observing weather patterns.

Table 2. Estimated home range sizes (ha) for Merriam's wild turkey in the Helena National Forest.

Turkey ID#	Winter	Spring	Summer	Fall	Annual
1122(F)	258	1016	763	76	2076
5351(F)	114	252	-	-	1701
7104(F)	156	902	1211	494	1795
7152(F)	141	903	-	-	1399
1212(M)	-	346	921	157	2010
8102(M)	-	535	1040	157	2162
8114(M)	-	223	782	-	1845
All turkeys pooled	462	1410	2504	823	2883

Winter: December through February 1987.

Spring: March through May 1987.

Summer: June through August 1987.

Fall: September through November 1987.

The annual home range for all the turkeys considered together was found to be 2883 ha. The mean annual home range for males was larger ( $P < 0.10$ ) than for females. There were no winter season home ranges for toms because they were trapped in March, and too few locations were made on them in December to reasonably estimate a home range. While the spring mean home range for hens was greater ( $P < 0.10$ ) than that for toms, mean summer and fall home ranges

were not significantly different ( $P > 0.10$ ) between the sexes.

### Movements

The results for daily movements are presented in Table 3. The annual daily movements for toms were essentially the same ( $P > 0.10$ ) as those for hens. In summer and fall there was also no significant difference between sexes. However, in winter ( $P < 0.05$ ) and in spring ( $P < 0.10$ ), hens travelled more than toms. Turkey movements in winter were the least, even though the winter of 1986-87 was mild with very little snow. During summer the turkeys' movements were greatest, as was their home range size.

Table 3. Mean daily movements (km/day) of Merriam's wild turkey in the Helena National Forest. Movements should be used as an index of activity to compare among the turkeys, not as the actual distance travelled.

Turkey ID#	Winter	Spring	Summer	Fall	Annual
1122 (F)	.230	.321	.497	.060	.272
5351 (F)	.445	.723	-	-	.201
7104 (F)	.260	.348	.700	.151	.354
7152 (F)	.277	.393	-	-	.164
1212 (M)	-	.173	.658	.150	.272
8102 (M)	-	.301	.663	.150	.296
8114 (M)	-	.086	.471	-	.254
All turkeys pooled	.210	.297	.490	-	.262

Winter: December through February 1987.

Spring: March through May 1987.

Summer: June through August 1987.

Fall: September through November 1987.

In winter, the hens and toms primarily grouped together by sex. In early spring, the males split up, and 1 of them joined the females' group, which then became a harem. As the females started searching for nesting sites and ranging farther apart, their group separated and remained so during the rest of the summer. Two of the 3 toms joined together again in mid-summer and fall, and 2 of the radioed hens were seen together in early winter of 1988.

Movements between winter and summer ranges are presented in Table 4. The only juvenile bird that was instrumented was lost before summer, so it could not be ascertained whether juveniles disperse farther than adults. The bird that moved greatest distance, a female, moved entirely off the study area.

Table 4. Movements (km) of Merriam's wild turkey between winter (1987) and summer (1987) ranges.

Turkey ID #	Distance between ranges
1122 (F)	3.85
5351 (F)	>5.0
7104 (F)	1.58
7152 (F)	*
1212 (M)	2.17
8102 (M)	2.04
8114 (M)	2.83
Females	2.54
Males	2.29
All turkeys pooled	2.57

\*No data for summer range.

Habitat Use

The cover types (Mattson and Despain 1985) found in the study area were assigned numbers 1-7 (Table 5). These numbers are used in presenting the habitat use results in Tables 6-10. The data represent proportions of the total number of telemetry locations for each season as well as for the entire year.

Table 5. Description of cover types found on study area in Helena National Forest.

Code	Cover Type	Percentage
1	0-40 year old ponderosa pine	32.2
2	100-200 year old ponderosa pine	26.5
3	Mixed Douglas fir and ponderosa pine	7.8
4	Climax ponderosa pine	15.4
5	300 year plus ponderosa pine	13.7
6	Disturbed mining areas	2.0
7	Open fields and meadows	2.4

In winter (Table 6), turkeys used the mixed Douglas fir and ponderosa pine stands less than the proportion present on the study area. Three hundred year-plus ponderosa pine stands were also used less than would be expected by chance. Females used climax ponderosa pine less than males did, and much less than the proportion of climax ponderosa pine on the study area. Hens also utilized mining areas more during winter than any other season, perhaps because residents of those areas fed them.

Table 6. Winter habitat use by Merriam's turkey in Helena National Forest in 1987. Each value is the proportion of the total telemetry fixes in each habitat for each turkey during the season. Cover type code is in Table 5 (page 32).

Turkey ID No.	Cover Type Code						
	1	2	3	4	5	6	7
7104	<b>.625<sup>a</sup></b>	.208	.042	.000	.000	.125	.000
7152	<b>.625</b>	.208	.042	.000	.000	.125	.000
1122	.500	.167	.000	.083	.000	.250	.000
5351	.545	.182	.000	.000	.000	.273	.000
1212	.571	.143	.000	.143	.000	.143	.000
8102	.571	.143	.000	.143	.000	.143	.000
8114	.500	.167	.000	.167	.166	.000	.000
Females	.592	.197	.028	<b>.014</b>	.000	<b>.169</b>	.000
Males	.550	.150	.000	.150	.000	.150	.000
All	<b>.582</b>	.187	<b>.022</b>	<b>.044</b>	.000	<b>.165</b>	.000
Study Area Prop.	.322	.265	.078	.154	.137	.020	.024

<sup>a</sup>Bold faced values indicate a significant difference from the expected value.

During spring (Table 7), hens utilized climax ponderosa pine much more than males did, and males used 100-200 year-old ponderosa pine stands more than females. The nest that was found was located in a mixed Douglas fir/ponderosa pine stand on a steep, rocky, well-vegetated slope. The general location of another nest was known to be in a climax ponderosa pine stand. Generally, the turkeys used climax ponderosa pine areas more and the 300 year-plus ponderosa pine less than their respective proportions of the study areas.

Table 7. Spring habitat use by Merriam's turkey in Helena National Forest in 1987. Each value is the proportion of the total telemetry fixes in each habitat for each turkey during the season. Cover type code is in Table 5 (page 32).

Turkey ID No.	Cover Type Code						
	1	2	3	4	5	6	7
7104	.214	.197	<b>.321</b>	.232	<b>.018</b>	<b>.000</b>	.018
7152	.429	.286	<b>.000</b>	.265	<b>.000</b>	<b>.000</b>	.020
1122	.250	.375	<b>.000</b>	.344	<b>.000</b>	<b>.000</b>	.031
5351	.250	.321	<b>.000</b>	.393	<b>.000</b>	<b>.000</b>	.036
1212	.286	.333	<b>.000</b>	.381	<b>.000</b>	<b>.000</b>	<b>.000</b>
8102	.250	<b>.583<sup>a</sup></b>	<b>.000</b>	.125	.042	<b>.000</b>	<b>.000</b>
8114	.357	.571	<b>.000</b>	.072	<b>.000</b>	<b>.000</b>	<b>.000</b>
Females	.291	.279	.109	<b>.291</b>	<b>.006</b>	<b>.000</b>	.024
Males	.288	<b>.492</b>	<b>.000</b>	.203	<b>.017</b>	<b>.000</b>	<b>.000</b>
All	.290	.335	.080	<b>.268</b>	<b>.009</b>	<b>.000</b>	.018
Study Area Prop.	.322	.265	.078	.154	.137	.020	.024

<sup>a</sup>Bold faced values indicate a significant difference from the expected value.

In summer (Table 8), males used the mixed Douglas fir/ponderosa pine stands less than would be expected by chance, and females used them more. Males also used climax ponderosa pine stands more than would be expected. No turkeys were located in mining areas or fields and meadows during the season.

Table 8. Summer habitat use by Merriam's turkey in Helena National Forest in 1987. Each value is the proportion of the total telemetry fixes in each habitat for each turkey during the season. Cover type code is in Table 5 (page 32).

Turkey ID No.	Cover Type Code						
	1	2	3	4	5	6	7
7104	.274	.242	<b>.258<sup>a</sup></b>	.113	.113	.000	.000
7152	-	-	-	-	-	-	-
1122	.361	.306	.083	.139	.111	.000	.000
5351	-	-	-	-	-	-	-
1212	.185	.259	<b>.019</b>	<b>.352</b>	.185	.000	.000
8102	.235	.196	.039	<b>.295</b>	.235	.000	.000
8114	.184	.364	.030	.212	.212	.000	.000
Females	.306	.266	<b>.194</b>	.122	.112	.000	.000
Males	.203	.261	<b>.029</b>	<b>.297</b>	.210	.000	.000
All	.248	.260	.097	.223	.172	.000	.000
Study Area Prop.	.322	.265	.078	.154	.137	.020	.024

<sup>a</sup>Bold faced values indicate a significant difference from the expected value.

In fall (Table 9), turkeys avoided mixed Douglas fir/ponderosa pine stands as well as mining areas, fields and meadows. Males used 0-40 year old ponderosa pines less than their availability.

Table 9. Fall habitat use by Merriam's turkey in Helena National Forest in 1987. Each value is the proportion of the total telemetry fixes in each habitat for each turkey during the season. Cover type code is in Table 5 (page 32).

Turkey ID No.	Cover Type Code						
	1	2	3	4	5	6	7
7104	<b>.750<sup>a</sup></b>	.250	.000	.000	.000	.000	.000
7152	-	-	-	-	-	-	-
1122	.100	.000	.100	.500	.300	.000	.000
5351	-	-	-	-	-	-	-
1212	<b>.083</b>	.417	.000	.417	.083	.000	.000
8102	<b>.083</b>	.417	.000	.417	.083	.000	.000
8114	-	-	-	-	-	-	-
Females	.500	.154	.039	.192	.115	.000	.000
Males	<b>.083</b>	.417	.000	.417	.083	.000	.000
All	.386	.246	.017	.263	.088	.000	.000
Study Area Prop.	.322	.265	.078	.154	.137	.020	.024

<sup>a</sup>Bold faced values indicate a significant difference from the expected value.

When the data for the entire year is pooled (Table 10), it becomes evident that toms avoided using 0-40 year-old ponderosa pine, mixed Douglas fir/ponderosa pine stands, and open fields and meadows. Females used 300 year-old plus ponderosa pine much less than expected. Generally the turkeys avoided the disturbed mining areas along with open fields and meadows throughout most of the year.

Table 10. Annual habitat use by Merriam's turkey in Helena National Forest in 1987. Each value is the proportion of the total telemetry fixes in each habitat for each turkey during the year. Cover type code is in Table 5 (page 32).

Turkey ID No.	Cover Type Code						
	1	2	3	4	5	6	7
7104	.354	.222	<b>.221</b>	.127	<b>.051</b>	.019	<b>.006</b>
7152	<b>.531<sup>a</sup></b>	.235	<b>.012</b>	.161	<b>.012</b>	.037	.012
1122	.311	.278	.045	.244	.078	.033	.011
5351	.325	.300	<b>.000</b>	<b>.275</b>	<b>.000</b>	.075	.025
1212	.223	.287	<b>.011</b>	.351	.117	.011	<b>.000</b>
8102	.245	.319	<b>.021</b>	.255	.149	.011	<b>.000</b>
8114	.264	.396	<b>.019</b>	.170	.132	.019	<b>.000</b>
Females	.379	.247	.108	.179	<b>.043</b>	.033	.011
Males	<b>.241</b>	.324	<b>.016</b>	<b>.274</b>	.133	.012	<b>.000</b>
All	.325	.277	.072	.216	.079	.024	<b>.007</b>
Study Area Prop.	.322	.265	.078	.154	.137	.020	.024

<sup>a</sup>Bold faced values indicate a significant difference from the expected value.

The data include roosting sites, feeding areas, nests, and loafing areas. The information collected did not allow for detailed analysis of preferences in roosting sites; however, all 5 of the sites found were on south-facing slopes in older, more mature ponderosa pine stands.

## DISCUSSION

There appeared to be a suitable food supply for turkeys, evident in their normal body weights and general vigor throughout the study. Dalke et al. (1942) found that the year-round diet of turkeys closely reflects the availability of various kinds of plants and insects. Exum et al. (1987) concluded there were few differences between the diets of males and females and that green vegetation and insects made up the bulk of the diet. The results of this study also agree with those of Rose (1956) in that although ponderosa pine nuts were extremely abundant, they were not used as a staple food. His study on the first successfully transplanted turkeys into Montana by the Montana Department of Fish and Game showed that those turkeys ate foods very similar to the turkeys in this study. Feed provided by area residents appeared to be a very important component of the turkeys' diets in winter.

It has been suggested that turkey home range size can be considered a function of habitat quality (Ligon 1946, Korschgen 1967, Exum et al. 1987). Williams (1981) states that, for all age classes, typical home ranges are larger in winter than in summer most likely because of a better food supply and fewer nutritional needs during the warmer season. However, the winter home ranges of the turkeys in

this study were substantially smaller than during other seasons. This difference could be explained by the supplemental feeding by residents as well as the mild, warm winter of 1987. The individual seasonal home ranges were larger than in other similar studies, but not large enough to indicate marginal habitat (Wigley et al. 1986, Bidwell et al. 1989).

Porter (1977) and Lewis (1963) found that deep snow and cold weather dramatically limited turkey movements and thus home range size in winter. However, in this study, there was very little snow, so it was likely not the reason for the smaller winter home range sizes. The summer home ranges were the largest of all, and the hen with a brood had the largest individual summer range. Jonas (1966) found hens in his study also moved great distances. The results of this study also agree with the findings of Ellis and Lewis (1967) in that the turkeys did not wander over their entire range, but they used small portions during 1-3 week intervals.

Typically, Merriam's turkeys winter at lower mountain altitudes and then may move 15-30 km to higher elevations to nest, unless habitat conditions are suitable where they are (Williams 1981). Most of the turkeys in my study dispersed less than 5.0 km to their summer ranges, which was also the case with turkeys in Missouri (Ellis and Lewis 1967). Lancia et al. (1975) determined that the

exaggerated movements by hens they observed were due to marginal habitat quality. From these observations, it seems that habitat on the study area was adequate.

Habitat use by the turkeys showed that certain areas were preferred while others were avoided. In Virginia Holbrook et al. (1987) determined that most turkeys used habitats in proportion to their availability. Although some showed preferences, no 2 birds showed the same preference, which attests to the wild turkey's adaptability. Generally turkeys in this study used the same habitat types as those in the Judith Mountains and the Long Pines area (Rose 1956).

Although the habitats on the study area seem sufficient from a nutritional aspect, the population remains at low levels. A number of other factors, including low production, disease, and predation may be causing the low population levels.

Although a detailed analysis was not possible, low poult production was observed in the population. The nest that was located had 2 eggs in it with no evidence of other broken eggs around the nest. That brood of 2 was seen 9 days after hatching in a "gang" brood of 5 poults and 2 hens. Two unmarked hens were observed throughout the summer of 1987 with only 4 poults. There was a report from a resident who sighted 2 hens with as many as 10 poults just north of the study area. These figures are very low

considering the average clutch size is 9-13 eggs (Williams 1981).

Several pathogens of domestic turkeys are known to lower egg production and affect poult survival without significantly affecting adult hosts. Information on the occurrence of these pathogens on wild turkeys is scarce (Rocke and Yuill 1987). Mycoplasmosis, a common domestic turkey disease, however, has been observed in wild populations and was linked to the decline of a population in Colorado (Adrian 1984). Further study will be necessary to determine if some pathogen is limiting this population in Montana.

Predation may also be another factor limiting the population. I observed an immature golden eagle (Aquila chrysaetos) unsuccessfully attempt to prey on the "harem" flock in spring. Rose (1956) observed a turkey kill made by 2 golden eagles. Other potential predators present on the study area include great horned owls (Bubo virginianus), striped skunks (Mephitis mephitis), raccoons (Procyon lotor), bobcats (Felis rufus), mountain lions (Felis concolor), and coyotes (Canis latrans). However, no evidence was found that would implicate predation as a limiting factor. In the 1960s and early 1970s poaching was reportedly a distinct problem in the area, but no evidence was found of poaching during my study.

All of these factors are interrelated and present no real cause of or solution to the low population level on my study area. Residents as well as those who use the Helena National Forest would like to see more turkeys in the area and possibly have a hunting season on them. It has been suggested that more turkeys be transplanted into the area to improve possibilities for higher production. I suggest this be carried out with at least modest monitoring of the population to determine the effects of such an effort.

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