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Life History and Habitat Utilization of Merriam's Turkey in Southwestern Utah

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LIFE HISTORY AND HABITAT UTILIZATION OF MERRIAM'S TURKEY IN SOUTHWESTERN UTAH

by

Fred C. Bryant

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ABSTRACT

Life History and Habitat Utilization of Merriam's Turkey in Southwestern Utah

by

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Utah State University, 1974

Major Professor: Dr. J. Juan Spillett
Department: Wildlife Resources

A study of the Merriam's wild turkey was conducted March 1972 to August 1973 in southwestern Utah to determine the life history and habitat utilization. Using transects, bio-telemetry, and observational techniques, information on flocking, hen:poult and sex ratios, and approximate dates for spring dispersal, nesting, and hatching was obtained. Turkey observations in relation to habitat variables were used to determine habitat utilization.

Except during the spring mating season, male flocks remained apart from other turkeys. Hen flocks in fall and winter consisted of adult hens and juveniles of both sexes. Males dispersed from winter flocks in March, and those that became harem gobblers attracted not more than 3 hens. Egg-laying probably took place from mid-April to mid-May and hatching from mid-May to mid-June. A drop in hen:poult ratios from 1:2.2 in 1972 to 1:0.7 in 1973 was attributed to harsh spring weather. Hens comprised an estimated 60 percent of the population during the study period.

Turkeys utilized a fall-winter-early spring habitat of mountain brush and scattered ponderosa pine. Late spring use was associated with a ponderosa pine or aspen-mixed-conifer habitat type. Broods highly used glades dominated by an aspen overstory with intermingling mixed-conifer, while a male flock used mixed-conifer clearings at 10,000 feet elevation. The upper and lower limits of turkey range on the study area were 10,000 and 6,000 feet, respectively. Turkeys began spring migration in April and fall migration in late September or early October.

(98 pages)

INTRODUCTION

Background

Through colonization and subsequent exploitation, our largest upland game bird became extirpated from more than 83 percent of its original range (Dalke et al., 1946; Schorger, 1966; Mosby, 1967). Three characteristics of the turkey which probably hastened this reduction were its size, palatability, and value as a trophy animal.

Interest in the wild turkey as a game species was rekindled in practically every state during the early 1950's (Sanderson and Schultz, 1973). As a result, turkeys now number about 1,250,000 birds (Mosby, 1973). Additionally, the harvest has grown from 47,000 bagged in 1952 to 128,000 in 1968 (Jahn, 1973).

Contributing to the population increase of turkeys in America has been the Merriam's subspecies (Meleagris gallopavo merriami) which historically is associated with the mountainous terrain of the West (Schorger, 1966). Releases of wild-trapped Merriam's turkeys into new areas have since extended this subspecies' range (Figure 1).

Justification

Wild turkeys never existed in Utah historically (see Figure 1) (Schorger, 1966; Mosby, 1973). However, wildlife managers recognized that wherever ponderosa pine (Pinus ponderosa) occupied large segments of an area's habitat,

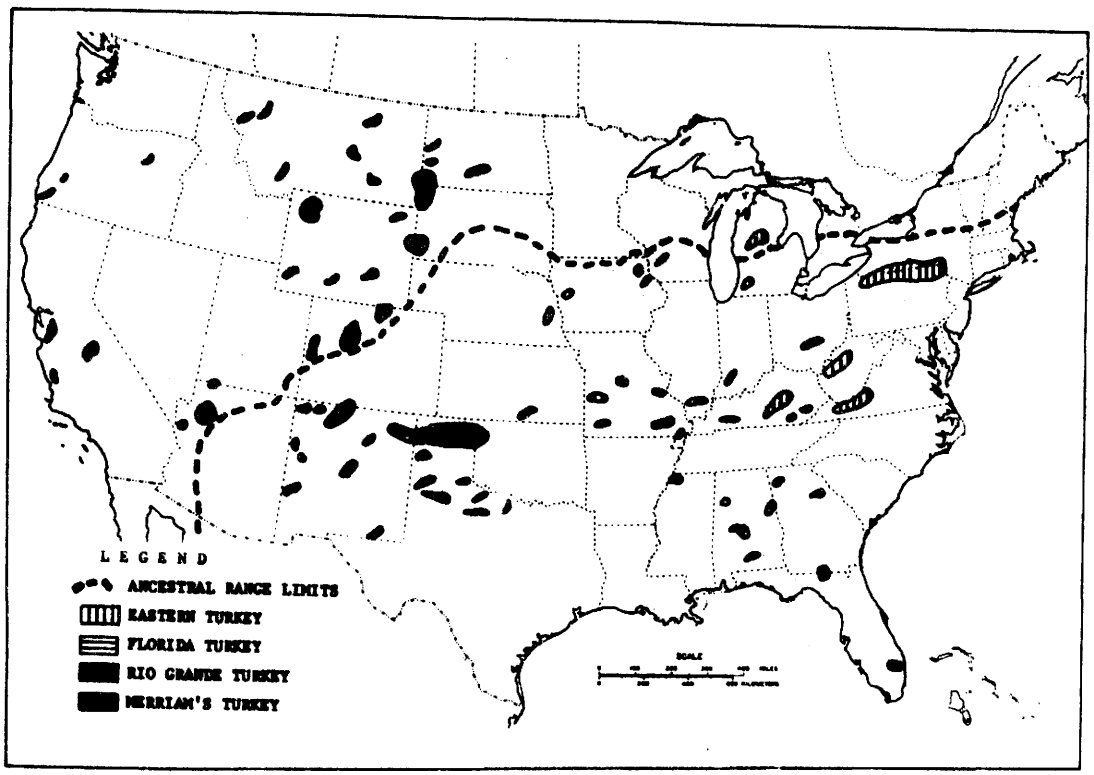

Figure 1. Historic and present distribution of turkeys in the United States with special reference to the Merriam's subspecies (from Mosby, 1973).

Merriam's turkey had a fair chance of surviving. Although attempts to introduce game-farm wild turkeys into Utah's habitat prior to 1950 failed, game managers were not discouraged. Perfected methods of trapping and transporting wild stock led to successful introductions in Utah. Merriam's turkeys have now been established in the La Sal, Boulder, Tushar, and Pine Valley Mountains and on Blue and Cedar Mountains (Figure 2). On these areas, ponderosa pine is a primary component of the vegetative communities.

The initial plant on Cedar Mountain consisted of 26 birds trapped in Arizona. These 18 hens and 8 gobblers were introduced into Lydia's Canyon in Kane County on December 17, 1957 and January 19, 1958. In February, 1960, five hens and two gobblers were released at the same site to supplement growing flocks and to enhance the genetic pool. This population since has dispersed over some 500 square miles to include the southern extremes of the Paunsagaunt and Markagaunt Plateaus and Kolob Terrace.

This area also has been the most productive turkey habitat in the state since fall hunting seasons were opened there in 1963 (Nish, 1973). Some 406 turkeys were bagged over a 9-year (1963 to 1972) period in this area, whereas only 72 were harvested on the Boulder Mountains during the same period. Hunting expenses (i.e., travel, lodging, equipment) would give the Utah turkey economic value along with its present aesthetic worth.

In light of these facts, quantification of the life history of turkeys in Utah was necessary, because no previous ecological studies had been undertaken. Most important, however, was habitat use, because this information would en-

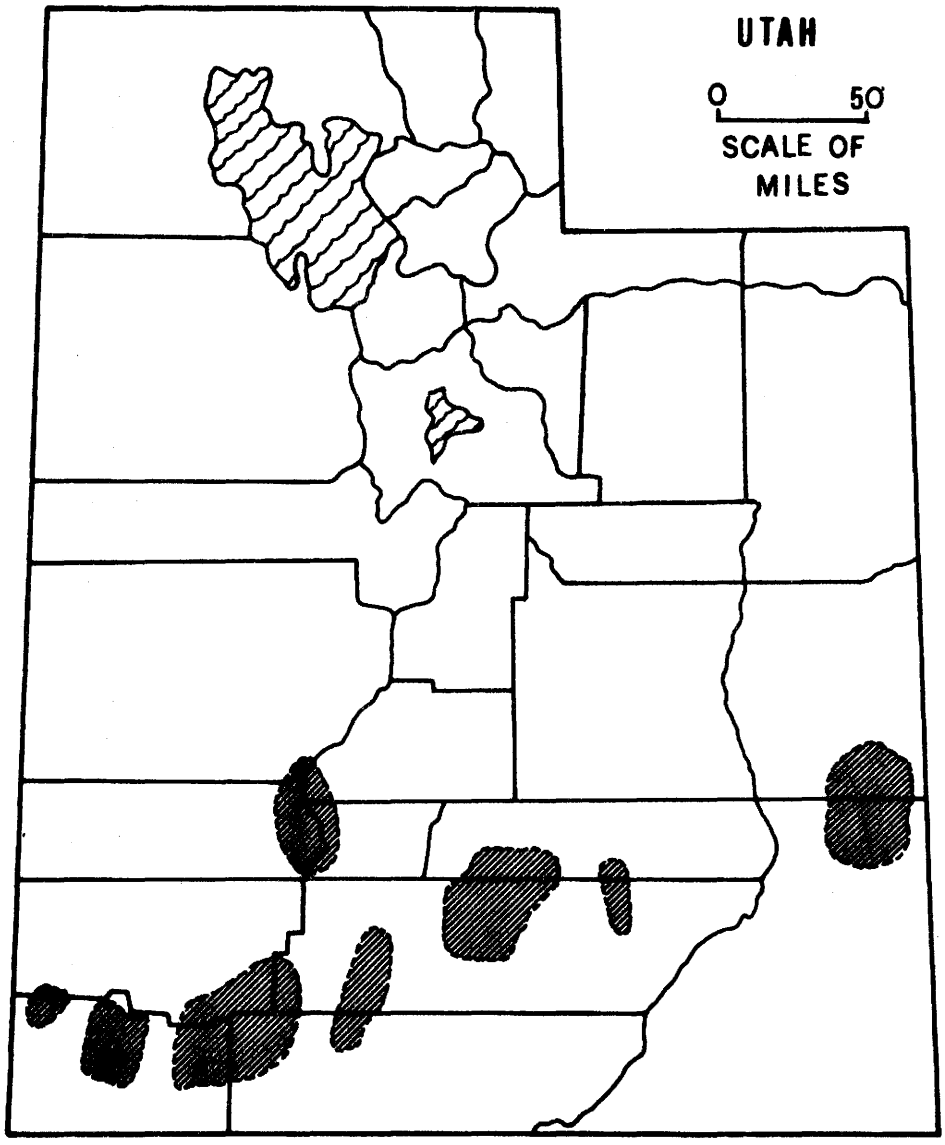

Figure 2. Approximate distribution of Merriam's turkeys in Utah.

able game managers to better evaluate future Utah transplant sites. While there had been numerous studies of this bird in other parts of the United States, these results were not considered an adequate description of the responses of Merriam's turkey to conditions in Utah. Thus, information obtained in the study would provide a better basis for future transplants, improve harvest techniques, and enhance existing populations of the species.

The locality surrounding the Lydia's Canyon release site was selected as the study area because it provided: (1) the largest segment of turkey habitat in Utah, (2) a relatively high density of birds, (3) a stable population, and (4) winter accessibility.

The study was initiated in March, 1972. Concerted efforts by the Utah Division of Wildlife Resources and the Utah Cooperative Wildlife Research Unit made the project possible.

DESCRIPTION OF THE STUDY AREA

The study area location and its boundaries are shown in Figures 3 and 4, respectively. It encompassed 322 square miles (205,986 acres) of which 81 percent was estimated to be suitable turkey habitat. The study area contained all of the winter range and most of the summer range of at least two turkey populations.

Approximately 65 percent of the study area was privately owned. The remaining 35 percent was controlled by the U. S. Forest Service, Bureau of Land Management, and the State of Utah.

Climate

Weather data were taken from the nearest weather station in Cedar Canyon (5,980 Mean Sea Level). Mean daily maximum and minimum temperatures over a 30-year period were 64.7 F and 36.1 F, respectively (Arlo Richardson, personal communication). July and January usually were the hottest and coldest months of the year, respectively. A 30-year average for annual precipitation was 10.3 inches. The study was conducted at considerably higher elevations than Cedar Canyon, so there were no accurate estimates for snow depths above 7,500 feet.

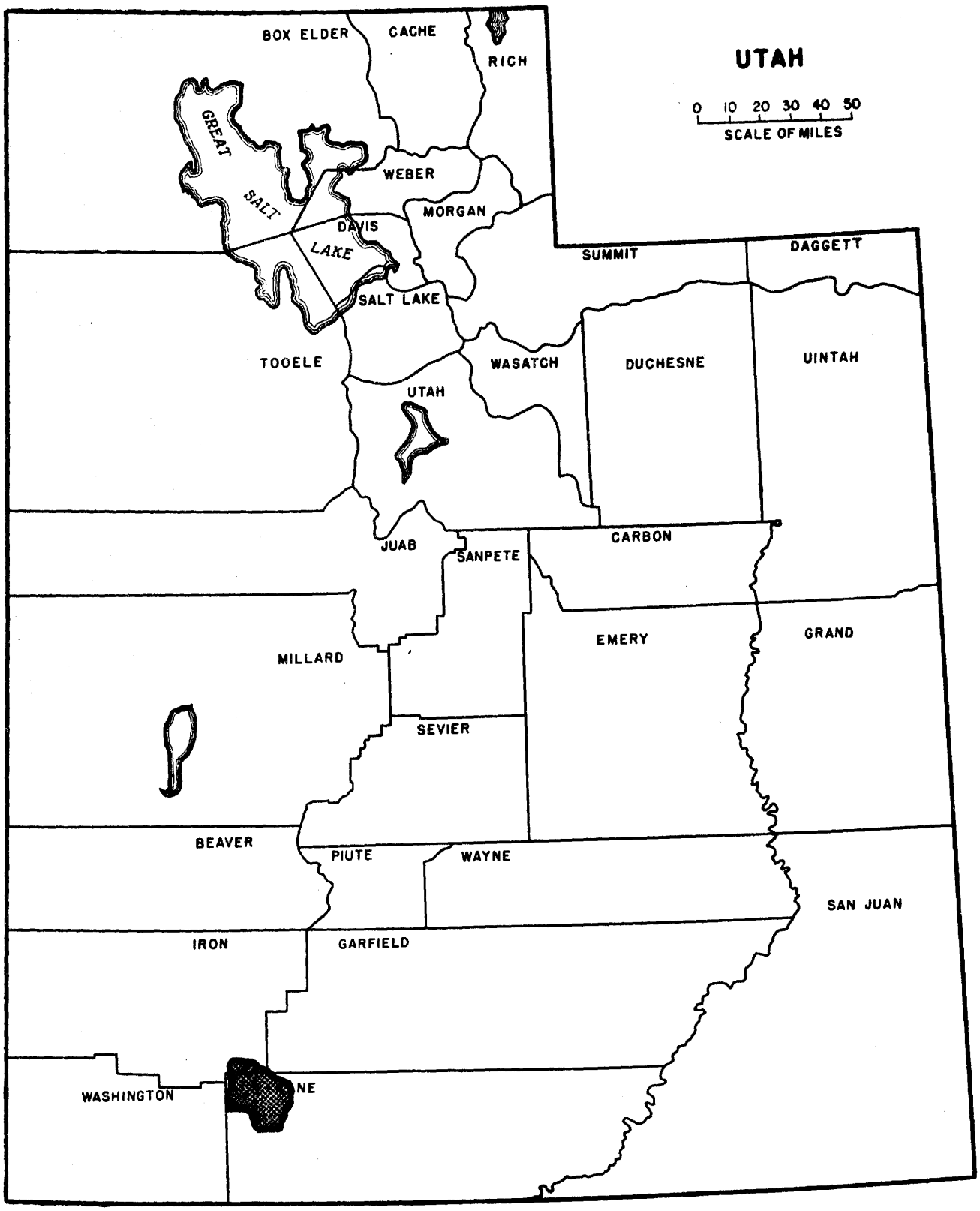

Figure 3. Location of the study area.

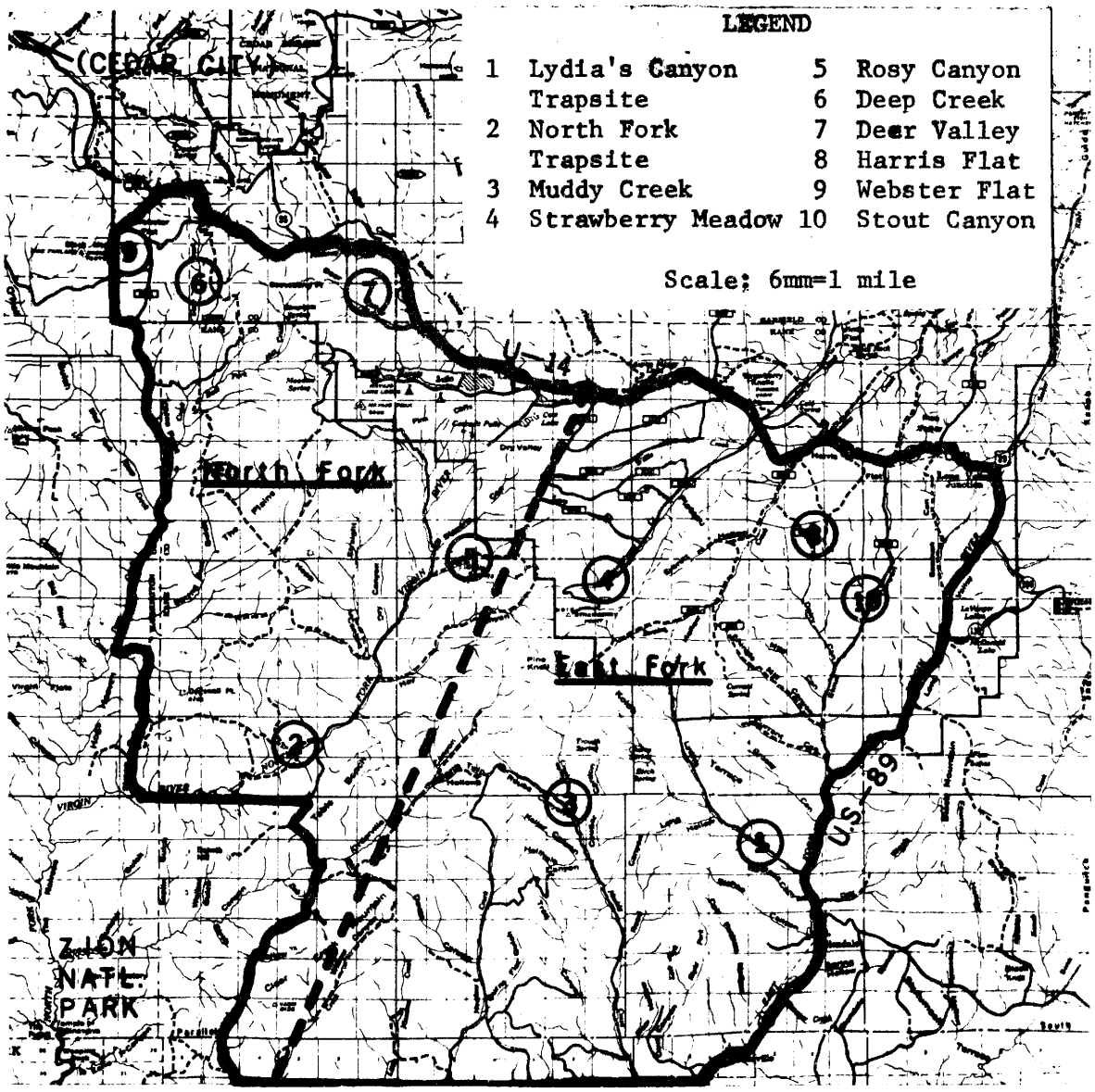

Figure 4. Important drainages, sub-divisions, and boundaries of the Utah study area.

Topography

The topography on the area ranged between 6,000 feet at lower Meadow Creek and 10,000 feet at the rim above Navajo Lake. A dominating feature was the series of 8,000-foot high Pink Cliffs, which formed the southeastern edge of the Markagaunt Plateau. These cliffs had vertical walls of 400-600 feet in several places. I assumed these cliffs marked the boundary between the turkey's summer and winter ranges, separating the Transition and Boreal life zones. A similar demarcation, formed by "the plains," and the breaks of Deep Creek, existed on the western part of the study area. However, it was consistently at a much lower elevation (7,000 - 7,500 feet).

Below 7,500 feet, the area was comprised of rugged canyons which fed the three major tributaries of the Virgin River: Deep Creek, North Fork, and East Fork. Important drainages of the North and East Forks also are presented in Figure 4.

Minor drainages of Deep Creek were separated from the North Fork by Cogswell Point and "the plains." Orderville Canyon, to the south, was separated from the North Fork by Table Bench. A significant divide, formed by the confluence of Table Bench and Clear Creek Mountain with Strawberry Point, separated the North Fork and East Fork drainages.

A network of primary and secondary roads paralleled most of the drainages above the Pink Cliffs, in North Fork, Deep Creek, and Stout Canyon of the East Fork. These provided summer access to numerous homesites. Many other drainages were accessible only by horse, on foot, or by 4-wheel drive

vehicles. Approximately 100 houses were located upon the turkey range, averaging almost one per 3.2 square miles.

Permanent running water was present in the minor drainages of the East and North Forks, and Deep Creek, regardless of precipitation received during any given year. In a dry year, the area above the Pink Cliffs seemed to contain less permanent water than in a wet year.

The major land use on the area was cattle and sheep grazing. There was a limited lumbering of mature ponderosa pine. In 1973, aspen (Populus tremuloides) was logged at Webster Flat, primarily for excelsior.

Vegetation

The vegetational complex consisted of Transition and Boreal life zones (Hylander, 1966). The Transition Zone included pinyon pine (Pinus edulis), juniper (Juniperus spp.), scattered ponderosa pine, and Gambel oak (Quercus gambelii). This zone was usually associated with the rugged terrain below the Pink Cliffs.

The Boreal complex, usually located above the Pink Cliffs, consisted of Douglas fir (Pseudotsuga menziesii) or Montane Forest. This complex included Douglas fir, ponderosa pine, aspen, and the Hudsonion sub-division or spruce (Picea spp.) and fir (Abies spp.). Deciduous trees, such as river birch (Betula fontinalis) box-elder (Acer negundo), and big-toothed maple (Acer grandidentatum), were found along riparian canyon bottoms.

Dominant understory shrubs ranging through these zones were: big sagebrush (Artemisia tridentata), rabbitbrush (Chrysothamnus spp.), serviceberry (Amelanchier utahensis), bitterbrush (Purshia tridentata), mountain mahogany (Cercocarpus spp.), manzanita (Arctostaphylos patula), snowberry (Symphoricarpos oreophilus), currant (Ribes spp.), and wildrose (Rosa woodsii).

The more common forbs included: penstemon (Penstemon spp.), locoweed (Astragalus spp.), skyrocket gilia (Gilia aggregata), aster (Aster spp.), mullein (Verbascum thapsus), dandelion (Taraxacum spp.), vetch (Vicia spp.), clover (Trifolium spp.), eriogonum (Eriogonum spp.), and lupine (Lupinus spp.).

Dominant grasses were: blue grama (Bouteloua gracilis), Indian ricegrass (Oryzopsis hymenoides), bluegrass (Poa spp.), bearded wheatgrass (Agropyron subsecundum), crested wheatgrass (A. cristatum), bluestem wheatgrass (A. smithii), slender wheatgrass (A. trachycaulum), cheatgrass (Bromus tectorum), nodding brome (B. anomalus), smooth brome (B. inermis), orchardgrass (Dactylis glomerata), timothy (Phleum pratense), alpine timothy (P. alpinum), letterman needlegrass (Stipa lettermania), and spike trisetum (Trisetum spicatum).

Study Area Sub-Divisions

In an attempt to explain turkey distribution, the study area was separated into two parts: (1) East Fork (174 square miles) and (2) North Fork-Deep Creek (148 square miles) (see Figure 4).

Winter ranges

The rugged canyons below the Pink Cliffs were similar on both the East and North Forks, containing scattered ponderosa pine in association with juniper, pinon pine, Gambel oak, serviceberry, mountain mahogany, sagebrush, and rabbitbrush.

Water, primarily in the form of free-flowing streams, was present in most drainages of both units. There also appeared to be adequate roost trees on south and south-east facing slopes.

The towns nearest the area (Glendale, Orderville, and Mt. Carmel) were along U. S. Highway 89 and between 5 and 9 miles from optimum winter range on the East Fork. These towns also were nearest to the North Fork winter range, but 30-35 road-miles distant.

Summer range

The East Fork summer range, occurring above the Pink Cliffs, was dominated by ponderosa pine communities (both mature and cut-over). These occurred mostly in pure stands, but also were associated with mixed-conifer (on north-facing slopes) and groves of aspen or aspen-mixed conifer. In contrast, the North Fork was dominated by aspen and aspen-mixed conifer communities. There were no pure stands of ponderosa pine there.

Water was available mainly in the form of seeps and springs on the East Fork. Abundant water always occurred below the Pink Cliffs and never more than 1 mile from any point on the summer range. On the North Fork,

ponds, springs, and creeks provided abundant water. Roost trees were available on ridge tops and north and north-east facing slopes on both areas.

There were 50-60 summer homes on the East Fork summer range concentrated at Willis, Strawberry, and Swains Creeks, and at Harris Flat. The 40 summer homes on the North Fork were concentrated near Navajo Lake and in Ashdown Canyon.

METHODS

Observations

Locating turkeys in relation to habitat types was imperative. It was soon obvious that visual (or direct) observations would not provide sufficient data. Thus, direct observations were supplemented with indirect observations from tracks, droppings, feathers, scratchings, or dust baths. Each location where turkeys were observed either directly or indirectly is referred to as an observation site.

Various means of travel were used to investigate the study area. Horses and foot travel were employed when terrain or weather prohibited vehicle use. Sno-cats, snowmobiles, and snowshoes also were used when conditions dictated (see Appendix, Table 15).

Research Tools

Transects and track counts

Driving and walking transects were established in what was considered optimum turkey habitat, primarily on summer ranges, to enhance the possibility of observing hens and poults. Transect locations, lengths, and vegetation trends are described in the Appendix (Table 16). Transects were traveled once each week during early morning or late afternoon, as weather permitted. Equal time was spent on both the East and North Fork transects. Tracks,

particularly of hens and poults, were recorded on the transects to supplement visual observations used in determining hen:poult ratios. Dirt roads at Webster Flat, Deep Creek, Strawberry, and Harris Flat were swept at 4-day intervals, and tracks crossing these roads were counted.

Sex ratio data also were collected on transects and supplemented with observations of tracks found at watering or similar sites where positive identification as to sex could be made. Sex-ratio track counts were restricted to the period between December 1 and July 1. After July 1, tracks of immature males could not be distinguished from those of hens. Birds observed directly were sexed using characteristics described by Burget (1957).

Males observed directly from January 1 to May 1 were classed as adult or juvenile depending upon beard length. Juvenile males usually attain a beard length of less than three inches by April (Lewis, 1973).

Bio-telemetry

Bio-telemetry was used to help determine nesting habitats, nest and brood success, and seasonal and daily movements in relation to habitat types. Six transmitters (Model ST-1), six gold-plated antennas, and 12 mercury batteries (Model RM828) were purchased from the AVM Instrument Company, Champaign, Illinois. Transmitter frequencies (MHz pulsing signals) corresponded with an AVM 12-channel receiver and directional antenna supplied by the Utah Cooperative Wildlife Research Unit. Battery life was six to nine

months. Each radio package, consisting of transmitter, batteries, antenna, and dental acrylic (cold monomer and polymer type), weighed 7 ounces.

Three hens and two gobblers were equipped with radios during the 1972-73 winter. The radios were strapped to the turkeys, as described by Williams et al. (1968).

Trapping and marking

During the 1972-73 winter, 10 turkeys were captured, marked, and released in the North Fork area, near the confluence of the North Fork road and the North Fork of the Virgin River (see Figure 4). Two turkeys also were trapped, marked, and released 1.0 mile northwest of the junction of U. S. Highway 89 and the mouth of Lydia's Canyon. The two release and capture sites were 14 air-line miles apart. The capture method was described by Glazener, et al. (1964).

Colored streamers of plasticized nylon fabric were attached to the wing patagium with turkey wing tags as described by Knowlton et al. (1964). The tags allowed identification of trapsite, date trapped, sex, and age. Age classes were designated as adult or juvenile (Williams, 1961).

Numbers of turkeys were estimated from birds directly observed on winter concentration areas, and from tracks observed of single or groups of birds from winter breakup of flocks until hatching (March 1 through June 1). Thus, density estimates could be calculated.

Habitat Analysis

Macro-habitat

Determination. Broad vegetational communities on the study area were described from U. S. Forest Service analyses of grazing allottments (John Padden, personal communication). The major habitat types and acreage compositions arranged by average elevation above sea level were: (1) mountain brush--90,323 acres, (2) conifer (ponderosa pine)--12,336 acres, (3) aspen--13,144 acres, and (4) non-range conifer (dense mixed-conifer)--34,884 acres. Turkeys did not use the pinon-juniper type (40,108 acres). Minor types, such as sagebrush, barren ground, and meadow (15,191 acres), were included with the associated major types. Thus, macro-habitat analyses were limited to only four broad categories.

The entire study area was mapped by habitat. For portions within the Dixie National Forest, U.S.F.S. Range Surveys of Grazing Allotments were used. Private, state, and BLM lands were mapped according to Utah Big Game Range Inventories (Coles and Pedersen, 1969).

Analyses. Sightings of turkeys were plotted on a map overlay. When placed over the habitat type map, the overlay provided information on turkey distribution, and monthly, seasonal, and annual habitat utilization. Figure 5 shows location of turkey sightings.

Turkey use of habitats was calculated on a monthly and seasonal basis as: the number of observations recorded on each habitat type relative to the total numbers recorded for all habitat types.

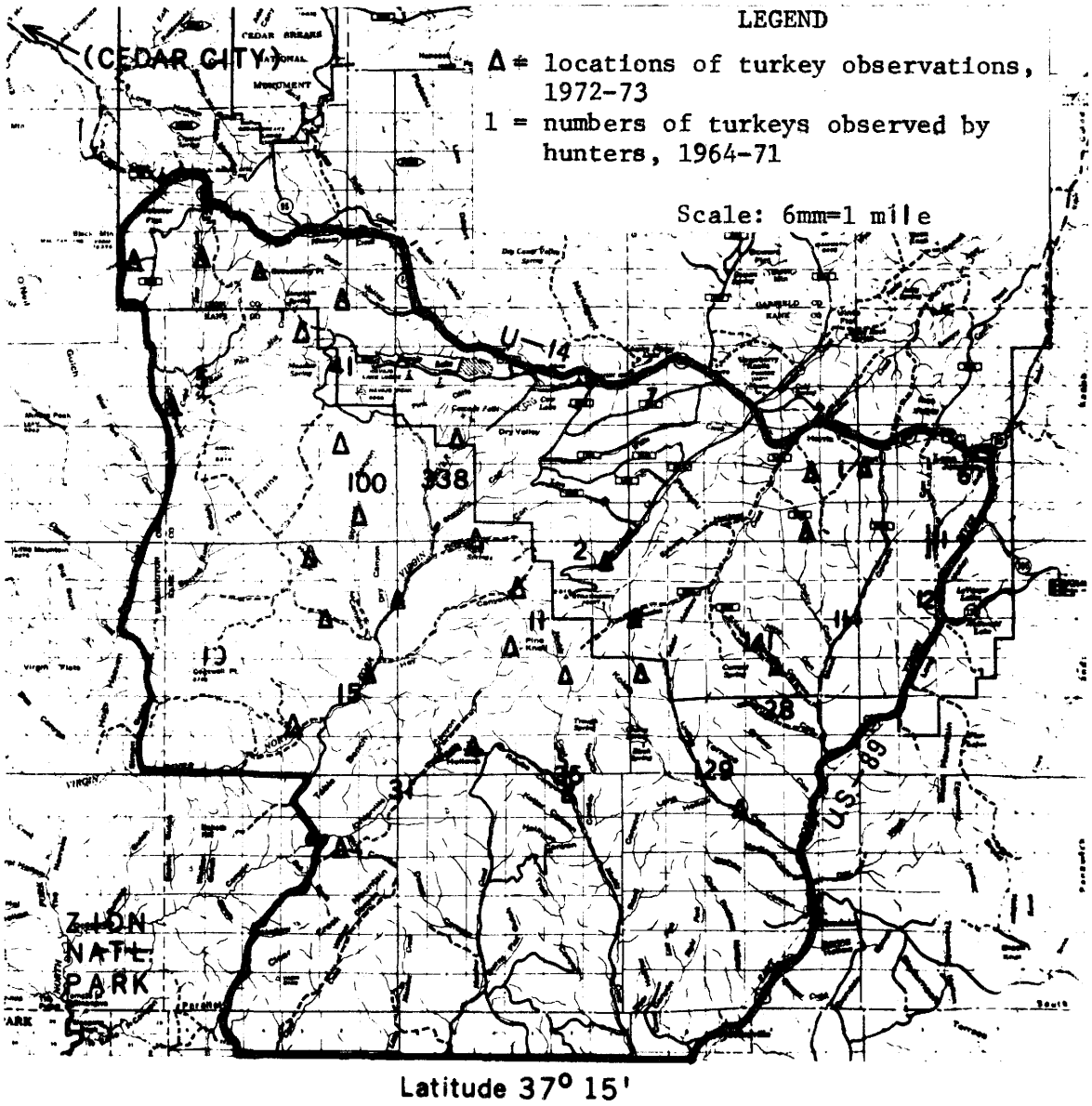

Figure 5. Locations of 1972-73 turkey observations and numbers of turkeys reported by hunters from 1964-1971.

A preference index (P.I.) for each habitat type was calculated by month. The index was determined by dividing the percent utilization of each habitat type by the percent availability. Interpretation of this index follows: P.I. = 1, turkeys utilized a habitat in proportion to its availability (no preference); P.I. < 1, turkeys actually avoided the type; and P.I. > 1, turkeys used the type over other, more abundant types.

Understandably, not all habitats were available during winter. Most of the area lying outside the Dixie National Forest was below the Pink Cliffs (8,000 feet) and total snow cover during winter. Assuming the area below the Pink Cliffs was the only area available to turkeys, even during mild winters, the preference index was adjusted relative to percent availability of the four habitat types for the period December 1 through April 1.

Other variables. Permanent water is believed to restrict wild turkeys in their selection of habitat (Reeves, 1953; Schorger, 1966; MacDonald and Jantzen, 1967; Hoffman, 1968). The proximity of observations to permanent water sources was an important variable in the evaluation of macro-habitat. The spring of 1972 was abnormally dry and enhanced the possibility of labeling water as permanent or occasionally available. Thus, water available throughout an extremely dry year was classed as permanent.

Human disturbance may influence a turkey's selection of habitat (Jahn, 1973). Therefore, the distance of an observation site from a frequently traveled road was measured. These roads, U. S. 89, U-14, U-15 and Stout Canyon, North Fork, Strawberry, Swains Creek, and "the plains" roads, are shown in Figure 5.

During the 1972-73 winter the only frequently traveled roads were the paved highways kept clear for travel.

Micro-habitat

Determination. Micro-analyses also were employed to evaluate turkey habitat use. Vegetational composition, bare soil, rock, and litter were recorded within a 100-foot radius of the center of each observation. This point was determined by the site of the most abundant sign, or the site where the birds were observed while undisturbed.

Percent composition of ground cover at each observation point was estimated using two 100-foot long point-step transects (Phillips, 1959). These transects ran north-south and east-west. Fifty steps on each transect yielded 100 hits per sample and provided a simple conversion to percent cover.

Percent crown cover (percent of area covered by crown) by species was estimated for both shrubs and trees within the 100-foot radius. Repeated estimates and subsequent measurements were made, using the line-intercept method (Canfield, 1941). This enabled me to become efficient in the ocular estimate of percent shrub and tree cover. These estimates were then placed in one of the following categories: 0-5, 5-10, 10-20, 20-30, 30-40, 40-60, 60-80, and 80-100 percent.

Analyses. I was unable to obtain exact numbers of turkeys using an observation site due to few direct observations. Analyses of plant species occurring at turkey observation sites were limited to frequency of occurrence

and percent ground or canopy cover. Thus, frequency of occurrence equals the number of observations in which each plant species occurred relative to the total number of observations for each time period under consideration. Mean percent cover per season was the total percent cover for each species divided by the total number of observations. This method allowed me to evaluate turkey observations with respect to a plant community, rather than to individual species. Percent turkey observations also was compared to tree and shrub density. The percent of seasonal turkey observations occurring on various aspects was calculated.

Plant identification. Plants were identified to species whenever possible, using Hitchcock's (1971) "Manual of the Grasses of the United States" and Welsh's (1964) "Guide to Common Utah Plants". Most plant identifications were verified by James Bowns, Southern Utah State University, Cedar City.

RESULTS AND DISCUSSION

Life History

Flock formations

Among turkeys the adult males generally flock separately from the hens and juveniles in all seasons except the breeding season (McIhenny, 1914; Wheeler, 1948; Bailey and Rinell, 1967; Watts, 1968; and Barwick and Speake, 1973). Observations during my study confirmed this.

Summer flocks. In addition to hen-poult flocks observed at Strawberry, Deep Creek, and Webster Flat a flock of five males was observed at Deer Valley above Navajo Lake. The five gobblers used the area for at least 45 days (July 25 to September 9). No tracks were found during this period to indicate use of the area by hens or poults. This suggests that males may separate from the hens once breeding is over. Other authors likewise claim that gobblers seldom associate with hens and young (Burget, 1957; Mosby and Handley, 1943).

Fall and winter flocks. On the North Fork, a flock of 18-24 adult hens and juveniles was observed on November 29 and December 3, 1972, prior to trapping. Eleven of these were trapped on December 4, 1972, and seven were adult hens and four were juvenile males (Appendix, Table 17). Two weeks after trapping, we observed 18 turkeys (of which 6 were marked) in the same location and none were adult males. Another group of two hens and four juveniles was trapped 15 miles outside of the study area on December 8, 1972 (Appendix, Table 18).

On January 25, 1973, a marked female was observed with four turkeys only 2 miles north of the trapsite. None of the four had beards, which would indicate an adult male. A radio-equipped female was also nearby, but was not seen. The same day, we observed a flock of six adult males in Rosy Canyon, 7 miles north of the December 4 trapsite.

Six adult males used Lydia's Canyon on the East Fork during the 1971-72 winter (Woodbury, personal communication) and two during the 1972-73 winter. I directly and indirectly (sign) observed these two from November 27, 1972, until March 25, 1973. Also, the landowner of Lydia's Canyon reported seeing a flock of 4-6 turkeys there in early November, 1972. I found no other turkey wintering areas on the East Fork, but hen tracks in Muddy Creek, Lydia's Canyon, and Shinglemill Canyon during April, 1973, suggest there was a hen flock south of Lydia's Canyon the previous winter. Hen flocks to the north would have been unlikely due to snow depth.

Thus, in fall and winter on the study area, there were hen flocks and adult male flocks. Hen flocks included adult hens and juveniles of both sexes. In contrast to these findings, Watts and Stokes (1971) and Hillestad (1973) stated that young males of the Rio Grande (M. g. intermedia) and eastern (M. g. silvestris) subspecies of turkeys usually leave the flock by late fall, generally around the time of winter flock formation. McIlhenny (1914), Mosby and Handley (1943), and Ellis and Lewis (1967) also observed an annual fall breakup of eastern turkey flocks into all-hen and young-gobbler groups. Lewis (1973) agreed with the findings in Utah, stating that in some areas young gobblers stay with hens all winter and are not on their own until early spring.

Feeding flocks. In severe winter, as in 1972-73, when food is scarce, turkeys may split up and drift in smaller flocks (Burget, 1957; and Hoffman, 1973). My observations of large fall flocks (18-20 turkeys) and smaller winter flocks (5-7 turkeys) imply this behavior may have occurred on my area.

Traditional wintering grounds. MacDonald and Jantzen (1967:523) noted a tendency to "home" to winter ranges for Merriam's turkey. On my area, ranchers reported that turkey flocks winter consistently along the North Fork of the Virgin River, Muddy Creek, and in Lydia's Canyon. I also observed turkeys on these same areas in the winter.

Spring dispersal of male flocks

Spring 1972. Few turkeys were observed on the North Fork during the spring of 1972. Reports of males gobbling and harvest of sexually active males are the only data to indicate male turkeys had dispersed from winter flocks for breeding (see Appendix, Table 19).

In Muddy Creek of the East Fork, I observed an adult gobbler strutting before hens on April 7, indicating spring dispersal had already begun there.

Spring 1973. No adult males were observed with hens or hen flocks on or prior to January 25, 1973. On that date, an adult male flock was observed in Rosy Canyon at least 7 miles from the December 4 trapsite and 4 miles from any hen flock sighting. However, two gobblers with beards longer than six inches were feeding with hens on March 13, 1973. One male was with a flock of six turkeys (including a radio-equipped hen) and the other with one of seven (including two

marked hens), but both groups were less than 0.5 miles west of the trapsite. Therefore, I assumed that spring dispersal of adult male flocks had begun there, on or prior to March 13.

On the East Fork, we trapped, marked, and instrumented two adult males in Lydia's Canyon, March 17, 1973. These two gobblers were the only turkeys that used Lydia's Canyon during the winter of 1972-73. Radio tracking and turkey sign indicated they remained within one mile of the trapsite at least until March 25, and presumably were little disturbed by being trapped. When we received no radio signals or found no fresh sign at or near their traditional roost on March 28, we assumed they had dispersed for spring breeding. Lydia's and Stout Canyons were thoroughly investigated via snowmobile on March 30, and no sign of either gobbler found. Other drainages were inaccessible for investigations.

I speculate that spring dispersal of adult males probably occurs during March on the study area. Trapping data from the Boulder Mountains also support this theory, because adult males and females were trapped together on March 22, 1973 (see Appendix, Table 18). Other studies suggest that breakup of winter flocks occurs for both Merriam's and eastern wild turkeys between March 1 and April 1 (Ligon, 1946; Schorger, 1966; Hoffman, 1973; and Barwick and Speake, 1973). Burget's (1957) statement that adult gobblers in Colorado join hen flocks in late January or early February contrasts with my findings in Utah.

An interesting topic for speculation is why males dispersed 12 to 14 days later on the East Fork than the North Fork. The breeding season apparently is triggered by increasing day length and rising temperatures (Lewis, 1973). Schorger (1966) and Ellis and Lewis (1967) claimed spring weather triggers the precise time of dispersal. If so, dispersal of the males on the study area should have been more synchronized. Hens wintering near the North Fork gobblers may have provided a stimulus unavailable to the males in Lydia's Canyon, since they were the only turkeys to winter there. Also, on the North Fork, turkeys moved up and down the Virgin River in response to increasing or decreasing snow depth. This may have resulted in interactions between hen and gobbler flocks.

A gobbler trapped in Lydia's Canyon provided proof as to air-line miles moved from winter range to the strutting ground. On May 3, 1973, the larger of the instrumented gobblers was radio tracked to the head of Lydia's Canyon. Tracks on the strutting site revealed use by a male and two or three females. The site was 6 air-line miles from the trapsite and 5 air-line miles from the winter roost. Since no hens wintered in Lydia's Canyon and the gobbler left the drainage completely upon dispersal, the distances probably do not reflect the actual miles traveled. Also, selection of this strutting ground probably was influenced by where the gobbler wintered.

Traditional breeding grounds

Local ranchers reported that turkeys had regularly used the Muddy Creek-Reubes Canyon confluence in winter and spring since the early 1960's. This area,

which was used for at least one month during the spring of 1972, was investigated again on February 18 and April 24, 1973. I tracked only a single hen for 2 miles on April 24, from the confluence to a point where sign was less than 24 hours old. Although six turkeys wintered in Lydia's Canyon during 1971-72, no breeding grounds were found there the spring of 1972. No gobblers responded to my calling, nor were turkeys observed directly. However, during the spring of 1973, an instrumented gobbler established a strutting ground at the head of Lydia's Canyon.

It is my contention that Merriam's turkeys may not have traditional breeding grounds on the Utah study area. Lewis (1973), however, reported that traditional breeding grounds are used by Rio Grande turkeys. The severity of winter snowfall and spring weather probably are inhibitory variables. An additional deterrent may be the harvesting of males from breeding grounds. No turkeys returned to the immediate area surrounding the Muddy Creek strutting ground after an adult male was harvested there on May 1, 1972.

Harem behavior

A gobbler may acquire four to six hens in his harem (Wheeler, 1948; Thomas, 1954; Schorger, 1966; and Lewis, 1973). The gobbler I observed on April 7, 1972 in Muddy Creek of the East Fork had a harem of three hens. At least two gobblers were calling in the same area on April 27 and May 1. The gobbler radio tracked to the head of Lydia's Canyon on May 3, 1973, had a harem of two, and possibly, three hens. Shinglemill Canyon, 3.5 miles north

of the Lydia's Canyon trapsite, was used by a male and one or two females for a short period until April 25, 1973.

During May 1973 on the North Fork, I followed the tracks of a male and three females along a secondary road 1.5 miles from the mouth of Rosy Canyon to a point where total snow cover began.

From this I conclude that each gobbler on the study area that established a strutting ground, attracted a maximum of three hens in their harem. And, although additional gobblers may be nearby, they did not appear to participate in courtship on the strutting ground.

Watts (1968) and Barwick and Speake (1973) found that sibling male groups remained together throughout the strutting and gobbling season. Gobblers sometimes establish joint strutting territories (Ellis and Lewis, 1967). Lewis (1973: 42) described a "carnival atmosphere" as the courting behavior for both the Rio Grande and Merriam's turkey, whereas the eastern and Florida turkeys (M. g. osceola) mate in smaller, more intimate groups. Similarly, in Colorado, as many as 16 gobblers were observed on a strutting ground (Burget, 1957). This does not appear to be the case for Merriam's turkey in Utah, at least during periods of low density. Conditions in Utah may best be described in a statement by Latham (1956). He claimed young gobblers that attach themselves to the harem of an adult tom live in harmony as long as they show no tendency to mate.

Nesting

Estimates of nest size, clutch size, or nest success will not be reported since no nests were found during the study. This is not unusual for nesting

studies on Merriam's turkey. In Colorado, an intensive study produced only one nest from 1941 to 1945 (Burget, 1957).

Egg laying, incubation, and hatching dates

A spring dispersal for males between March 1 and April 1 was estimated for the study area. Burget (1957) reported that copulation of Merriam's turkey begins as much as 3 weeks prior to egg laying. In game-farm and wild turkeys at least 2 weeks are required to lay a clutch of eggs (Blakey, 1937; Mosby and Handley, 1943; and Latham, 1956). When these time periods (totaling 5 weeks) are correlated with the estimated period of dispersal, egg laying could begin in early April and incubation by mid to late April. Most clutches may be completed by May 1. This estimate is supported by Ligon (1946), Burget (1954), and Schorger (1966). Allowing 28 days for incubation (Blakey, 1937), the approximate hatching period of mid-May through mid-June in Utah concurs with other reports for Merriam's turkey (Rose, 1958; and Lewis, 1973).

Estimated poult size also could indicate approximate hatching dates. Two broods with poults of different sizes were observed in 1972. In general, the hatch dates from Table 1 correspond with the dates of mid-May to mid-June estimated from established spring dispersal dates.

Hen:poult ratios

Data on hens and poults observed during the study are presented in Table 2. According to Shaw (1973), the number of observations would not be enough to

Table 1. Approximate hatching dates in southwestern Utah based on estimated poult heights recorded during the summer of 1972 and 1973

Observation date	Estimated poult height (inches)	Approximate age**	Hatching dates
July 27, 1972	12-16	8-9 weeks	May 23 - June 1
July 27, 1972	8-10	4-5 weeks	June 23 - June 30
July 28, 1972	8-10*	4-5 weeks	June 23 - June 30
Aug. 3, 1972	8-10*	4-5 weeks	June 23 - June 30
July 25, 1973	9-12	5-8 weeks	May 30 - June 20

*Same brood as observed on July 27, 1972.
**From Bailey and Rinell (1967)

achieve certain limits of reliability. Because such data is lacking for Utah, I have chosen to report these estimates, regardless. Also, MacDonald (1964) raised relevant questions to hen:poult estimates which did not include unsuccessful hens. Therefore, I have reported both successful and unsuccessful hens in relation to the total number of poults observed. A percent estimate of unsuccessful hens will not be given, since these hens are less likely to be observed. Spicer (1954) and Burget (1957) estimated these percentages at 64 and 70 respectively.

In 1972, the hen:poult ratios for the East Fork, North Fork, and total study area were 1:2.0, 1:2.3, and 1:2.2, respectively (Table 3). Average brood sizes for successful hens from New Mexico, Arizona, Colorado, and California were 6.0, 3.9, 6.9, and 3.7, respectively (Schorger, 1966). Even though unsuccessful hens were not included in those estimates, they still suggest low production

Table 2. Observations of hens and poults on the study area

Date	Location	Hens	Poults	Type observation
1972:				
July 1	Webster Flat (North Fork)	1	3	Unconfirmed
July 5	Deep Creek (North Fork)	3	11	Track Count
July 5	Deep Creek (North Fork)	1	5	Track Count
July 7	Deep Creek (North Fork)	2	6	Track Count
July 7	Deep Creek (North Fork)	1	0	Track Count
July 18	North Twin Hollow (East Fork)	2	0	Track Count
July 24	Deep Creek (North Fork)	1	7	Unconfirmed
July 27	Strawberry (East Fork)	1	3	Visual
July 27	Strawberry (East Fork)	1	3	Visual
July 28*	Strawberry (East Fork)	1	3	Visual
August 3*	Strawberry (East Fork)	1	3	Visual
August 11	Webster Flat (North Fork)	1	8	Track Count
August 11	Webster Flat (North Fork)	2	4	Track Count
August 25	Strawberry (East Fork)	1	6	Unconfirmed
August 29	Deep Creek (North Fork)	1	1	Track Count
October 4	Strawberry (East Fork)	2	0	Visual
December 4	Chamberlin Ranch (North Fork)	7	4	Trapped
1973:				
May 30	Harris Spring Hollow (East Fork)	2	0	Visual
July 8	Billingsly Creek (East Fork)	2	0	Track Count
July 22	Harris Flat (East Fork)	1	1	Track Count
July 25	Webster Flat (North Fork)	4	5	Visual

*Same brood as observed on July 27.

Table 3. Estimated hen:poult ratios, including unconfirmed reports and trap data, on the study area for 1972 and 1973

Location	Hens		Poults		Hen:Poult Ratio	
	1972	1973	1972	1973	1972	1973
North Fork	24	4	52	5	1:2.3	1:1.2
East Fork	9	5	18	1	1:2.0	1:0.2
Total Study Area	33	9	73	6	1:2.2	1:0.7

for my study area. Intense drouth from January to June 1972 may have been a contributing factor.

Hen:poult ratios in 1973 were considerably lower. On July 25, 1973, four hens and five poults were observed near Webster Flat. Since all poults were of equal size, I assumed these were siblings. Perhaps then, only one of the four hens was successful, indicating poor reproduction that year. Also, two hens observed in late spring on the East Fork were included as unsuccessful hens in the hen:poult ratios, even though incubation for other hens probably was not completed at the time they were seen. Since most hens nest alone and are more secretive in their behavior (Lewis, 1973), the observed behavior of these hens indicated they probably were not incubating. The fact that they had no poults supported my assumption that they were unsuccessful.

The density of turkeys (Table 4) and the hen:poult ratio on the East Fork was much lower than the North Fork. Therefore, there probably is a reduced

Table 4. Numbers of turkeys observed on the study area from November to May, 1972-73

Unit	Date	Estimated adult & juvenile turkeys on winter-spring range	Density (turkeys/square mi.)	Percent of 1972 summer observ.
East Fork (174 sq. mi.)	Nov. 1972 - Mar. 1973	2	0.1	23
	Apr. 18, 1973	1		
	Apr. 20, 1973	2		
	Apr. 24, 1973	3		
	May 3, 1973	4		
	May 16, 1973	1		
	May 25, 1973	2		
Sub-Total		15	0.1	23
North Fork (148 sq. mi.)	Dec. 2, 1972	18	0.3	77
	Jan. 26, 1973	6		
	Jan. 26, 1973	5		
	Mar. 17, 1973	10		
	May 5, 1973	4		
Sub-Total		43	0.3	77
Total (322 sq. mi.)		58	0.2	100

chance for wild turkey survival on the East Fork, at least for a few years following the study period.

The reason for the decrease in the hen:poult ratios is difficult to ascertain. I assumed that food supply for poults, hence juvenile survival would be enhanced greatly by the wet winter and spring of 1972-73, especially when compared to the drouth that prevailed in previous years, including the winter and spring of 1971-72.

Temperature records for the study area appear in Table 5. One can speculate on these data. November and December had record cold. These extremely cold temperatures coupled with a lack of fall-winter acorns might have caused additional stress prior to breeding. Jenkins et al. (1967) reported red grouse (Lagopus lagopus) hens may have been too undernourished to breed when the habitat was in poor condition and cold weather ensued.

March through June could have been especially critical months, when mating, egg laying, incubation, and hatching took place. May and June temperature and precipitation were average. However, respective deviations in March from average maximum and minimum temperatures were -9.1 F (43.5 F) and -0.7 F (26.1 F) and precipitation was 1.9 inches above the monthly mean.

Perhaps even more spectacular was April weather, when egg laying probably began. Since hens do not incubate while laying, the eggs are exposed and subject to freezing. This may have been especially true on the North Fork where adult males were observed with females by March 14. The mean minimum temperature for April was 3.2 F below the norm or just below freezing (31.8 F). Thus, the abnormally wet and cold months prior to and including egg laying might, in part, be responsible for the poor productivity for 1973.

Table 5. Deviations from 30-year means at the weather station in Cedar Canyon from November to June, 1971-72 and 1972-73

Month	Normal (1931-1960)		Deviations from the norm			
			Maximum		Minimum	
	Maximum	Minimum	1971-72	1972-73	1971-72	1972-73
Nov.	52.6°F	25.9°F	-5.1	-9.7	+1.9	-7.3
Dec.	43.0	20.1	-5.7	-6.4	+4.2	-3.9
Jan.	40.5	17.1	+4.2	-4.2	+4.1	-1.0
Feb.	44.4	21.1	+8.0	-2.3	+7.3	+3.1
Mar.	52.6	26.8	+9.7	-9.1	+7.9	-0.7
Apr.	62.6	35.0	+0.8	-6.2	+1.9	-3.2
May	71.6	42.4	+0.8	-0.5	+3.3	+2.5
June	81.5	51.1	-0.8	-1.2	+3.9	+2.6

Other authors have reported similar results. Hatching success depends largely upon the temperatures to which eggs are exposed (Reeves, 1953). Jantzen (1959) found a close inverse relation between minimum temperatures during the laying period and hen:poult ratios. In general, low temperature and heavy rainfall in spring are considered the most important climatic causes of short-term fluctuations in turkey populations (Mosby and Handley, 1943; Ligon, 1946; Wheeler, 1948; Schorger, 1966; Holbrook and Lewis, 1967; and Powell, 1967). Other galliforms including pheasants, grouse, and prairie chickens, are similarly affected by weather (Allen, 1946; Buss and Swanson, 1950; Baker, 1953; and Gill, 1966). Besides the direct influences of abnormal weather, cold may delay maturity of food sources for poults (Markley, 1967).

Sex composition

The sex composition of males and females in a population can be used to establish harvest recommendations. Changes in the percent composition have also been used to indicate differential mortality between sexes (Mosby, 1967). Insufficient sample size required that adults and juveniles be combined to determine sex percentage on the study area (Appendix, Table 20). There appeared to be a preponderance of hens, or 59 percent females compared to 41 percent males (Table 6). On the East Fork, the percent of males observed was less than on the North Fork.

Table 6. Percentage of each sex, including adults and juveniles, occurring on the study area based on direct and indirect observations

Location	Numbers*		Percent of the population	
	Males	Females	Males	Females
North Fork	26	28	48	52
East Fork	12	27	31	69
Study Area	38	55	41	59
Indirect observations	13	27	33	67
Direct observations	25	28	47	53

*Date from track counts were included only if recorded from December 1 through July 1.

Eastern wild turkeys killed during the fall in Virginia, 1958-63, show that adult toms and hens occurred in almost equal proportions (19 percent males and 21 percent females) (Schorger, 1966). The immature sexes also were in almost equal numbers (31 percent males and 29 percent females). Table 7 (from Mosby, 1967) lists sex percentages of adult and immature eastern and Florida turkeys. Sex ratios from Florida more closely approximate those observed on the Utah study area. Also, reported male:female ratios of Merriam's turkeys on three national forests in Arizona for 1952, 1953, and 1954 were 1:2.7, 1:1.2, and 1:1.0, respectively (Jantzen, 1955). These ratios also exhibit a preponderance of hens (a 3-year average of 1:1.6), similar to what was observed on the Utah study area (male: female ratio of 1:1.4).

Mosby (1967) warned against placing too precise an interpretation on sex ratios, especially since methods of sampling are probably subject to one or more sources of error or bias. He also stated that sex proportions probably are changing constantly throughout the year. Also, males probably are less likely to be observed due to behavioral differences. Therefore, the only conclusion drawn from the data is that there appeared to be a higher percentage of hens than males on the study area both in 1972 and 1973.

Habitat Utilization

Ponderosa pine covers a significant portion of the historic Merriam's turkey range (MacDonald and Jantzen, 1967). The presence of this tree has been used as an indicator of possible suitable range outside of the historic range as

Table 7. Sex percentages of adult and immature eastern and Florida turkeys, based on samples taken during the fall hunting season*

State	n	Males (%)	Females (%)	Reference
		Adults		
Florida	1,049	46	54	Powell, 1963
Pennsylvania	500	53	47	Wunz, pers. comm.
Virginia	710	53	48	Gwynn, 1964
West Va.	504	50	50	Bailey & Rinell, 1965
New York	71	58	42	Austin, 1961-1963
		Immatures		
Florida	758	43	57	Powell, 1963
Pennsylvania	617	34	66	Wunz, pers. comm.
Virginia	684	51	48	Gwynn, 1964
New York	142	50	50	Austin, 1961-1963

*From Mosby (1967).

turkeys have been transplanted to Nebraska, Montana, Wyoming, Utah, and other western states (Mosby, 1973). Menzel and Hurt (1973) believe that ponderosa pine is merely an indicator of suitable habitat rather than being an essential part of a turkey's needs. Other than seasonal habitat use, one purpose of my study was to evaluate the role of ponderosa pine as a guide to future transplanting in Utah.

Macro-habitat

There were four habitat types used by turkeys on my area: (1) mountain brush, (2) ponderosa pine, (3) aspen, and (4) mixed-conifer (spruce-fir). Herein, I have reported the amount turkeys used these types during each season.

Winter (January-March). Turkeys used mountain brush habitat exclusively during winter (Figure 6). Because other types (i.e., ponderosa pine and aspen) were at higher elevations where snow was deeper, mountain brush probably was the only available type which could satisfy a turkey's daily needs.

Basically, the mountain brush type consisted of Gambel oak, pinon and ponderosa pine, and juniper (plant species are discussed in "Micro-habitat"). Two woodland types are found on the historic range of Merriam's turkey (see Figure 1). These include chaparral browse and pinon-juniper (MacDonald and Jantzen, 1967). A mountain shrub type was included in the description of a Colorado study area (Hoffman, 1968). The winter habitat used by Utah turkeys closely resembles turkey habitats in Arizona (Reeves, 1953; and Scott and Boeker, 1973). Ponderosa pine is scattered in Utah, whereas, in Arizona it probably plays a more dominant role in the plant communities.

In reference to an Arizona study by Knopp (1959), MacDonald and Jantzen (1967) claimed turkeys would use the ponderosa pine type more in mild winters. This should not apply to Utah where pure stands of ponderosa pine mostly occurred at higher elevations (between 7,800 and 8,500 feet).

No Utah turkeys used the pinon-juniper belt, typified by monotypic stands of pinon pine and juniper. This probably can be attributed to lack of suitable roost

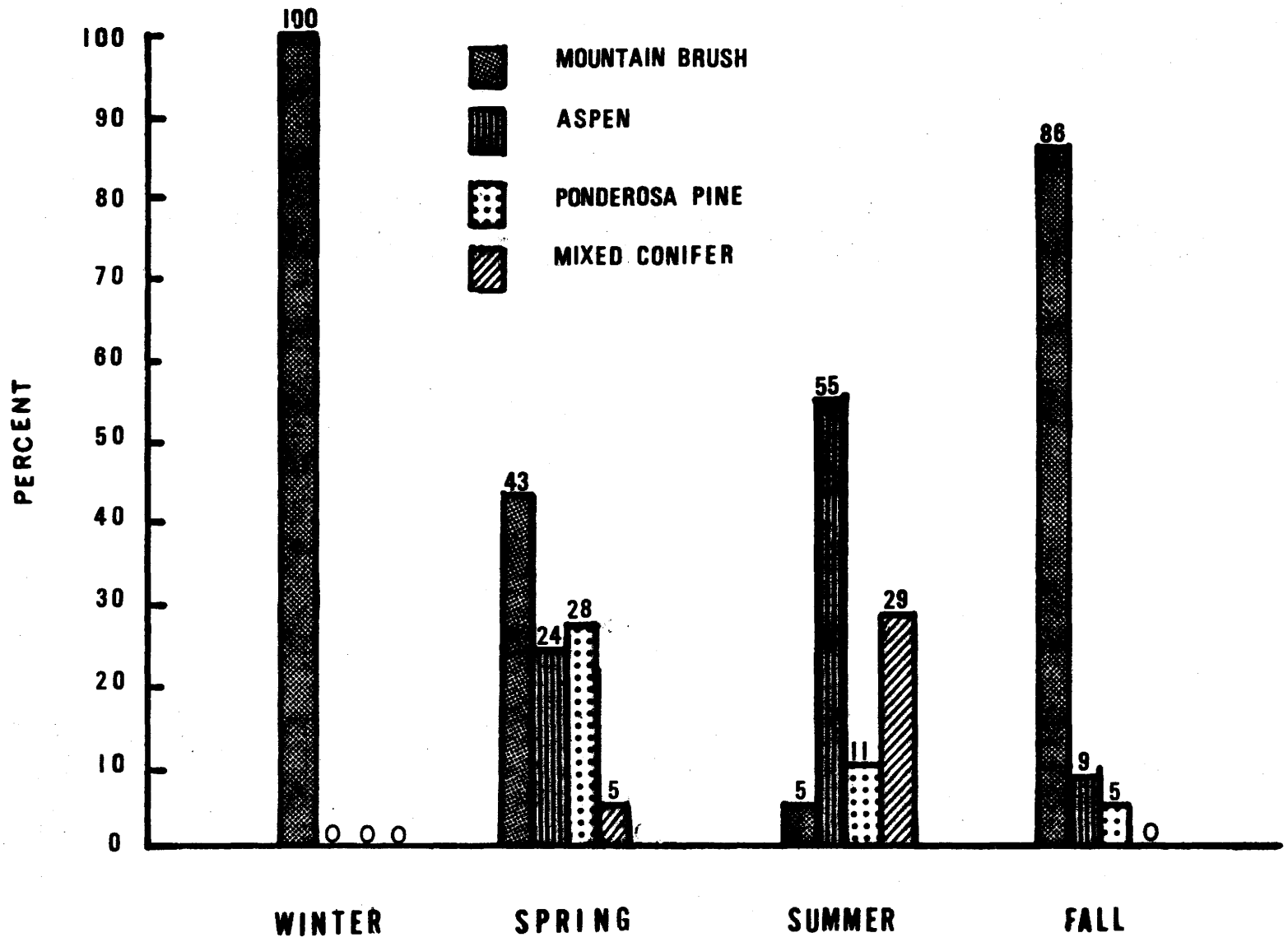

Figure 6. Seasonal turkey use of four habitat types.

trees, since the winter roosts I located near the North and East Fork trapsites were overmature ponderosa pine. In contrast, turkeys used the pinon-juniper type on the San Mateo Mountains, New Mexico in every month but December. Use of this type in New Mexico also occurred during fall and winter on the Jemez Mountains (MacDonald and Jantzen, 1967). Pinon-juniper types in Utah may differ from that found in New Mexico.

Spring (April-June). Spring habitat data presented herein are averages of turkey observations for both 1972 and 1973.

Almost half of the spring observations occurred in the mountain brush types (Figure 6). However, the preference for this type declined from April to June while that for mixed-conifer and aspen increased (Figure 7). Ponderosa pine was preferred during May (P.I. = 5.5), but aspen in June (P.I. = 7.0).

These trends in habitat use during spring suggest the mountain brush-aspen or mountain brush-conifer ecotones may be a close estimate of nesting habitat. Hens that nest at these ecotones where aspen glades or mixed-conifer clearings are close by, have readily available food sources for young poults.

No nests were found on the study area, but Ligon (1946) noted several occasions where hens nested at the base of an overmature ponderosa. He also mentioned that nests normally were in areas without low growing vegetation. Hoffman (1962) reported hens favored well covered slopes of slash or shrub oak thickets for nesting. Burget (1957) found a nest set in a small clump of oaks, close to a small second growth pine. Dense fir and aspen were used as nesting sites in Arizona (Knopp, 1959). In southwestern Utah, Garn Blackburn

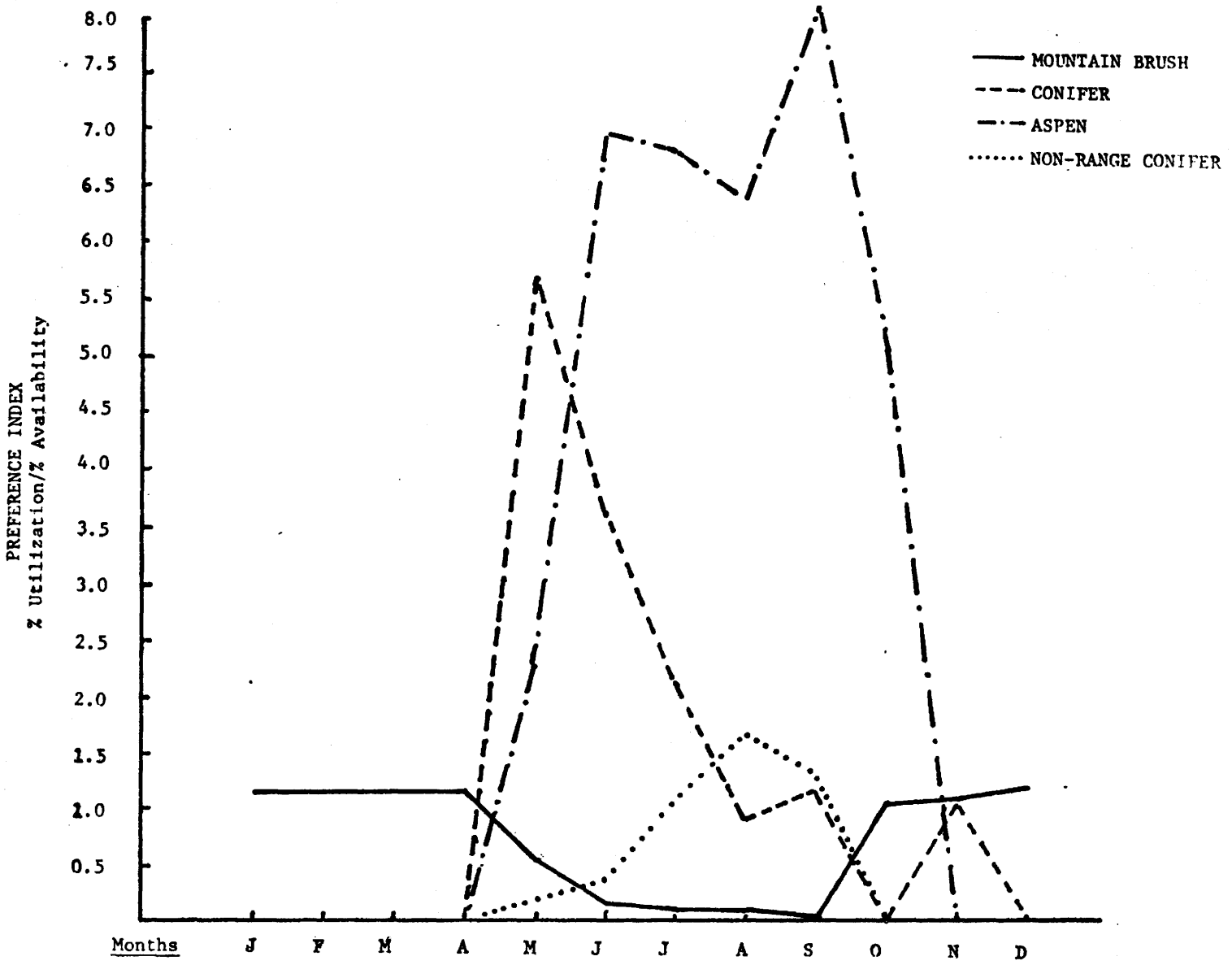

Figure 7. Monthly preference indices (percent use/percent availability) of four habitat types.

(personal communication) reported flushing a hen from her nest located in a dense stand of Gambel oak. These, generally, support my contentions.

Summer (July-September). Fifty-five percent of my summer observations occurred in aspen, with mixed-conifer nearby. For the same period, 29, 11, and 5 percent occurred in mixed-conifer (spruce-fir), ponderosa pine, and mountain brush, respectively. Also, aspen had a mean summer preference index of 7.1 while the P.I. for each of the other types was less than 1.5

Seventy-seven percent of my summer observations occurred on the North Fork where aspen is the open canopy overstory. A dense overstory allows less sunlight to penetrate and has less vegetation growth under it. Fewer birds and fewer summer observations were associated with the East Fork (see Table 4) where clearings or glades were associated with pure stands of ponderosa pine or mixed-conifer rather than aspen. The East Fork may more closely resemble summer habitat on historic ranges (Reeves, 1953; Schorger, 1966; Menzel and Hurt, 1973).

In Colorado and Arizona, turkeys also use mixed-conifer types at high elevations during summer (Knopp, 1959; MacDonald and Jantzen, 1967; Hoffman, 1968; and Scott and Boeker, 1973). Although aspen was usually listed as a member of the plant community, it was not a distinct vegetative type, as it occurred on my study area. Consequently, no one has reported Merriam's turkey consistently using an aspen type.

In the Deep Creek summer range of the North Fork, most aspen stands were interspersed with dense, mixed-conifer stands on ridgetops and north-

facing slopes. Since turkeys used mixed-conifer clearings on their historic range, the use of aspen glades in Deep Creek may have occurred regardless of the presence or absence of any overstory. However, on Webster Flat there existed a continuum of aspen in overmature stands. Use of this area by broods would seem dependent upon the presence of an overstory, aspen in this case. Without the existing canopy, there would have been large tracts of "clearing," devoid of edge. Ecologically, it seems unlikely wild turkeys would become completely dependent upon aspen canopy, since it usually follows fire and seldom succeeds itself (MacDonald and Jantzen, 1967). Yet, aspen seemed to be important brooding sites on my study area.

Fall (October-December). Use of the mountain brush type during fall was 86 percent (see Figure 6) and the P. I. increased from September to December (see Figure 7). A turkey's preference for aspen dropped sharply from September to November. Except in November, there was little preference for ponderosa pine and none for mixed-conifer during fall months. In other areas Merriam's turkeys are also driven by increasing snow depths to vegetative types at lower elevations during fall (Ligon, 1946; Reeves, 1953; Hoffman, 1973).

Micro-habitat

Winter plant community. The dominant overstory species, both in occurrence and cover, were Gambel oak, juniper, ponderosa pine, and pinon pine (Figure 8 and Table 8). Of these, Gambel oak appeared most important.

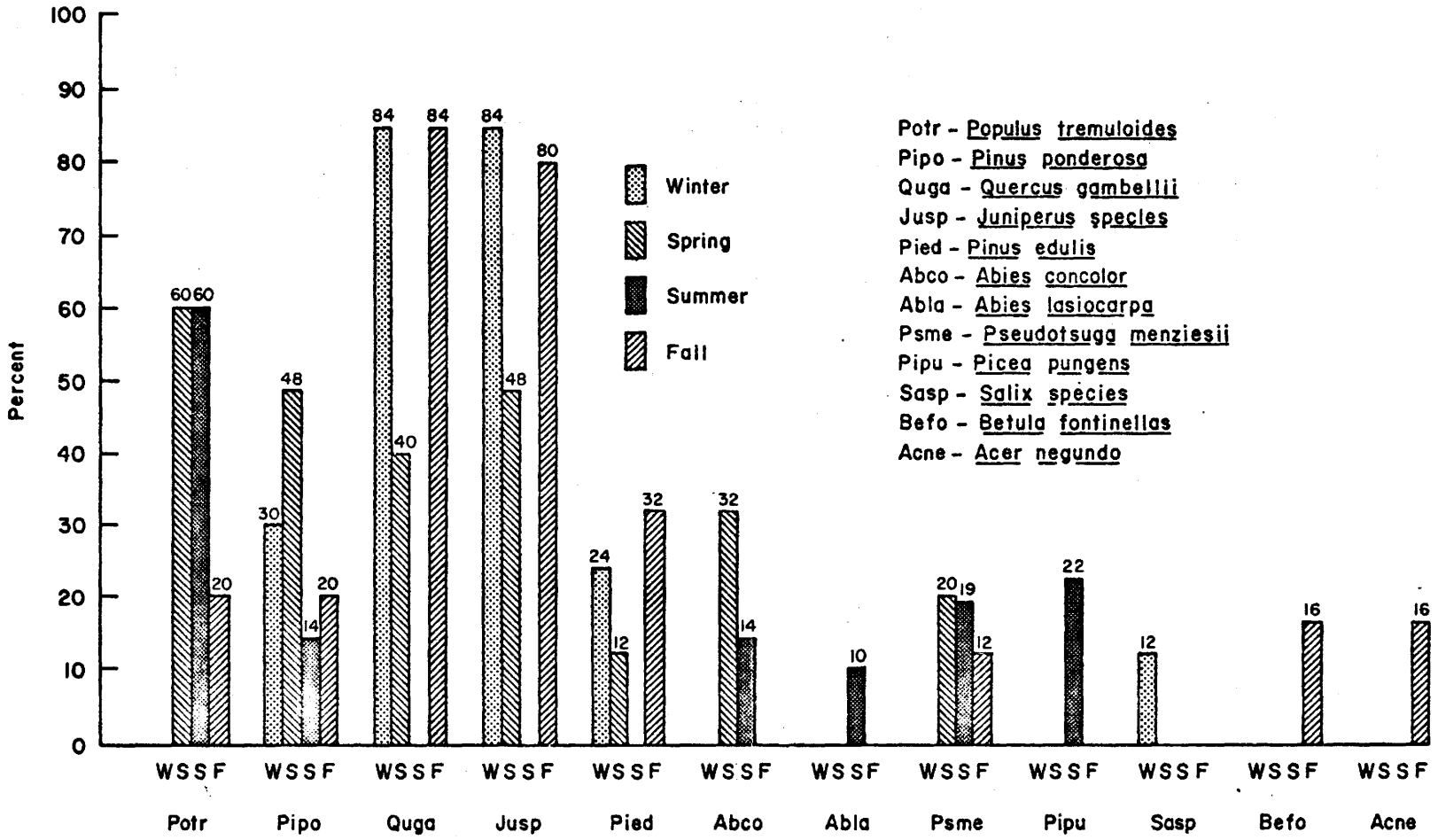

Figure 8. Percent frequency (by season) of tree species occurring at turkey observation sites.

Table 8. Seasonal estimates of mean canopy cover for each tree species occurring where turkeys were observed

Season	Quga	Jusp	Pied	Pipo	Sasp	Acsp	Potr	Psme	Abco	Pipu	Abla	Pifl	Pien	Befo
Winter	37.3	18.4	2.5	4.6	2.5	15.0	---	---	---	---	---	---	---	---
Spring	25.3	10.7	3.5	8.1	---	18.8	17.3	14.3	4.3	2.5	2.5	---	---	---
Summer	22.5	2.5	---	6.1	---	---	17.8	7.2	9.3	7.1	5.0	4.2	2.5	2.5
Fall	29.8	8.2	2.5	3.1	25.0	30.4	8.7	4.2	2.5	7.5	2.5	---	---	---

Key: Quga - Quercus gambelii; Jusp - Juniperus spp.; Pied - Pinus edulis; Pipo - Pinus ponderosa; Sasp - Salix spp.; Acsp - Acer Spp.; Potr - Populus tremuloides; Psme - Pseudotsuga menziesii; Abco - Abies concolor; Pipu - Picea pungens; Abla - Abies lasiocarpa; Pifl - Pinus flexilis; Pien - Picea engelmannii; Befo - Betula fontinalis

It occurred at 84 percent of the winter turkey observation sites, with a mean canopy cover of 37 percent. Ponderosa pine was found only in scattered clumps or occasional trees throughout the mountain brush type. In view of canopy estimates (5 percent cover) and frequency of occurrence (30 percent) at my observation sites, it appears this tree also was important to turkeys.

The winter shrub community associated with turkey observations was dominated by Gambel oak and wildrose (Table 9). Other species, including bitterbrush serviceberry, mahogany, willow (Salix spp.), rabbitbrush, and big sagebrush, comprised the remainder of the shrub community. Since snow covered most of the ground during winter, little information could be drawn from community association of forbs and grasses (Figure 9).

The most important mast producers on the area were Gambel oak, juniper, and wildrose. Acorns are prime food on all North America turkey range when available (as summarized by Schorger, 1966). Juniper is an emergency food when other mast crops fail (Ligon, 1946; Reeves, 1951; Reeves and Swank, 1955; Burget, 1957; and Scott and Boeker, 1973). Another emergency food is wildrose (Burget, 1957). These species also appeared important to Utah turkeys in view of their dominance and abundance at wild turkey observation sites.

Spring plant community. Aspen occurred at 60 percent of spring turkey observation sites but usually was recorded late in May or June after turkeys had moved to higher elevations. Ponderosa pine also was associated frequently with turkey observations (48 percent occurrence), but had only an estimated 8 percent canopy cover, compared to 17 percent for aspen. Thus, turkeys did not frequent pure stands of ponderosa pine.

Table 9. Percentage of occurrence and mean canopy cover categories* for shrub species identified where turkey observations occurred

Shrub species	Winter		Spring		Summer		Fall	
	Occ.	Cov.*	Occ.	Cov.*	Occ.	Cov.*	Occ.	Cov.*
Gambel oak (Quercus gambelii)	72	3.3	36	1.8	0.5	3.0	32	3.4
Rabbitbrush (Chrysothamnus spp.)	6	1.0	16	1.2	3	1.0	16	2.3
Sagebrush (Artemisia tridentata)	6	3.0	20	2.3	5	1.0	16	3.8
Snowberry (Symphoricarpos spp.)	--	---	40	2.4	35	2.6	20	3.2
Currant (Ribes spp.)	--	---	36	2.4	35	2.5	12	2.0
Manzanita (Arctostaphylos patula)	--	---	4	1.0	3	1.0	12	1.0
Rose (Rosa woodsii)	30	2.0	8	2.0	--	---	52	2.6
Bitterbrush (Purshia tridentata)	18	2.6	4	3.5	--	---	12	1.0
Serviceberry (Amelanchier spp.)	12	1.0	4	1.0	--	---	24	1.0
Mahogany (Cercocarpus spp.)	12	1.0	4	1.0	--	---	4	1.0
Common juniper (Juniperus communis)	--	---	16	1.0	19	1.8	--	---
Aspen (Populus tremuloides)	--	---	--	---	38	2.2	8	1.0
Willow (Salix spp.)	6	1.0	--	---	--	---	4	1.0
Blacksage (Artemisia nova)	--	---	4	1.0	--	---	--	---
Chokecherry (Prunus virginiana)	--	---	4	4.0	--	---	--	---
White fir (Abies concolor)	--	---	--	---	5	3.0	--	---
Elderberry (Sambucus spp.)	--	---	--	---	4	3.0	--	---
Silversage (Artemisia cana)	--	---	--	---	4	3.0	--	---
Horsebrush (Tetradymia spp.)	--	---	--	---	2	3.0	--	---
Blue spruce (Picea pungens)	--	---	--	---	1	3.0	--	---
Subalpine fir (Abies lasiocarpa)	--	---	--	---	1	3.0	--	---
Russian thistle (Salsola kali)	--	---	--	---	--	---	4	1.0
Squawapple (Peraphyllum spp.)	--	---	--	---	--	---	4	1.0

*Canopy cover categories: (1 = 0-5 percent, 2 = 5-10 percent, 3 = 10-20 percent, 4 = 20-30 percent).

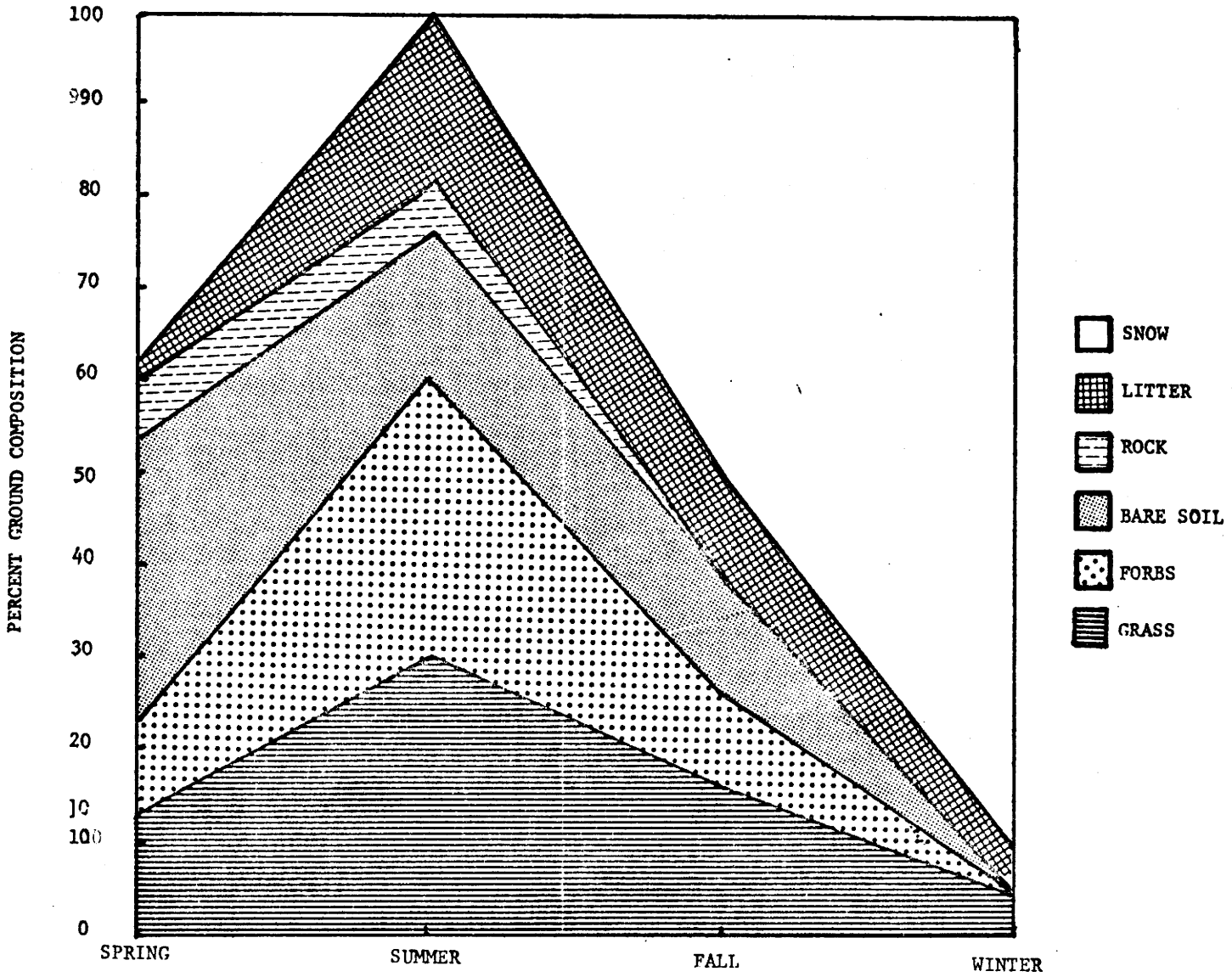

Figure 9. Seasonal percent ground cover at turkey observations.

A great variety of shrubs were associated with turkey observations during the spring (see Table 9). I attributed this to the altitudinal migration of turkeys as they moved through different habitat types. Thus, shrub communities probably are grouped according to elevation. At lower elevations, rabbitbrush, wildrose, big sagebrush, bitterbrush, serviceberry, and mahogany dominate the community. Whereas snowberry, currant, common juniper (Juniperus communis), and manzanita comprised the shrub community associated with turkey observations at higher elevations.

Dominant plants of the ground community in spring were: yarrow (Achillea lanulosa), dandelion, and bluegrass (Tables 10 and 11). These comprised 47 percent, by volume, of the spring foods eaten by wild turkeys in Arizona (Scott and Boeker, 1973).

Summer plant community. The precise community of plant species at turkey observation sites was associated with aspen and mixed-conifers. Important tree species were aspen, blue spruce (Picea pungens), Douglas fir, ponderosa pine, white fir (Abies concolor), and sub-alpine fir (A. lasiocarpa) (see Figure 8). Major shrubs were currant, snowberry, and aspen regrowth. Grasses and forbs, comprising 60 percent (see Figure 9) of the summer ground community, included: bluegrass, wheatgrass, bromegrass, trisetum, dandelion, yarrow, clover, aster, loco, and lupine (see complete lists of species in Tables 10 and 11). According to Scott and Boeker (1973) grasses and forbs made up 45 percent, by volume, of the total summer diet. They also reported leaves, flowers, and seeds heads of the genus Taraxacum were eaten by turkeys in large quantities

Table 10. Percentage of occurrence and ground cover of forbs identified at turkey observations sites

Forb species	Spring		Summer		Fall	
	Occ.	Cov.	Occ.	Cov.	Occ.	Cov.
Common dandelion (Taraxacum officinale)	36	2.0	78	11.0	30	3.0
Western yarrow (Achillea lanulosa)	40	2.4	81	6.0	30	2.0
Loco (Astragalus spp.)	8	0.5	35	2.5	8	0.2
Oregon grape (Berberis repens)	12	0.6	5	1.0	20	0.8
Clover (Trifolium spp.)	16	2.1	15	2.0	20	0.5
Mustards (Cruciferae)	--	---	16	0.6	8	0.2
Aster (Aster spp.)	--	---	30	4.0	20	0.6
Thistle (Cirsium spp.)	--	---	5	0.2	10	0.4
Sagewort (Artemisia ludoviciana)	--	---	3	0.2	4	0.4
Lupine (Lupinus spp.)	24	0.8	16	0.5	--	---
Lambsquarters (Chenopodium album)	--	---	8	0.4	--	---
Goldenrod (Solidago spp.)	--	---	3	0.2	--	---
Bluebell (Mertensia spp.)	--	---	8	1.2	--	---
Penstemon (Penstemon spp.)	--	---	--	---	8	0.5
Knotweed (Polygonum spp.)	--	---	--	---	8	0.2
Groundsel (Senecio spp.)	8	0.2	--	---	8	0.2
Sedge (Carex spp.)	--	---	--	---	4	0.1
Equisetum (Equisetum spp.)	--	---	--	---	4	0.1
Mullein (Verbascum thapsus)	4	0.1	--	---	2	0.1
Other	--	1.3	--	0.2	--	0.7

Table 11. Percentage of occurrence and ground cover of grass species identified at turkey observation sites

Grass species	Spring		Summer		Fall	
	Occ.	Cov.	Occ.	Cov.	Occ.	Cov.
Bluegrass (Poa spp.)	68	7.0	81	12.0	40	12.0
Wheatgrass (Agropyron spp.)	--	---	68	5.3	10	1.2
Needlegrass (Stipa spp.)	--	---	65	5.0	20	1.0
Brome grass (Bromus spp.)	--	---	49	4.2	20	0.6
Redtop (Agrostis alba)	--	---	8	0.2	20	1.0
Timothy (Phleum spp.)	--	---	8	0.2	10	0.2
Indian ricegrass (Oryzopsis hymenoides)	--	---	3	0.1	10	0.4
Trisetum (Trisetum spp.)	--	---	41	1.2	--	---
Squirreltail (Sitanion spp.)	--	---	16	0.9	--	---
Orchardgrass (Dactylis glomerata)	--	---	5	0.3	--	---
Barley (Hordeum spp.)	--	---	3	0.1	--	---
Muhly (Muhlenbergia spp.)	--	---	3	0.1	--	---
Other	--	---	--	0.4	--	1.6

when available. Dandelion had the highest percent composition of forbs at wild turkey observation sites during spring and summer months on the study area. This implies Utah summer ranges adequately supply known important food sources utilized heavily by turkeys on a neighboring, historic range.

Fall plant community. Dominant overstory and shrub species associated with fall turkey observations were Gambel oak, juniper, maple, pinon pine, ponderosa pine, Douglas fir, wildrose, snowberry, big sagebrush, rabbitbrush, serviceberry, manzanita, bitterbrush, and currant. Certain grasses and forbs also were of importance. These included bluegrasses, needlegrass, redtop (Agrostis alba), wheatgrass, bromegrass, yarrow, dandelion, thistle (Cirsium spp.), and penstemon.

Gambel oak and wildrose also are important in a turkey's diet in the fall, along with dandelion, yarrow, and grass panicle (Korschgen, 1967; and Scott and Boeker, 1973).

Plant density. Wild turkeys on the study area seemed to prefer areas on which total canopy covered by tree species was 40-60 percent (Figure 10). These may have been heavily weighed due to a usual dense cover of Gambel oak when it was present as the dominant overstory species at turkey observations. Other peaks occurred when percent tree cover was 10-20 and 60-80, but are, as yet, unexplained. Conversely, turkeys appear to use areas irrespective of shrub density.

Aspect. Most observations during winter and fall occurred on south-facing slopes (Table 12). Since south slopes become free from snow, food

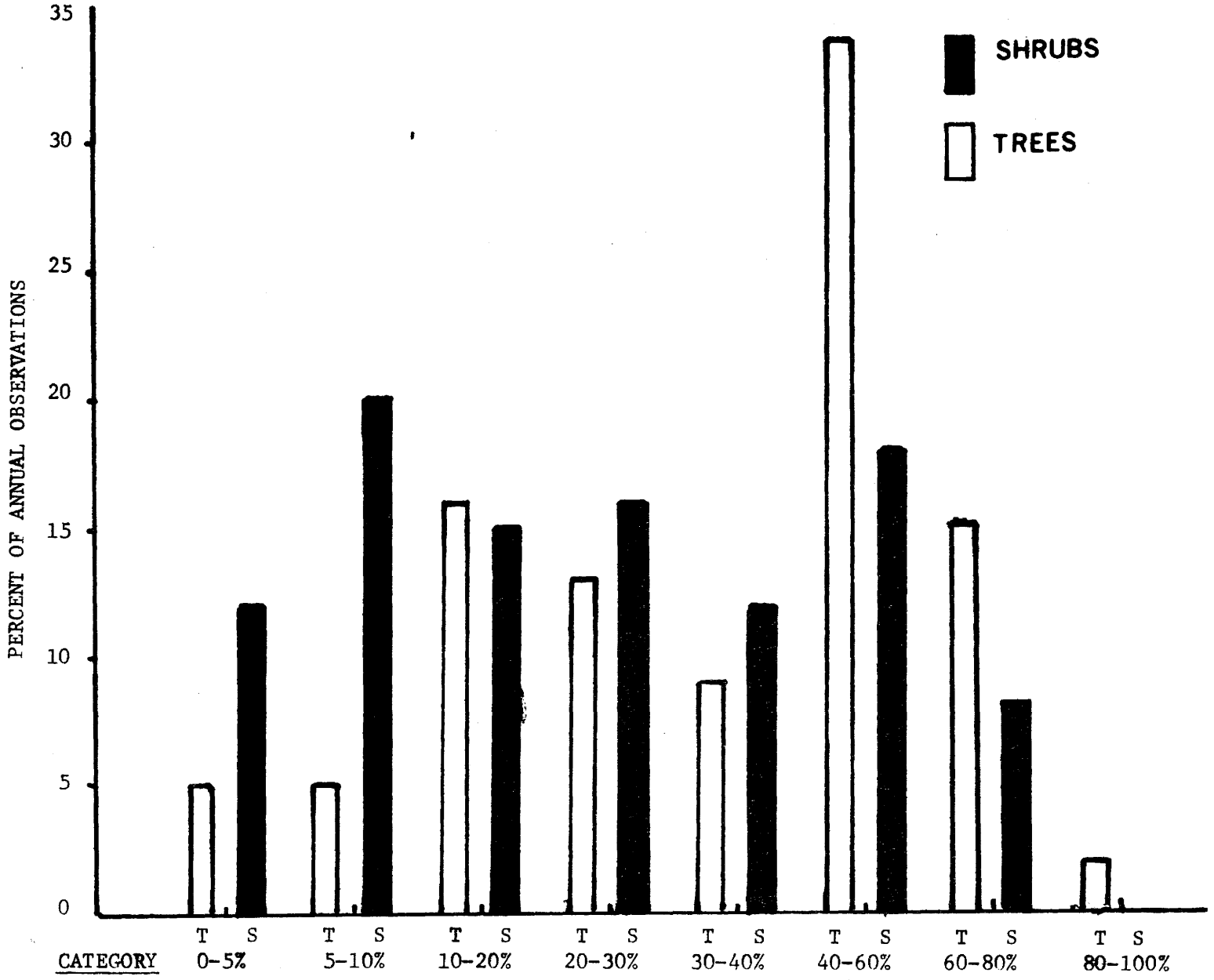

Figure 10. Percent of total observations occurring among each tree and shrub canopy cover category.

Table 12. Percent of seasonal turkey observations occurring on slopes of various aspects on the Utah study area

	Winter	Spring	Summer	Fall	Winter-Spring-Fall
North-facing	--	12	14	--	7
East-facing	--	25	29	28	21
West-facing	--	20	20	--	10
South-facing	100	43	37	72	62

sources would be more available to turkeys (Burget, 1957).

There seemed to be no preference for exposure during summer. North-facing slopes were avoided throughout the year, probably due to: (1) deep snow which covered food supplies in winter, and (2) dense stands of mixed-conifer which prevented sunlight penetration in summer and prohibited growth of understory vegetation.

Other variables

Water requirements. Eighty-four percent of turkey observations recorded during the study were within 0.5 miles of permanent water. The remaining 16 percent were between 0.5 and 1 mile from water. Wild turkeys used water in all forms including snow, seeps, potholes, springs, stock-watering ponds, and fast-flowing streams. No preference for particular water forms was noted.

Water availability, in fact, had little impact on turkey distribution since no point on the optimum summer or winter ranges was more than a mile from water and even nesting hens may travel upwards of 2 miles to obtain water (Spicer, 1959).

The abundance of free-flowing streams was an asset to the study area habitat. Reeves (1953) stated that streams allow turkeys to obtain water at numerous places, thus, flocks use larger, more varied sections of habitat (i.e., food sources).

Altitudinal use. Monthly, mean elevations for turkey observations are presented in Figure 11. The lowest and highest elevational means were recorded in December and September, respectively. The mean for turkey observation during winter months was 6,333 feet, while in summer the mean approached 9,000 feet (Table 13). The range in elevational and turkey use on the study area was from 6,000 to 10,000 feet.

Table 13. Seasonal mean elevation and range (in feet) based on turkey observations during the study period

	Winter (Jan.-Mar.)	Spring (Apr.-June)		Summer (July-Sept.)	Fall (Oct.-Dec.)
	1973	1972	1973	1972	1972
Mean elev.	6333	7491	7648	8988	6887
Range	6000-7000	6600-8600	6600-8700	7600-10,000	6000-8300

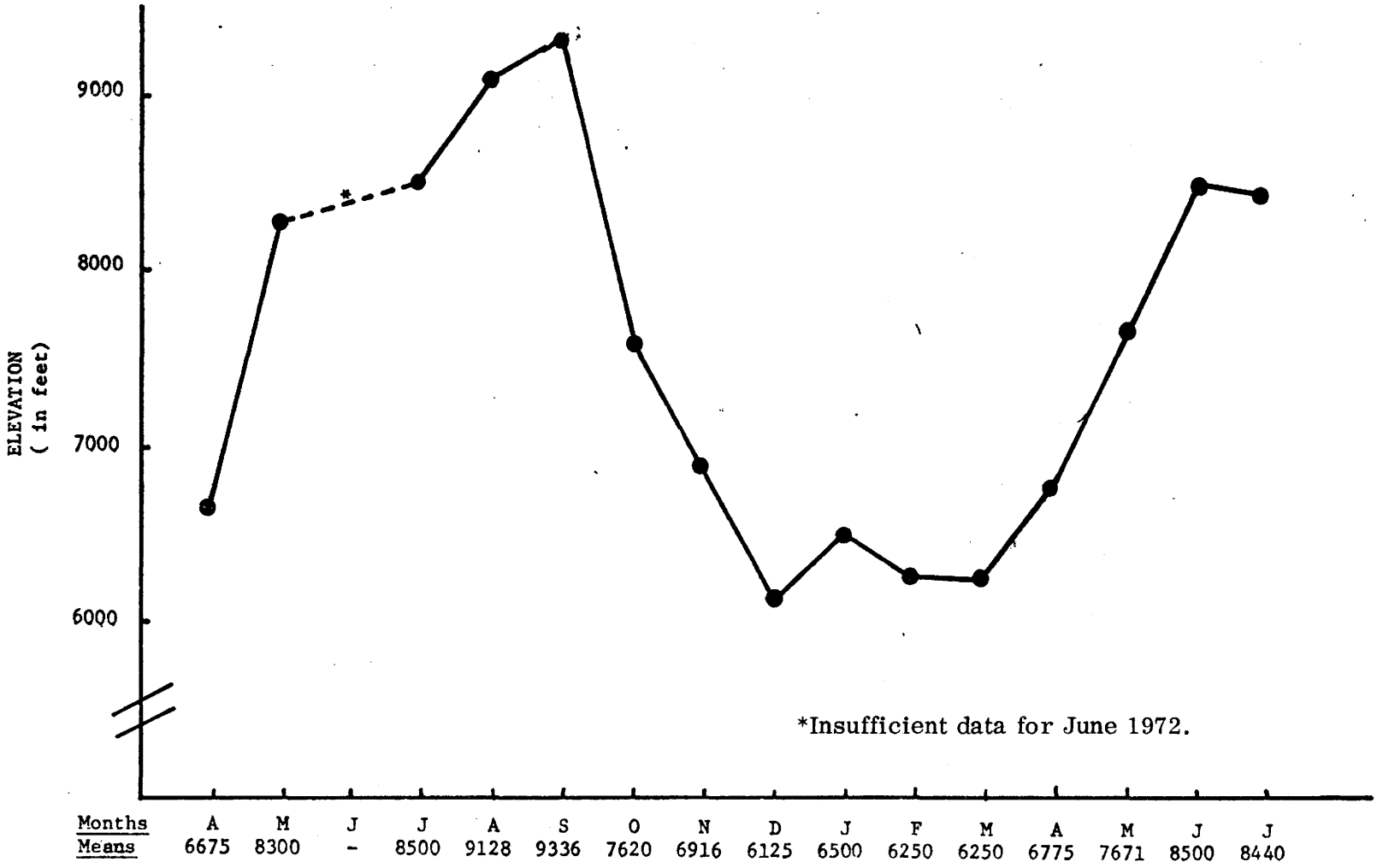

Figure 11. Monthly, mean elevations of wild turkey observations.

Turkeys on the study area used lower elevations in winter than reported for some areas of Colorado, New Mexico, and Arizona (Schorger, 1966; Hoffman, 1973). However, lower limits on some forests in Arizona may be 5,000 feet (Knopp, 1959). Sightings in Utah occurred during a severe winter. Since milder winters are the rule in southwestern Utah, my observations could be at the lowest elevational extent of winter range (Figure 12).

Summer elevations of turkeys on the study area in Utah were similar to most findings in Colorado, New Mexico, and Arizona where mountains were at higher elevations (Ligon, 1946; Schorger, 1966; Hoffman, 1973; Scott and Boeker, 1973).

Migration. Turkeys migrated from elevations as low as 6,000 feet at the North Fork trapsite in winter to as high as 10,000 feet at Deer Valley in summer. During migration, turkeys ascended to an elevation of around 8,500 feet by early summer (see Figure 12). Apparently they did not reach their ultimate summer range until August or September, at which time the mean elevation was 9,000 feet for broods and 10,000 feet for male flocks.

The downward migration began late in September. Most of the descent was covered by late October and finished by December.

According to Bailey and Rinell (1967), wintering and nesting areas may be 25 to 50 miles apart. But, in the Sitgraves, Apache, and Coconino Forests of Arizona, turkeys migrate only a short and almost vertical distance (Reeves, 1953).

Radio locations provide only air-line miles traveled from trapsites on winter range to summer range. Three radio-equipped turkeys were monitored

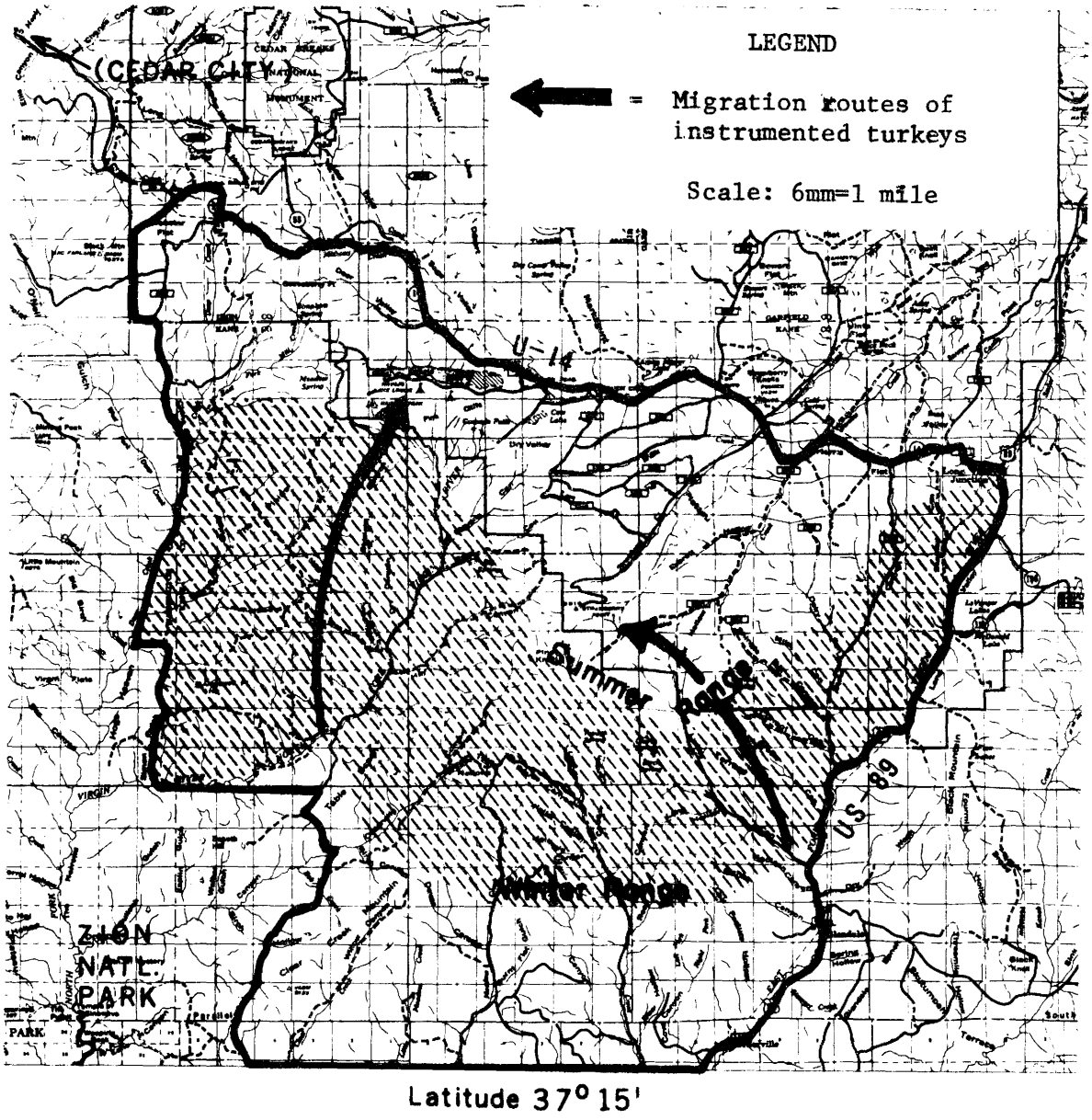

Figure 12. Winter to summer migration routes of instrumented turkeys and approximate lower limits of winter and summer ranges.

from an airplane on June 27, presumably before they had reached the highest summer range. A hen, instrumented at Chamberlin Ranch on the North Fork and last radio-located there on March 15, 1973, moved 8 air-line miles to the head of Oak or Straight Canyons by June 27. Based on ground and air-tracking, the males trapped in Lydia's Canyon moved only 6 air-line miles, ascending 2,000 feet to the head of Swains Creek, between March 17 and July 2, 1973.

The hen marked near Chamberlin Ranch migrated north (see Figure 12). Thus, turkeys which wintered in the North Fork and summered in Deep Creek had to move some 16 air-line miles, providing Deep Creek was the ultimate summer range. Gobblers that wintered in the same location and spent late summer at Deer Valley would be required to travel 11 air-line miles.

Distances from frequently traveled roads. The distances of monthly observations from frequently traveled roads were placed in varying categories (see Appendix, Table 21). Most observations seemed to occur either less than or greater than 1 mile from traveled roads (Table 14).

Table 14. Percent of seasonal turkeys observations occurring more or less than 1 mile from a frequently traveled road.

Distance	Spring 1972	Summer 1972	Fall 1972	Winter 1973	Spring 1973	Total
<1 mile	20	29	14	65	17	31
>1 mile	80	71	86	35	83	69

Turkeys avoided human activity in all seasons. Sixty-nine percent of all sightings were more than 1 mile from a well-traveled road. The wintering area for two adult males in Lydia's Canyon (East Fork) was 0.5 to 3 miles from daily, human activity (Chamberlin dairy). The winter roost was located at the extreme distance (i.e., 3 miles). Whereas the largest winter concentration of turkeys I found on the study area (on the North Fork) was more than 20 miles from any human activity or frequently traveled road. I believe that most turkeys preferred a winter range removed from human activity.

Factors influencing habitat utilization and turkey distribution

Winter. The primary factors which influence the use of a particular winter habitat type are snow depth and food resources (Ligon, 1946; Reeves, 1953; Burget, 1957). However, human disturbance may have influenced the movement of turkeys to the North Fork that once used the East Fork drainages. The three towns on the study area were within 3 to 9 miles of East Fork turkey winter range. Possibly the chances for human disturbance were enhanced there. On the North Fork, there was a much lower chance for disturbance by humans.

Summer. The importance of clearings, glades, or openings to wild turkey broods is well documented from all ranges of Meleagris gallopavo (Mosby and Handley, 1943; Dellinger, 1973; Hillestad, 1973; Holbrook, 1973; and Thomas, et al., 1973). Dalke (1942) stressed the importance of clearings for insects. Openings also provide the essentials for breeding, nesting, and brooding (Holbrook and Lewis, 1967). Guidelines for opening brush specifically for Rio Grande

turkeys in Texas were established by Glazener (1967).

At the same time, human disturbance may restrict the use of these important entities by wild turkeys in southwestern Utah. According to Burget (1957), man is still the greatest deterrent in wild turkey development. Jantzen (1959:184) supported this by stating "human disturbance from logging, settlement, recreation, farming, and ranching has greatly reduced the amount of available habitat." More specifically, human variables may have been the most important factor in the limited success of releases to restore non-primary turkey range in West Virginia (Bailey, 1973).

There were only two substantially large meadows or clearings found on the summer range of the East Fork--Strawberry Meadow and Swains Creek. Both meadows were ideal because they were long (7 to 8 miles) and narrow (30 to 100 yards), so that turkeys using them would not have had to venture far from cover. There also was ample water within 0.5 miles during most years and within 1.0 miles even during drouth years. However, there were numerous summer homes or improved well-traveled roads that ran the length of each meadow. And, there were light-aircraft landing strips on each of these clearings. Although numerous summer homes were located on turkey summer range on the North Fork, they were concentrated near Navajo Lake. This leads me to believe that human disturbance on the East Fork summer ranges, with respect to prime clearings, was suppressing the population there by limiting the use of available habitat. This could have caused turkeys to favor the North Fork where brooding range was much less accessible to humans. The result would,

in part, not only explain the higher density of turkeys on the North Fork, but also the turkey's use of the aspen habitat which dominates the summer range there.

Another factor which may have affected summer habitat use by turkeys is opportunism. Grasses and forbs provide the bulk of Merriam's turkey summer diet (Reeves, 1951; Reeves and Swank, 1955; Hoffman, 1962; Scott and Boeker, 1973). An overstory dominated by aspen was the most productive on the study area, insofar as grasses and forbs are concerned (Coles and Pedersen, 1969). Turkeys probably were taking advantage of the area with the most available food supply.

Human disturbance, opportunism, and certain behavioral responses probably were operative in habitat selection by turkeys. But, further study is required to determine the precise mechanisms by which behavioral responses and opportunism operate.

Possible limiting factors

Winter range. When primary mast fails, wild turkeys resort to juniper berries on most southwestern ranges (Ligon, 1946; Reeves, 1953; Reeves and Swank, 1955; Korschgen, 1967). Since the ground under dense juniper canopies usually remains free from snow, high consumption of the berries probably results from availability rather than food preference (Scott and Boeker, 1973). When there are no fall acorns to prime turkeys for winter and juniper berries are the only available food source, turkeys may suffer nutritional stress and weight loss.

The acorn crop failed in southwestern Utah during 1972. The winter of 1972-73 was unusually harsh, with record low temperatures in December and snowfall 300 percent above normal. Observations in January revealed extensive use around the base of juniper trees. Additionally, at least 6 (1 mature hen, 1 immature hen, 1 immature gobbler, and 3 unidentified) of an estimated 43 turkeys (see Table 5) died on the North Fork winter range. The loss represented 14 percent of the estimated wintering flock. Other turkeys may have died that were not found.

Some form of winter feeding may have prevented this loss. Hoffman (1973) reported that in areas where supplemental feeding stations were provided, wild turkeys remained on normal winter grounds and showed no signs of abnormal winter stress. The reverse was true on areas without winter feeding stations. Also, he suggested these may help stabilize winter flocks and make winter counts. In New Mexico, Spicer (1959) stated that winter feeding led to turkey concentrations rather than actual increase in numbers. However, he also suggested that fertility was increased by winter feeding. Predation around the feeding stations did not increase. Even in Florida, where snow is not a factor, turkeys use feeders as a supplement on marginal habitats (Powell, 1967). MacDonald and Jantzen (1967:518) summarized winter feeding:

> Although studies have demonstrated considerable use of artificial feeding stations and food plots, the use of such readily available food sources by turkeys would be expected, even if the natural food supply were perfectly adequate to permit healthy survival of the flock through the winter. Even if an increase in population resulted from winter feeding, efficient management requires that the results justify the expense.

In concentration areas such as the North Fork, supplemental feeding (planted food plots) may enhance the over-winter survival of wild turkeys. If the aim is only to maintain a nucleus or remnant turkey population, then feeding should not be considered. On the other hand, winter feeding may enhance populations if recreation in the form hunting is desirable. Used effectively, it may also help redistribute turkeys away from centers of human activity and reduce numbers on high concentration areas. Lastly, more accurate winter counts may be obtained and used to determine population trends.

Summer range. On the North Fork, sheep and cattle may be depleting valuable food sources for turkeys and disturbing significant brooding areas. Most authors agree that livestock not only compete with turkeys for natural and planted foods, but they also may destroy nests and nesting cover (Blakey, 1937; Reeves, 1951; Glazener, 1967; Scott and Boeker, 1973; and Jahn, 1973).

Critical livestock management areas on turkey summer ranges were Deep Creek and Three Creeks. Turkey broods in Deep Creek used the aspen glades extensively until herders moved sheep onto them for a 2-week grazing period. After the sheep were gone, broods did not return to these aspen clearings.

Sheep grazing under a herder regime tends to maximize use of the range resource (grasses and forbs) during a short time period, leaving little for turkey broods (Padden, personal communication). Added stress for turkeys was the invasion of their brooding sites by man and his dogs. Three Creeks may also be over-used since grazing is not strictly controlled, as on U. S. Forest Service lands.

Webster Flat, near the entrance to the Clark Ranch, was also grazed but turkey broods continued to use it. The herding techniques for sheep was not used and may have contributed to broods using this area irrespective of livestock.

Fall range. Overgrazing typical fall habitat reduces availability of grass panicles which, according to Lee (1959:15), are a wild turkey's "ace-in-the-hole." Such may be the case in Corral, Straight, Dry, Seth, and Oak Canyons.

SUMMARY AND CONCLUSIONS

Life History

Fall and winter flocks were comprised primarily of two groups: (1) adult hens, juvenile hens, and juvenile gobblers, and (2) adults gobblers. Gobbler flocks remained apart from hens and young during summer. Smaller feeding flocks were observed during the winter of 1972-73.

Spring dispersal of adult males probably occurred between March and April 1, egg laying between early April and early May, and hatching from mid-May to mid-June. Spring dispersal may have been delayed on 1 area due to lack of hens on the winter range.

The maximum harem size was 3 hens. Additional gobblers may or may not be near the strutting ground. One strutting ground was located 4 miles distant from the harem gobbler's wintering ground, but in the same drainage. It did not appear that traditional strutting grounds existed. However, turkeys probably utilize the same wintering area each year.

Hen:poult ratios for 1972 were lower than comparable data from other areas of Merriam's range when unsuccessful hens were included in the hen:poult ratios. The observed decrease in reproductive success during 1973 as compared to 1972 (2.1 to 0.7 poults per hen, respectively), probably was due to the abnormally cold, wet winter and spring. Below freezing temperatures during April egg

laying may have had the most pronounced effect. Track counts enhanced hen: poult data on an area of low turkey density.

Sex ratios showed a higher percentage of hens than males in the population. Track counts were not an accurate means of sex determination.

Habitat Utilization

During winter and fall, turkeys almost exclusively utilized a mountain brush habitat type similar to that found on historic ranges. This type was dominated by Gambel oak, juniper, wild rose, and pinon pine, in association with scattered ponderosa pine. The lower elevational limit for winter range was established at about 6,000 feet MSL, but did not encompass the pinon-juniper habitat type. A higher density of turkeys utilized an area isolated from human activity.

Turkeys utilized different habitat types during spring, depending upon whether it was early, middle, or late spring. Respectively these were: mountain brush, ponderosa pine, and aspen. This use pattern was attributed to seasonal migration. It was hypothesized that nesting areas were near the ecotone of mountain brush and ponderosa pine or aspen-mixed conifer.

A greater number of summer turkey observations occurred where aspen glades, broken by mixed-conifers, dominated the habitat. Whereas, little use was associated with the ponderosa pine habitat type. This was attributed to the lower density of turkeys (1 turkey to 4.4 square miles compared to 10.4 square miles) on the area where ponderosa pine dominated the summer range. Adult gobblers utilized mixed-conifer clearings at the upper limits of the study area

summer range (10,000 feet MSL), while broods preferred aspen glades at lower elevations (9,000 feet MSL).

Opportunism, human disturbance, and behavioral responses probably were operative in habitat and area utilization patterns exhibited by turkeys. But, introduced species may need considerable time to establish habitat or area preferences. Further study is required to determine the mechanisms by which influencing factors operate.

Vertical turkey migrations ranged from 6,000 to 10,000 feet in elevation. They probably moved from 6 to 16 air-line miles from winter to summer range. Most of the distance during fall migration was covered between September and October.

Possible variables acting to suppress turkey populations during the study period were: (1) failure of oak mast preceding a severe winter, (2) abnormally cold weather during egg laying, (3) human disturbances on the brood ranges, and (4) overgrazing and disturbance by domestic livestock. Available water was not a limiting factor.

The habitat for wild turkeys in Utah may be marginal at best. This should be expected since they were not known to occur there historically and probably is due to a physical barrier--the Grand Canyon. However, human disturbance may be the most important variable in limiting turkey populations on the study area.

The following are management recommendations for Merriam's turkey in southwestern Utah:

1. Establish winter feeding stations in the North Fork and Muddy Creek during severe winters only.

2. Make intensive efforts to locate other winter concentration areas in Utah for the possibility of establishing similar feeding stations on them.

3. Determine turkey numbers from winter counts to evaluate population trends.

4. Obtain estimates of annual hen:poult ratios by establishing transects at Webster Flat, Deep Creek, and Strawberry Meadow and by soliciting the help of local ranchers and herders.

5. Petition the U. S. Forest Service to reduce AUM's on the Deep Creek, Webster Flat, Fife Mill, and Lone Pine Spring grazing allotment or delay grazing until late August or early September.

6. Investigate the possibility of opening small clearings and building nearby water catchments (for convenience rather than necessity) on the East Fork summer range near Strawberry Meadow and Swains Creek.

7. Evaluate the area encompassing Uinta Flat, Bowers Point, and lower Tommy Creek for possible "leap-frog" turkey transplants. Water catchments and clearings also may be necessary.

8. Select transplant sites which contain habitats similar to those presented herein.

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APPENDIX

Table 15. A mileage chart for reference in future studies

Mode of transportation	Estimated miles traveled
Truck	21,000
Jeep	939
Horse	663
Walk	241
Sno-cat	240
Snowmobile	145
Snowshoes	64
Aircraft (2.5 hours)	
Total	23,292
mean miles/month	1,664

Table 16. Description of wild turkey observation transects on the study area

Mile point	Approx. elevation	slope	Vegetation	
			Overstory	Understory
	(ft.)	(deg.)		
			Harris Flat Transect	
Begin 2/10 mile from U-14 on Stout Canyon Road. Heading westerly 2.5 miles, turn north to U-14 where transect ends. Total length, 4 miles.				
0.0	7,850	0-3	Pipo	Syor, Risp, Artr
0.5	7,900	-	Pipo	Syor, Risp
1.0	8,200	0-7	Pipo meadow	Jusp, Risp. Chna
1.5	8,000	0-5	Pipo, Potr	Risp
2.0	8,050	-	Potr (dense), Pipo, Psme	Syor, Risp
2.5	8,000	10	Abco, Psme, Potr, Pipo	Risp, Syor
3.0	7,900	3-8	meadow, Potr, Pipu, Psme	Chna, Risp
4.0	7,900	3-8	meadow, Potr, Popu, Psme	Risp, Chna
			Willis Creek Transect	
Begin 2/10 mile from U-14 ending at Lars Fork Road Junction. Length 5.5 miles.				
0.0	8,400	-	Pipo, Psme	Risp, Syor, Potr
0.5	8,400	0-5	Pipo, Psme	Risp, Syor, Potr
1.0	8,300	0-5	Pipo, Psme, Potr	Juco, Jusp
1.5	8,200	0-20	Potr, Pipu, Abco, meadow	Chna
2.0	8,200	0-20	Potr, Pipu, Abco, Pipo	Syor
2.5	8,200	0-20	Potr, Pipu, Abco, Pipo	Syor
3.0	8,200	0-20	Potr, Pipu, Abco, Pipo	Syor
3.5	8,275	0-20	Potr, Pipu, Abco	----
4.0	8,500	0-5	Potr, Abco	Arpa
4.5	8,600	-	Potr, Abco, Pifl meadow	----
5.0	8,800	8-15	Potr, Abco, Pipo	----
5.5	8,800	5-7	Potr, Abco	Syor

(con't)

Table 16 (Continued).

Mile point	Approx. elevation (ft.)	slope (deg.)	Vegetation Overstory	Vegetation Understory
			Deep Creek Transect	
			Begin 2/10 mile east of "plains" road exit on U-14. Heading south begin transect 3/10 miles from U-14. Length, 2.6 miles.	
0.0	9,400	0-5	Potr	Risp, Syor
0.5	9,200	12	Potr, Pipu	Risp
1.0	9,000	0-5	Potr, Pipu	Abco
1.5	8,900	0-5	Pipu, Abco, Potr	Abco
2.0	8,800	0-3	Meadow, Potr	Syor
2.5	8,700	0-3	Meadow, Pipu, Potr, Abco scattered Pipo	----
			Strawberry Ridge Transect	
			Begin 0.5 miles from U-14 on Strawberry Ridge heading southwest 6.8 miles, turn north and ending at Strawberry Meadow. Length, 10 miles.	
0.0	8,450	0-3	Pipo	Risp, Potr
1.0	8,450	0-3	Pipo	Risp, Potr
2.0	8,500	0-3	Pipo, Psme, Potr	Risp, Potr
3.0	8,500	0-3	Pipo, Potr	Risp
4.0	8,550	0-3	Psme, scattered Pipo 1 acre clearcuts	Abco
5.0	8,700	5-8	Potr, 25-30 acre clearcuts	Syor, Risp
6.0	8,800	0-5	75-100 acre clearcuts Psme, Abco	Syor, Risp
7.0	8,900	15-20	Potr, Psme, Abco	Syor, Risp
8.0	8,800	0-3	Pipo, Potr	Juco, Potr
9.0	8,800	11	Potr, Pipu, Pipo	meadow
10.0	8,800	0-8	Pipo on slopes	meadow

(con't)

Table 16 (Continued).

Mile point	Approx. elevation	slope	Vegetation Overstory	Understory
			Muddy Creek Transect	
Begin 9.9 miles from U.S. 89. Head north follow road. Length - 2 miles.				
0.0	6,500	0-3	Quga, Jusp, scattered Pipo	Prvi, Chna, Syor, Artr
0.5	6,500	0-3	Quga, Jusp, Acne	Artr, Chna
1.0	6,400	0-3	Quga, Jusp, Pipo	Artr, Chna, Amut, Rowo
1.5	6,300	-	Quga, Pipo, Jusp	Artr
2.0	6,300	0-3	Quga, Jusp	Artr
			Webster Flat Transect	
Begin at junction of "plains" road and U-14. Follow road south to Clark Ranch Road and turn west, following said road to U.S.F.S. boundary.				
			Hay and Rosy Canyon Transect	
Begin 6.6 miles from U-14 on Strawberry Meadow. Turn south on dugway leading from the Pink Cliffs.				
			Lars Fork-Cascade Falls Transect	
Begin at junction of Lars Fork and Strawberry Meadow. Head west and at 7.0 miles turn west at junction of roads. End 0.5 miles from east end of Navajo Lake. Total length, 10 miles.				
0.0	8,000	10	Pipo, Psme	Quga, Syor, Jusp
0.5	8,000	35	meadow, Pipu, Abco, Potr	Syor
1.0	8,300	10	meadow, Pipu, Potr	Risp, Syor, Potr
1.5	8,300	10	meadow, Pipu, Potr	Risp, Syor, Potr
2.0	8,300	10	meadow, Pipu, Potr	Risp, Syor, Potr
2.5	8,550	10	dense Pipu, Abco, Potr	Syor, Abco
3.0	8,750	5-10	dense Pipu, Abco, Potr	Risp, Syor
3.5	8,900	11	Pipo, Abco, Potr	Risp, Syor, Potr

(con't)

Table 16 (Continued).

Mile point	Approx. elevation (ft.)	slope (deg.)	Vegetation Overstory	Understory
4.0	9,000	5-8	Abco, Potr, Pipo	Risp, Syor, Potr
4.5	9,000	8	Potr, Abco	Risp, Juco Abco, Potr
5.0	9,050	0-3	Potr, Abco, Pipo	Juco, Abco, Potr
5.5	9,050	0-3	Potr, Abco, Pipo	Juco, Abco, Potr
6.0	9,050	0-3	Potr, Abco, Pipo	Juco, Abco, Potr
6.5	8,800	0-3	dense Potr, Abco	Juco, Abco, Potr
7.0	8,550	0-3	dense Potr, Abco	Juco, Abco, Potr
7.5	8,650	0-5	Potr, Abco	Juco, Potr
8.0	8,800	0-5	Potr, Abco	Chna, Arno, lava rock
8.5	8,800	0-5	sage flat 300 yds. wide	Arno
9.0	8,900	0-5	sage flat 300 yds. wide	Arno
9.5	8,900	8-10	sage flat 150 yds. wide	Arno
10.0	8,900	8-10	sage flat 50 yds. wide	Arno

Key to overstory and understory species.

Pipo--Pinus ponderosa

Psme--Pseudotsuga menziesii

Abco--Abies concolor

Potr--Populus tremuloides

Pipu--Picea pungens

Pifl--Pinus flexilis

Syor--Symphoricarpos oreophilus

Risp--Ribes species

Artr--Artemisia tridentata

Jusp--Juniperus species

Chna-- Chrysothamnus nauseosus

Juco--Juniperus communis

Arpa--Arctostaphylos patula

Amut--Amelanchier utahensis

Prvi--Prunus virginiana

Rowo--Rosa woodsii

Table 17. Data on 13 turkeys trapped on the Utah study area

Date	Location	Sex	Age	Weight (Pounds)	Leg Band	Wing Band	Patagium Marker Background color	Sex Ident.	Transmitter	Beard (inches)	Spur
12-4-72	North Fork	female	adult	12.0	451	18-19	blue	yellow circle	#1203	--	--
		female	adult	11.5	454	4-5	red	yellow circle	--	--	--
		female	adult	11.0	453	6-7	blue	red circle	#1206	--	--
		female*	adult	11.0	455	1-2	red	yellow circle	--	--	--
		female	adult	11.0	457	8-9	blue	red circle	--	--	--
		female	adult	10.0	448	24-25	blue	yellow circle	#1204	--	--
		female	adult	10.0	458	12-13	red	blue circle	--	--	--
		male	Juv.	9.0	456	10-11	blue	red triangle	--	--	--
		male	Juv.	8.5	452	14-15	blue	red triangle	--	--	--
		male	Juv.	8.0	450	20-21	blue	yellow triangle	--	--	--
		male	Juv.	7.5	449	22-23	blue	yellow triangle	--	--	--
3-17-73	Lydia's Canyon	male	adult	17.0	415	26-28	red	--	#1207	8 3/4	17
		male	adult	13.0	416	30-31	red	--	#1205	6 1/4	9

* injured at the trapsite

Table 18. Weight, sex, and age of wild turkeys captured near the southwestern Utah study area during fall 1972 and spring 1973

Location	Trapping Date	Sex	Weight (pounds)	Age
Cedar City	December 8, 1972	Female	9.0	Mature
		Female	9.0	Mature
		Female	7.5	Juvenile
		Female	6.5	Juvenile
		Female	6.5	Juvenile
		Male	7.0	Juvenile
Boulder	March 22, 1973	Female	9.0	Mature
		Female	8.5	Mature
		Female	6.0	Juvenile
		Male	15.5	Mature
		Male	14.5	Mature
		Male	12.0	Mature
		Male*	8.5	Juvenile

*Released at Boulder trapsite.

Table 19. Harvest locations, weights, and measurements for eight male turkeys harvested on the Utah study area during the 1972 spring hunt

Date killed	Location	Weight	Total length	Wing spread	Beard length	Spur length
		(lbs.)	(in.)	(in.)	(in.)	(mm)
April 29	East Fork	21.0	46.0	58.0	8.75	30
April 29	North Fork	21.0	44.0	54.5	9.25	20
May 1	North Fork	14.5*	45.0	52.0	7.5	17
May 1	East Fork	18.0	47.0	59.5	8.5	15
May 4	North Fork	19.0	45.5	58.5	8.0	17
May 4	North Fork	19.0	45.4	51.0	8.5	28
May 6	North Fork	16.5*	46.0	59.0	9.0	30
May 8	North Fork	18.0	47.5	61.0	9.5	29
Means		19.3	45.8	56.7	8.6	23.2

*Field dressed weight (not included in mean weight).

Table 20. Location of Merriam's turkeys positively identified by sex

Date			Males	Females	Drainage	Study area unit	Observation type
Year	Mo.	Day					
1972	4	3	1	0	Shingle Mill	East Fork	Track count
	4	7	1	3	Muddy Creek	East Fork	Direct obs.
	4	25	0	1	Muddy Creek	East Fork	Direct obs.
	4	27	1	1	Muddy Creek	East Fork	Direct obs.
	5	9	1	0	Harris Flat	East Fork	Track count
	6	11	1	0	Sawmill Spring	North Fork	Direct obs.
	6	25	0	1	Muddy Creek	East Fork	Track count
	7	5	1	0	Deep Creek	North Fork	Track count
	7	5	0	2	Deep Creek	North Fork	Track count
	7	7	0	1	Deep Creek	North Fork	Track count
	7	7	0	1	Deep Creek	North Fork	Track count
	7	15	1	2	North Twin Hollow	East Fork	Track count
	7	27	0	2	Strawberry	East Fork	Direct obs.
	7	28	0	1	Strawberry	East Fork	Direct obs.
	8	1	5	0	Deer Valley	North Fork	Direct obs.
	8	3	0	1	Strawberry	East Fork	Direct obs.
	8	11	0	1	Webster Flat	North Fork	Track count
	8	11	0	2	Webster Flat	North Fork	Track count
	8	29	0	1	Deep Creek	North Fork	Track count
	9	13	1	0	Atkins Flat	North Fork	Track count
	10	4	1	2	Strawberry	East Fork	Direct obs.
	10	12	1	0	Hopp Canyon	North Fork	Track count
	11	27	2	0	Lydia's Canyon	East Fork	Direct obs.
	12	4*	4	7	Chamberlin Ranch	North Fork	Trapped

Table 20 (Continued).

Date							
Year	Mo.	Day	Males	Females	Drainage	Study area unit	Observation type
1973	1	25*	1	1	North Fork Can.	North Fork	Direct obs.
	1	25	6	0	Rosy Canyon	North Fork	Direct obs.
	3	14*	2	3	Chamberlin Ranch	North Fork	Direct obs.
	4	24	0	1	Muddy Creek	East Fork	Track count
	4	25	1	1	Shingle Mill	East Fork	Track count
	5	2	1	2	Lydia's Canyon	East Fork	Track count
	5	4	1	3	Rosy Canyon	North Fork	Track count
	5	9	1	1	Orderville Gulch	East Fork	Track count
	5	14	0	1	Muddy Creek	East Fork	Track count
	5	22	1	0	Harris Flat	East Fork	Track count
	5	22	0	1	Harris Flat	East Fork	Track count
	5	29	0	1	Deep Creek	North Fork	Track count
	5	30	0	2	Harris Spring Hollow	East Fork	Direct obs.
	6	11	1	0	Deep Creek	North Fork	Track count
	6	11	1	0	Deep Creek	North Fork	Direct obs.
	6	11	0	1	Deep Creek	North Fork	Track count
	6	13	0	1	Harris Spring Hollow	East Fork	Track count
	6	26	1	0	Deep Creek	North Fork	Track count
	7	8	0	2	Billingsley Creek	East Fork	Track count
	7	22	0	1	Harris Flat	East Fork	Track count
	7	25	0	4	Webster Flat	North Fork	Direct obs.
Total			38	55			

*Not all birds in flock positively identified as to sex.

Table 21. Percent of monthly and total observations occurring within each distance category from a frequently traveled road

Distance category	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	Total
0.0-0.5 mi.	-	50	-	30	28	18	40	8	25	50	100	56	-	-	9	20	23
0.5-1.0 mi.	-	-	-	-	7	-	-	-	50	-	-	-	-	36	9	40	8
1.0-1.5 mi.	-	-	-	7	43	-	-	-	-	-	-	-	-	21	73	-	15
1.5-2.0 mi.	-	-	-	46	-	9	-	-	-	-	-	-	-	-	9	20	9
> 2.0 mi.	100	50	100	17	22	73	60	92	25	50	-	44	100	43	-	20	45
																	100

VITA

Fred C. Bryant

Candidate for the Degree of

Master of Science

Thesis: Life History and Habitat Utilization of Merriam's Turkey in Southwestern Utah

Major Field: Wildlife Science

Biographical Information:

Personal Data: Born at San Antonio, Texas, December 19, 1947, son of John M. and Ruth E. Byrom Bryant; married Janis E. Hathaway, January 31, 1970; two children, Lisa E. and Clinton C.

Education: Graduated from John Marshall High School in 1966; received a Bachelor of Science degree from Texas Tech University, Lubbock, Texas, in 1970, with a major in Wildlife Management; began the Master of Science degree at Utah State University in 1971 and completed it in 1974.

Professional Experience: 1971, high school algebra teacher; presented a paper at the 1973 fall meeting of the Utah Academy of Science, Arts, and Letters, and submitted it for publication; presented a paper at the 1974 annual meeting of the Utah Chapter of the Wildlife Society; entire thesis published by the Utah Division of Wildlife Resources.