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Seasonal Habits and Habitat of the Ruffed Grouse in the Wellsville Mountains, Utah

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SEASONAL HABITS AND HABITAT OF THE RUFFED GROUSE IN THE WELLSVILLE MOUNTAINS, UTAH

by

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Robert L. Phillips

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INTRODUCTION

The ruffed grouse (Bonasa umbellus incana) inhabits much of the deciduous woodland of northern and central Utah. Its distribution is confined mainly to the Wasatch and Uinta mountain ranges (Figure 1). It has been observed in willows (Salix spp.) at 5,000 feet elevation and in Douglas-fir (Pseudotsuga menziesii) at 9,000 feet.

Anderson (1942) indicated that the ruffed grouse was once believed to be fairly scarce in Utah. He stated that there were "far too few ruffed grouse in Utah to consider them a game bird". Today, however, good populations are believed to be present, especially in the northern Wasatch Range (Rawley and Bailey, 1964).

The ruffed grouse has been on the list of hunted game birds since 1961. During the 1962 grouse hunting season, Utah hunters averaged 1.1 ruffed grouse per hunter day (Bailey, 1963). This figure was calculated from a small number of hunters who purchased grouse stamps in that year. An estimated 5,457 ruffed grouse were harvested during the 1963 hunting season (Bailey, 1964).

To manage this game bird through hunting regulations and encourage population increases, it is desirable to know its habitat requirements and its seasonal distribution within given habitats.

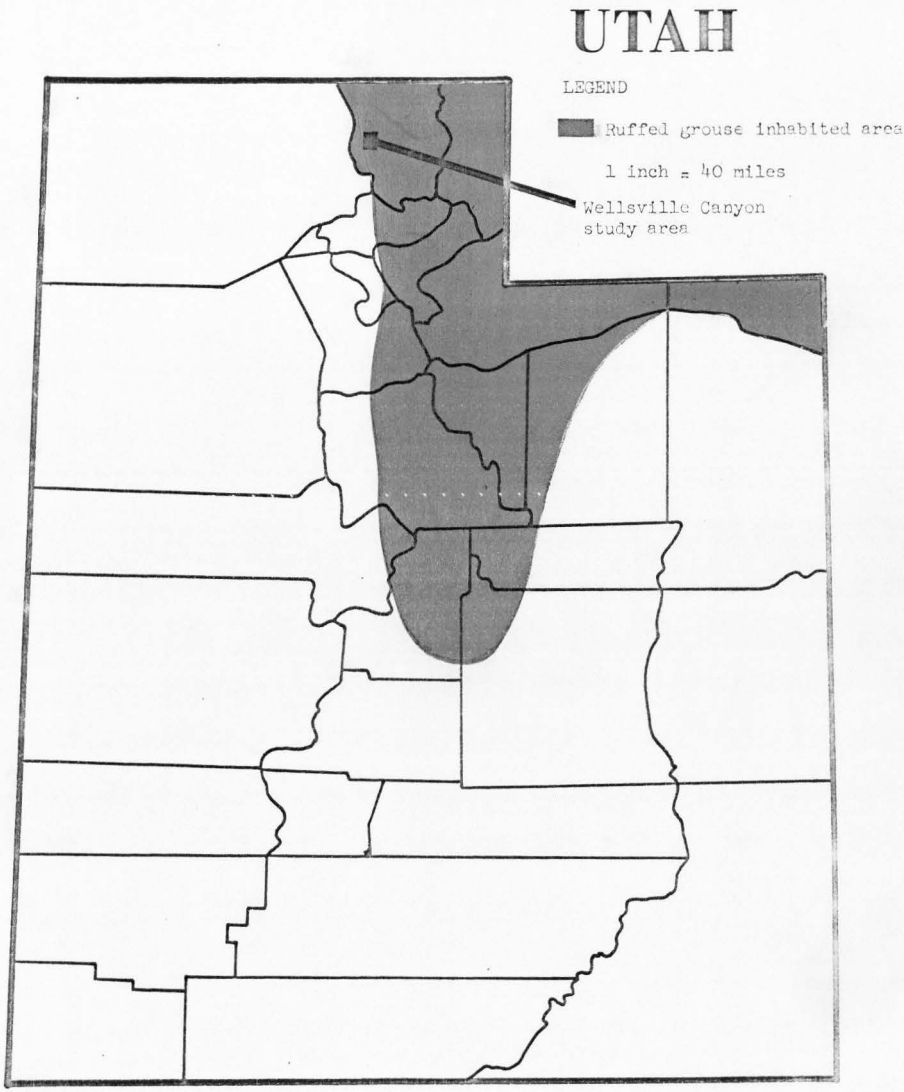

Figure 1. Distribution of ruffed grouse in Utah and location of study area (Rawley and Bailey, 1964)

OBJECTIVES

The objectives of this study were fourfold: (1) To correlate ruffed grouse distribution with habitat types at different seasons in an area in the Wasatch Range of northern Utah (2) to determine the chronological peak of drumming and relate this to plant development and climatic conditions (3) to determine the physical characteristics of drumming logs on the study area and (4) to gain information on the food habits of the ruffed grouse in Utah.

REVIEW OF LITERATURE

The ruffed grouse has been the subject of much research in the past 25 years. I will review only the literature pertinent to the objectives of this study.

Bump, Darrow, Edminster and Crissey (1947) studied the basic habitat requirements of the ruffed grouse in New York. With the increase of the ruffed grouse in Wisconsin, Dorney (1959) studied the relationship of ruffed grouse to forest-cover types. The only study of this nature in the western United States, was conducted by Hungerford (1953) in Idaho. He was concerned with grouse populations occupying a contiguous block of cut-over western white pine (Pinus monticola) and associated types common in northern Idaho.

The season of ruffed grouse drumming varies from March until June. There is variation in the beginning of drumming, and the length of the drumming period depending upon elevation, exposure and plant development. Hungerford (1953) correlated the peak of drumming in northern Idaho with willow (Salix scouleriana) catkin development.

Edminster (1947) described typical cover used for drumming in New York. He found that birds preferred young, second-growth woodland, predominantly hardwood, where a fair scattering of conifers - especially young conifers, were present. He also found that mature woodlands, solid coniferous stands, open slashings, and brushland seemed to be avoided.

Male grouse in Wisconsin do not select territories in habitat devoid of forest undergrowth less than 6 feet high (Dorney, 1959).

The most intensive investigation on the characteristics of ruffed grouse drumming sites was done by Palmer (1961) in northern Michigan. All sites studied were in lowland vegetation types. This suggested that upland types were not suitable for the establishment of courtship sites. Palmer attributed this unsuitability to lack of undergrowth resulting from advanced forest age and perhaps from an overabundance of deer. Lowland types were satisfactory as courtship sites because plants growing there were unpalatable to deer, therefore escaped serious browsing, and could reproduce.

Idaho ruffed grouse typically use a well-rotted ponderosa pine (Pinus ponderosa) windfall for drumming (Hungerford, 1953). A few Douglas-fir logs were used, but these were exceptions.

The most outstanding characteristics of brood cover are its diversity and youth. It is the early stages of woodland succession, with their profusion of herbaceous growth, that are attractive (Bump et al., 1947).

Hungerford (1951) found the earliest cover used by grouse broods during late June and early July was on the ridges and upper slopes. Many kinds of cover were available here including Douglas-fir, grand fir (Abies grandis), western white pine, western larch (Larix occidentalis), and mixtures of these species with ponderosa pine, Rocky Mountain maple (Acer glabrum), and many shrub species. None of the above types were used more than the others. As the warmer days of

summer approached, there was a gradual movement of broods to the lower slopes. The young grouse became more mobile and covered a greater area in search of their daily requirements.

Chapman et al. (1948) in Ohio and Polderboer (1942) in northeastern Iowa reported grouse broods using bramble patches and clearings where insects and fruits were abundant.

Steward (1956) working in Virginia stated that:

> In other regions including the southern Appalachians and Rocky Mountain area, the requisite habitat conditions are more local and restricted in area, and as a consequence ruffed grouse broods are somewhat spotty in their distribution. It would appear that the presence or absence of appropriate brood habitat conditions is a major limiting factor concerning the geographical distribution of this species.

For the Connecticut Hill study area in New York, Bump et al. (1947) stated that coniferous cover in winter "attracts grouse like a magnet." Hungerford (1953) and Marshall (1946) also found grouse using coniferous cover heavily during the winter. Chapman et al. (1948) found a definite relationship between grouse numbers and the presence of conifers in Ohio.

In contrast, Dorney (1959) found conifers in northern Wisconsin to be used at about the same rate as aspen types and northern swamp hardwoods. However, grouse used aspen and northern hardwood types mixed with conifers considerably more. Conifers may have less value as protective cover for ruffed grouse in northern Wisconsin than in New York, Idaho and Ohio.

DESCRIPTION OF STUDY AREA

The 491-acre study area is located in Wellsville Canyon 15 miles southwest of Logan, Utah. The area is on an east-facing slope at an elevation between 5,500 and 6,200 feet. I have classified the area as a mixed maple (Acer grandidetatum)-aspen (Populus tremuloides) type bordered by Douglas-fir at the higher elevations and by sagebrush (Artemisia tridentata)-grass at lower elevations (Figure 2).

The area was classified into five habitat types: aspen, maple, maple-aspen, conifer, and sagebrush-grass. The acreage of each type is given in Table 3. These types are highly interspersed in the area. Aspen clones occur in the moist drainages of canyons while maple is found in the shallow-soiled upland areas between canyons. The study area is 1.33 miles long, 0.87 miles wide at its maximum and 0.27 miles at its minimum width.

The Douglas-fir trees are scattered near the edge of the maple-aspen zone, but become more dense at the higher elevations. Scattered openings in the conifers contained ninebark (Physocarpus malvaceus) and snowbrush ceanothus (Ceanothus velutinus).

Common plant species in the sagebrush-grass areas include mulesear wyethia (Wyethia amplexicaulis), wheatgrasses (Agropyron spp.), horsemint (Agastache urticifolia), and sweetclover (Melilotus spp.).

Common understory plants in the maple-aspen are false Solomon's seal (Smilacina spp.), buttercup groundsel (Senecio serra), wild onion (Alium spp.), and chokecherry (Prunus virginiana).

Most of the study area is a portion of the Cache National Forest. During the 1930's some maple was logged from the area, but there has been regrowth from the original clumps. No grazing has been allowed on the area since the early 1940's because of its watershed value to the town of Wellsville. The privately owned land bordering the study area is farmed, the main crops being barley (Hordeum vulgare) and alfalfa (Medicago sativa).

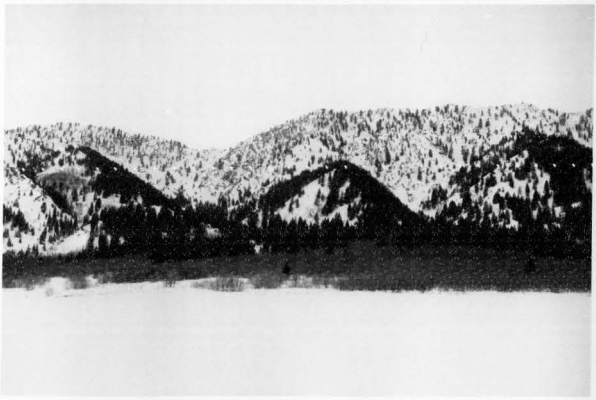

Figure 2. Wellsville Canyon study area during the winter; snow depth was 5 feet.

METHODS

Vegetation Analysis

A modified version of the cluster-plot system (Forest Service Field Handbook, 1962) was used to sample the vegetation. Circular plots with a radius of 7.45 feet (1/250 acre) were established to record data on tree species. The number of trees, average diameter, and percentage canopy cover were recorded in each of these plots. Each stem of 2 inches at breast height and larger was considered a tree. At the center of each circular quadrat, a square meter plot was located to describe the understory vegetation. Species composition, average height of the understory, and percentage bare ground were recorded in each of the square meter plots.

The plots were established approximately 1,000 feet apart along the flushing routes (Figure 3). Each point selected in the field was the center of a "sampling site" and the middle point of the center quadrats in the cluster (Figure 4). From this middle point eight more quadrats were established. Each of these quadrats was 60 feet from the mid-point.

Distribution Studies

Drumming males were located by stalking (Frank, 1947). This involved walking through the area listening for drumming. When a grouse was heard, it was approached and usually flushed at close range. The drumming log was identified by the presence of fecal droppings and

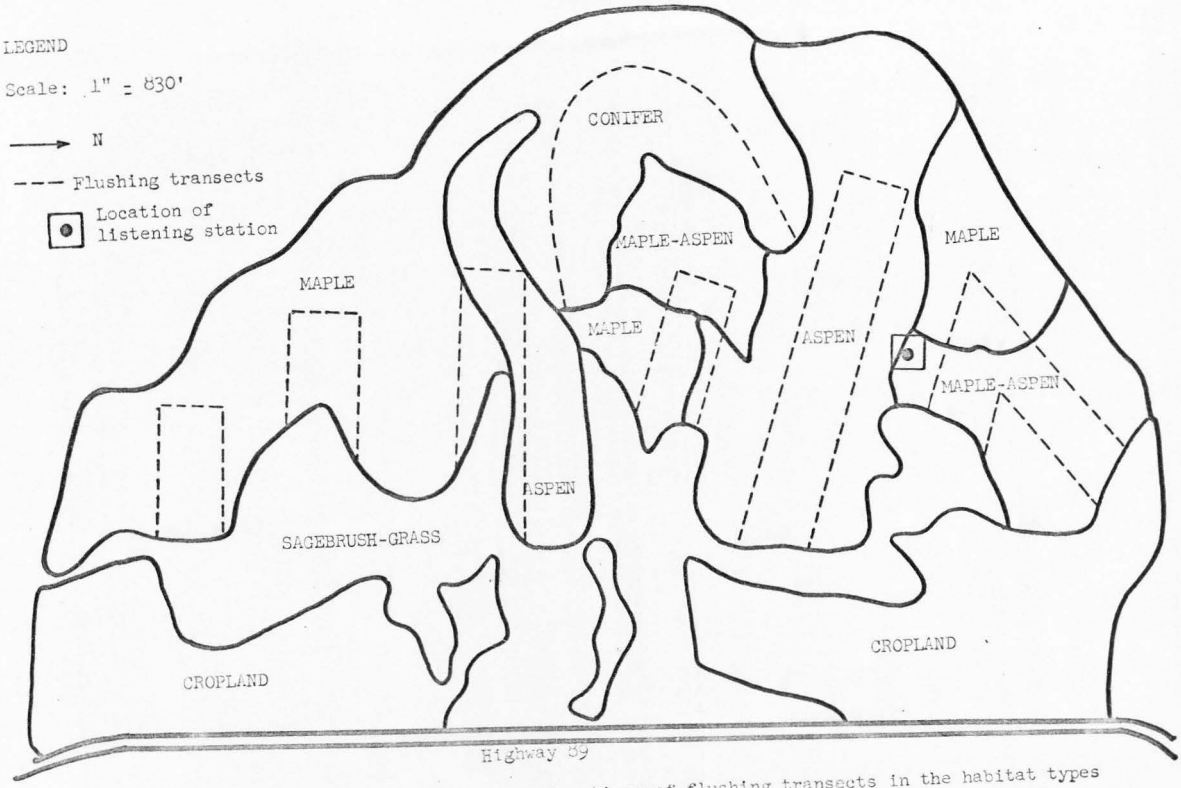

Figure 3. Wellsville Canyon study area showing locations of flushing transects in the habitat types

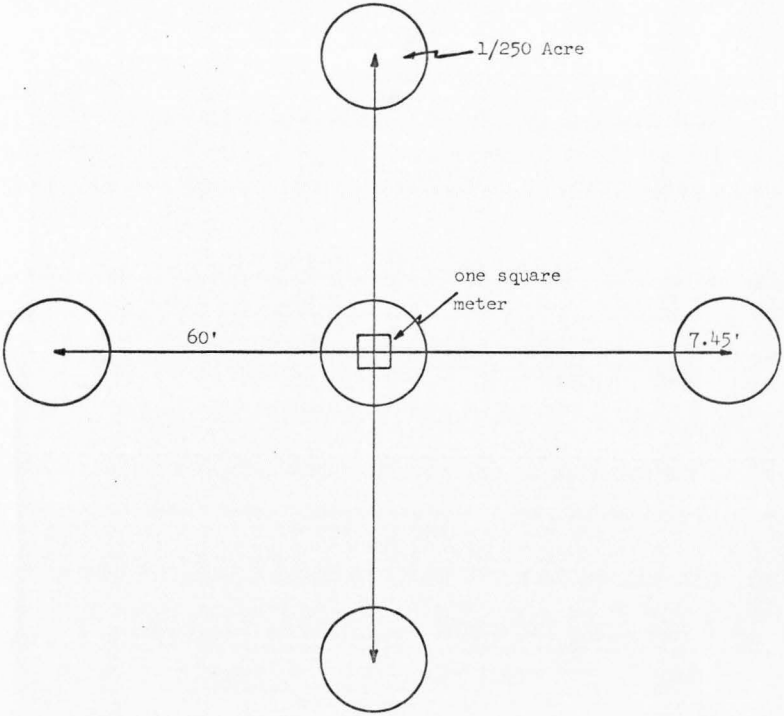

Figure 4. Sketch of quadrat vegetation sampling design used in analyzing the habitat types

feathers around the log. By live-trapping and marking birds, and also by checking the area repeatedly, the number of male grouse present was determined. Backtags similar to those used by Labisky and Mann (1962) were used in marking individual birds (Figure 5).

The general area in which each grouse drummed was referred to as a drumming site. Each site was identified on a map of the study area by a number.

Flushing transects were established approximately 400 feet apart perpendicular to the mountain range (Figure 3). These routes were walked with a dog during the summer and the number of grouse seen was recorded. Considerable time was spent searching for broods and recording the cover in which they were found.

During the winter months, the transects were walked without a dog because of the heavy snow. The number of grouse seen on each transect was recorded.

The flushing routes were walked six times during the first summer (1963), eight times during the winter, and eight times in the last summer (1964) of the project. Most of the transects were walked in the early morning hours when the maximum number of birds could be seen.

Study of Drumming Activity

A listening station was located at the north end of the study area in 1964, where it was known there had been past drumming activity (Figure 3). This station and other portions of the study area were visited every

Figure 5. Colored backtags were used in marking male grouse.

other day in the early morning hours from March 15 to May 11 when the first drumming was heard. Data were taken on drumming activity from May 11 to June 16 when drumming ceased. The number of drummings heard at the listening station was recorded for a 30-minute period beginning 15 minutes before sunrise. A record was kept of plant development, temperatures, cloud cover, and general weather conditions on all drumming-count days.

Physical Features of Drumming Sites

During the summer of 1964, visits were made to each of 32 drumming logs which had been located in the springs of 1963 and 1964. For the most part, each log was used by a single male. In some cases, however, two logs were used by a single male, who showed equal attachment to both. Where this was the case, data were taken on both logs.

The following information was taken on each of the drumming logs: vertical and horizontal diameter to the nearest inch, length to the nearest foot, species of log, azimuth of the log axis, distance of the drumming position from the largest end of the log, canopy cover above the drumming position, and tree density around the log using the point-center quarter method (Cottam and Curtis, 1956).

A random sample of non-drumming logs was taken in order to compare with drumming logs. Data were recorded on 60 logs which were encountered on the flushing routes. The same information which was recorded for drumming logs was also taken for non-drumming logs with the exception of canopy cover.

The distinction between drumming and non-drumming logs was not always clear. For example, logs with no evidence of use during this study may have been used in previous years.

Food Habits

The volume-percentage method (Martin et al., 1946) was used to record crop contents data. Crops used in the study were from birds shot in the 1962 to 1964 hunting seasons. Five crops were obtained from grouse collected in February and March, 1964.

To gain further information on winter food preferences, the following technique was used: When sign indicated that a grouse had been feeding on a particular plant, that plant was used as the center of a 1/50-acre plot. All plant species present in the plot were recorded and those species receiving use were indicated.

A preference rating for a given species was established by dividing the percentage of the total plots in which the species was used by its percentage frequency of occurrence in the plots.

RESULTS

Comparison of Vegetative Characteristics of Habitat Types

Species composition of understory

The data were analysed in order to determine if there was any difference in the floral composition of understory plants in the four woodland habitat types. The species present in each of the sample plots had been recorded. These species were categorized into three growth forms: grasses, low shrubs and forbs (Table 1). The occurrence of species in each category in each habitat type was totaled. These totals were used in a contingency table to determine whether habitat type and growth form were independent (Table 2). Analysis of these data resulted in a chi-square value of 27.22 (significant at the 1 per cent confidence level). Comparisons were then made between habitat types (Appendix Table 14).

Grasses and forbs occurred most frequently in the aspen type, probably because the understory of this type received the most light. Low shrubs were most abundant in conifers. This reflected the abundance of mallow ninebark and Oregon grape (Berberis repens) in this type.

Bare ground

Bare ground was defined as the amount of ground not covered by the crowns of individual herbaceous plants. It reflected relative coverage of understory plants. Analysis of variance of the bare ground data

revealed there were significant differences among the habitat types (Appendix Table 15). Planned comparisons were made between the types to see where these differences existed (Appendix Table 16).

There was a significant difference in bare ground between maple and conifer. Highly significant differences existed between maple and aspen, maple-aspen and aspen, and conifer and aspen.

The most bare ground was present in conifers, followed by the maple-aspen and maple types. Aspen showed the least bare ground reflecting the coverage of vegetation in this type. This type had the most dense understory while the maple and conifer types had the most sparse understory vegetation.

Canopy cover

Measurements of canopy cover were made by ocular estimate from the center of 1/250-acre plots. Analysis of variance of the vegetative characteristics showed significant differences to be present between the habitat types (Appendix Table 17).

Planned comparisons between types pointed out where these differences existed. Highly significant differences occurred between maple and aspen, maple-aspen and aspen, and conifers and aspen (Appendix Table 18).

The maple type had the most canopy cover followed by the maple-aspen and conifer types. Aspen proved to be the most open type.

Height of the understory

These data showed no significant differences between the types at the 5 per cent level, so no further analysis was made (Appendix Table 19). The greatest height of the understory vegetation was in the aspen type, followed by the maple-aspen and maple types. Conifers had the lowest understory.

Table 1. List of plant species occurring in sample plots categorized into growth form groups

Species and growth form	Occurrence in plots by habitat type			
	Conifer (15)*	Maple-aspen (15)	Aspen (20)	Maple (20)
Agropyron subsecundum	1	2	3	3
Poa pratensis		4	5	
Poa secunda		3	11	4
Bromus polyanthrus	1	3	1	4
Elymus glaucus	1	6	3	5
Total (Grasses)	3	18	23	16
Symphoricarpos oreophilus			3	1
Berberis repens	13	1	2	3
Amelanchier alnifolia	2	1		
Prunus virginiana		3	5	5
Populus tremuloides	3	6	1	3
Acer grandidentatum	6	4	5	11
Rosa woodsei	1	2	1	
Cercocarpus ledifolius	2			
Physocarpus malvaceus	5	1		
Total (Low shrubs)	32	18	17	23
Delphinium occidentale	2	3	4	
Erigeron speciosus	2	2	2	3
Rumex crispus				1
Lactuca serriola	1	3	2	1
Geranium fremonti		3	11	1
Achillea lanulosa			6	1
Apocynum androsaefolium	1	3		
Scrophularia lanceolata			3	1
Senecio serra		4	10	3
Pteridium aquilium		2		
Melilotus alba		2		
Melilotus officinalis	1			

Table 1. continued

Species and growth form	Occurrence in plots by habitat type			
	Conifer (15)*	Maple-aspen (15)	Aspen (20)	Maple (20)
Rudbeckia occidentalis	1			
Smilacina racemosa	5	3	1	8
Wyethia amplexicaulis	2		1	
Agoseris glauca			2	
Chenopodium album	1	5	1	6
Chenopodium hybridum	1	2		1
Helianthella uniflora	2			
Osmorhiza chilensis	4	5	1	4
Aster engelmannia	3	7	1	4
Descuriana richardsoni		1	3	1
Hackelia patens			4	4
Alium bisceptrum			2	1
Agastache urticifolia		3	10	5
Vicia americana	3	5	10	4
Viola vallicola	8	2	4	2
Galium boreale	3		4	3
Total (Forbs)	40	55	82	54

*number of plots analysed in each type in parentheses

Table 2. Contingency table using total number of occurrences in the growth form groups from Table 1

Growth form	Habitat type				Total
	Conifer	Maple-Aspen	Maple	Aspen	
Grasses	3	18	16	23	60
Low shrubs	32	18	23	17	90
Forbs	40	55	54	82	231
TOTAL	75	91	93	122	381

$X^2 = 27.22^{**}$(6 d.f.)

** significant at 1 per cent level

Distribution of Grouse by Season

Drumming males in spring

Eng (1959) concluded that the male ruffed grouse usually selects an individual territory during the first fall and winter, and keeps it throughout life. Palmer (1956) stated that territorial males spend most of their time within a 0.25 mile radius. Within this home range is found the drumming site, which appears to be the focal point of the year-long activities of the individual male (Eng, 1959).

In 1964, 19 drumming sites were found in the study area. Male territories were found in all habitat types except conifers. A high density of one male per 7.9 acres occurred in the maple-aspen type (Table 3).

Table 3. Comparison of population density of male ruffed grouse in five habitat types during the spring of 1964

Habitat type	Acreage of type	Number of drumming sites	Acres of type per male
Maple	147	4	36.8
Aspen	117	8	14.6
Maple-aspen	55	7	7.9
Conifer	63	0	----
Sagebrush-grass	109	0	----

Edminster (1947) has pointed out that the male ruffed grouse selects a drumming log which has good escape cover close by. Heavy undergrowth of chokecherry, maple, and aspen reproduction was most prevalent in the maple-aspen and aspen types (Figures 6 and 7). These types, which composed only 45 per cent of the total area, contained 80 per cent of the drumming logs. The lack of shrub cover and suitable logs in the dense maple and conifer stands apparently was responsible for the low density of males in these areas.

Summer

Grouse were observed in all habitat types during the summer months of the study. The most flushes were made in the maple type followed by the aspen and maple-aspen (Table 4).

Table 4. Distribution of ruffed grouse observations within the habitat types of the Wellsville Canyon study area in the summers of 1963-64, including birds seen on and off transects

Habitat type	Number of single flush observations	Number of brood observations
Maple	42	17
Aspen	29	10
Maple-aspen	28	4
Conifer	5	1
Sagebrush-grass	0	1

Figure 6. A mixture of maple and aspen with a dense shrubby understory provided ideal habitat for drumming sites.

Figure 7. Mature aspen stands had the second highest density of male ruffed grouse. This was the state of vegetational development when drumming began. Snow was 12 inches deep 4 days before this photo was taken.

Table 5. A comparison of ruffed grouse flush-frequency along transects from June 22 to September 22, 1963 and 1964

Habitat type	Number of grouse*	Distance walked in miles	Grouse per mile
Maple	25	16.49	1.52
Aspen	17	22.81	0.75
Maple-aspen	7	9.77	0.71
Conifer	3	8.54	0.35
Sagebrush-grass**	--	----	----

* A brood flush was treated as a single grouse for this season.

** Transects were not walked through this type.

Winter

Snow began to accumulate in the study area the latter part of November. It reached a maximum depth of 4-5 feet in March (Figure 2). In November tracks and roosts indicated that grouse were present in all habitat types. By early January nearly all the fall food items were covered with snow. The only remaining source of food was the buds and twig tips of chokecherry, maple, willow, and serviceberry (Amelanchier alnifolia) which protruded above the snow.

As the snow increased in depth, there appeared to be a shift of the grouse that once occupied the dense maple stands to the more open aspen and maple-aspen edges. On the winter transects grouse were flushed most frequently in aspen followed by the maple-aspen and conifer types (Table 6). No grouse were seen in the maple type. This movement may

Figure 8. Edge along dense maple stand was used on several occasions by ruffed grouse broods.

have been due to a shortage of food in the maple stands (Figure 9). A much more abundant food supply was available in the aspen and maple-aspen types (Figure 10). Chokecherry, aspen, and maple reproduction were abundant in these areas. Sign indicated that the buds and twig tips of these species were utilized as food throughout the winter (Figure 11).

Marshall (1946), Hungerford (1953), and Edminster (1947) all found heavy use of coniferous cover by grouse during the winter months. The lack of sign and few flushes indicated that this type received little use in this study area (Table 7).

During most of the winter, snow roosting was a common practice (Figure 12). Grouse were flushed singly from roosts and in groups ranging from two to six. They were observed to roost most frequently in woodland, but some roosting occurred in the sagebrush adjacent to this area.

As the snow began to melt and crust daily in late March and early April, snow roosting ceased. Sign indicated that grouse were roosting in trees and on the ground at the base of trees during this period. Two grouse were seen in the sagebrush-grass type as this area became bare of snow in late April. I presumed they were feeding on the young green vegetation which was emerging in these areas. A noticeable change in the texture and color of the droppings also indicated that grouse were feeding on the young vegetation which was only available in the sage-brush-grass type.

Table 6. Distribution of ruffed grouse observations within habitat types from November 24, 1963 to April 15, 1964, including birds seen on and off transects

Habitat type	Number of grouse
Maple	7
Aspen	41
Maple-aspen	22
Conifer	2
Sagebrush-grass	4

Table 7. A comparison of ruffed grouse flush-frequency along transects from November 24, 1963 to April 15, 1964

Habitat type	Number of grouse	Distance walked in miles	Grouse per mile
Maple	0	9.40	----
Aspen	17	13.55	1.25
Maple-aspen	7	6.04	1.16
Conifer	1	5.41	0.18
Sagebrush-grass*	--	----	----

* Transects were not walked through this type

Figure 9. Lack of desirable woody reproduction was apparent in the maple type. Areas like this received little use by grouse during the winter months.

Figure 10. An abundant food supply consisting of chokecherry, maple, aspen and serviceberry reproduction was available in aspen stands during the winter months. Note grouse trail in snow.

Drumming Activity

Hungerford (1953) reported the first drumming in northern Idaho in late February. April 15 was given as the first drumming date by Eng (1959) in northern Minnesota.

Petraborg (1953) stated that the appearance of warm, bare ground stimulates the start of drumming more than any other factor. Data on drumming activity in the Logan area also showed this relationship in the spring of 1964. The following first drumming dates for the Logan area were obtained by personal communications: Malibu Lodge in Logan Canyon, April 28 (Raymond Stephanski) and Mud Flat Ranger Station, May 12 (Robert Sutherland). These individuals were present in the respective areas during the early morning hours prior to the first drumming date. In the Wellsville Canyon study area it was noted that grouse began roosting on logs as early as April 15, yet no drumming was heard until May 11. In all of the above cases, areas bare of snow were just appearing when the first drumming began. It is not known how these dates would compare with other years. Perhaps in years with an early spring, drumming would commence earlier. It is also possible that because this area is at a higher elevation than other parts of ruffed grouse range, these drumming dates may be normal.

Drumming peak

The number of drummings and the average number of drummings per grouse heard at the listening station in the study area are shown in Figures 13 and 14. It is difficult to ascertain the peak of drumming

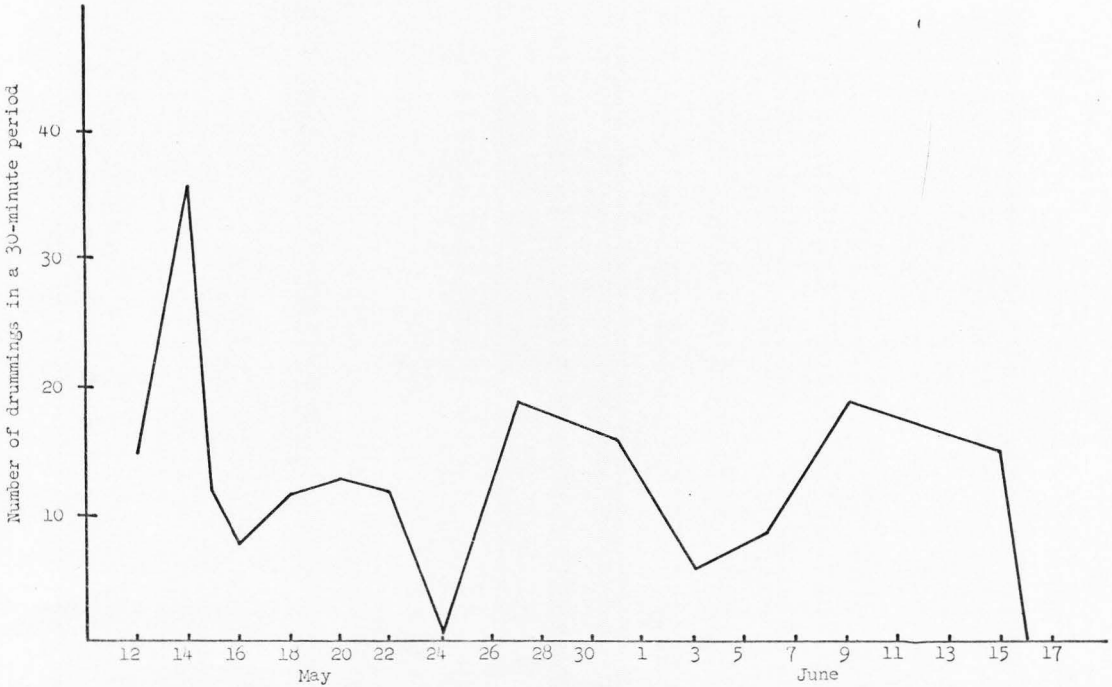

Figure 13. The total number of drummings heard at the listening station on drumming count days

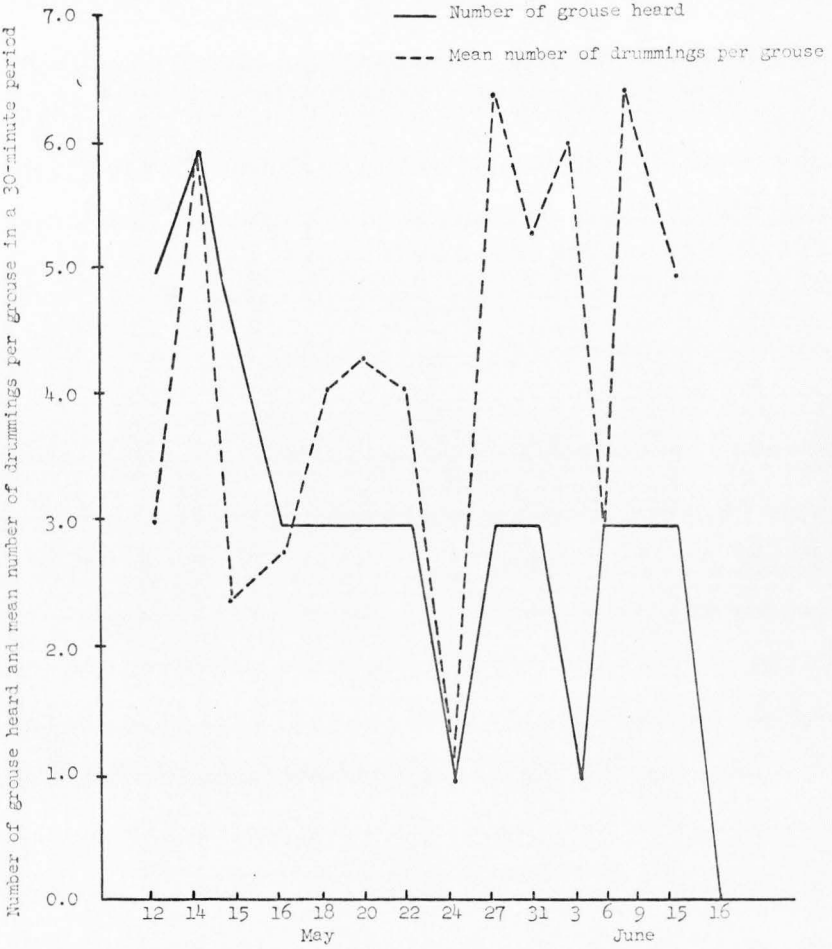

Figure 14. Number of grouse heard and mean number of drummings per grouse on drumming count days

from these data because they fluctuated so widely. The maximum number of drummings was heard on May 14, 3 days after drumming began. Six individual males were heard at this time. From this date on, the number of males drumming decreased (Figure 14).

Throughout the drumming season, drumming was sporadic and of low intensity. Possibly this was caused by the late spring. Most males showed little sign of attachment to a specific log. Some logs used by a single male were 100 yards apart. No grouse were known to use a single log. It may be typical of the grouse in this area to use several logs because of their abundance.

The lack of response to mirror traps also suggested low sexual activity. Some males were known to drum beside the trap, yet did not go in. The males that were caught were those which used the fewest logs and drummed the most actively.

The presence of "silent cocks" (Dorney et al., 1958) in the population may be an explanation why the number of drumming males dropped from six to three (Figure 14). Silent cocks are those males which drum only occasionally or do not drum at all. Males occupying sites 23 and 24 (Figure 15) apparently were silent cocks. These birds drummed actively from May 11 to May 16. However, after May 16, the male at site 24 was not heard again and the male at site 23 was heard only once.

Dorney and Kabat (1960) stated that approximately one-third of the juvenile male population were silent cocks. Such birds existed in the Wellsville Canyon area, but I could not make an estimate of what fraction of the population they represented.

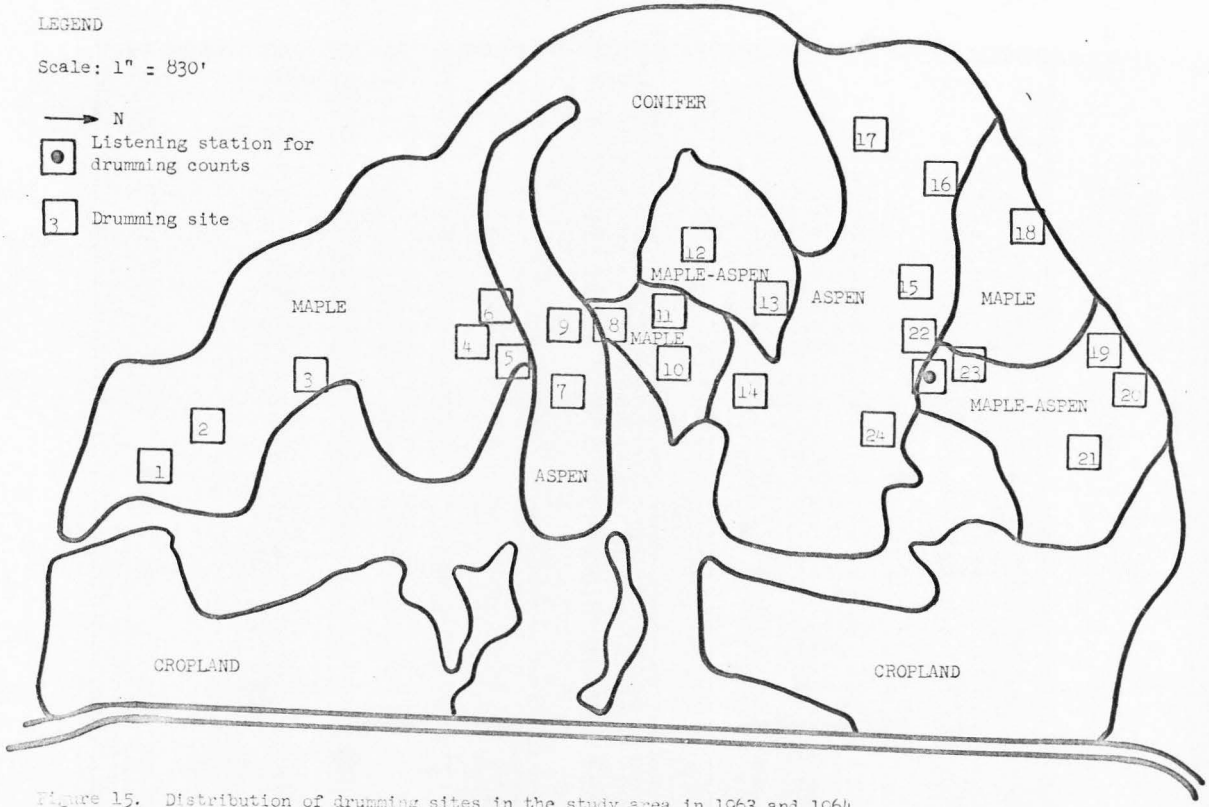

Figure 15. Distribution of drumming sites in the study area in 1963 and 1964

Subjectively, I would say that the most intensive drumming occurred between May 12 and May 18. During this period, drumming could be heard throughout the day. After this time, practically all drumming was confined to a short period before and after sunrise.

A possible explanation for the peak of drumming coming immediately after this activity began is that gonadal development may have been at its maximum much before weather conditions were suitable for drumming. Hence, when conditions were suitable, drumming started actively and rapidly tapered off.

Hungerford (1953) associated the peak of drumming in Idaho with the anthesis stage of willow (Salix scouleriana) catkin development. There were few willows in the study area, so this event could not be used as an indicator.

Two phenological events which were associated with the peak of drumming were the beginning of external leaf growth on aspen and choke-cherry trees and an abundance of flowering dog-tooth violets (Erythronium grandiflorum) throughout the area. Possibly these events could be used as indicators, but several years data would be needed to show their accuracy.

Factors affecting drumming

No definite relationship was observed between cloud cover, temperature, relative humidity and drumming activity. Temperatures varied from 38 to 54 degrees and relative humidity from 57 to 100 per cent

(Table 8). The most active drumming was heard on days with temperatures between 41 and 44 degrees, and with relative humidity readings between 82 and 100 per cent.

No drumming was heard when it was raining and sleeting. One day during the spring of 1963, an approaching storm seemed to be a stimulus for drumming in midmorning.

It appeared that the most active drumming was during the period just before and after sunrise. As the season progressed, the time of active drumming after sunrise was shortened.

The loud noise from a diesel tractor working in the cropland below the study area seemed to stop drumming on a morning when the birds had been active prior to this noise.

Table 8. Ruffed grouse drumming data and associated weather conditions in the spring of 1964

Date	Condition	Temperature	Relative humidity	No. of drums	No. of grouse heard	Avg. no. of drummings/ grouse	% of available grouse heard
5-12-64	Excellent	38	70	15	5	3.0	83.33
5-14-64	Excellent	44	82	36	6	6.0	100.00
5-15-64	Excellent	42	91	12	5	2.4	83.33
5-16-64	Excellent	47	67	8	3	2.7	50.00
5-18-64	Excellent	37	100	12*	3	4.0	50.00
5-20-64	Good (slight wind)	54	57	13	3	4.3	50.00
5-22-64	Fair	47	84	12	3	4.0	50.00
5-24-64	Excellent	42	84	1	1	1.0	16.66
5-27-64	Excellent	44	100	19	3	6.3	50.00
5-31-64	Excellent	40	100	16	3	5.3	50.00
6-3-64	Excellent	44	100	6	1	6.0	16.66
6-6-64	Excellent	47	100	9	3	3.0	50.00
6-9-64	Fair	41	100	19	3	6.3	50.00
6-15-64	Excellent	46	100	15	3	5.0	50.00
6-16-64	Fair	45	100	0	0	---	-----

* one potential drummer was in a trap

Characteristics of Drumming Logs

Species, type of log used, and location of drumming position

All drumming logs located in the study area were aspen, the most abundant tree in the area. Chokecherry, maple, and Douglas-fir logs were available but not used. Rock outcroppings were also present, but were not utilized as drumming sites. A rock that was being used as a drumming site was observed in Logan Canyon. There was a shortage of logs at this location. This was not the case in the study area, where fallen logs were abundant.

Males preferred old, partially decayed logs to those which were freshly fallen (Figure 16). Stages of decay ranged from rotten "pulpy" logs to those which showed no sign of decay.

The birds invariably drummed near the largest end of the log. The distance from the butt end of the log to the drumming position averaged 3.5 feet.

Log dimensions

Log width ranged from 6 to 13 inches with a mean of 9.5 inches. Height of the log varied from 4 to 23 inches with a mean of 9.7 inches and length ranged from 10 to 46 feet and averaged 30.4 feet (Figure 18).

Palmer (1961) stated that the probability of log use increases directly with log size. A comparison of drumming log dimensions with those of non-drumming logs in the study area showed drumming logs to be larger (Table 9).

Log direction

Azimuth readings were recorded to determine whether grouse preferred logs lying in a particular direction. Forty-four per cent of the logs fell in a northwest to southeast direction, 25 per cent in a southwest to northeast position and 25 per cent in a southeast to northwest direction. The remaining 6 per cent were in a northeast to southwest direction. Data on non-drumming logs showed the same general pattern indicating this is the way logs fall in the area, rather than selectivity by the grouse.

Stand density

Another possible factor influencing the selection of a drumming log is stand density around the log. Although the one sampling point taken at each drumming log would not provide adequate data for determining composition of the stand, it did provide comparative information concerning tree densities around logs.

Stand densities around logs showed considerable variation. Aspen densities ranged from 75 to 1,210 trees per acre while maple varied from 15 to 2,722 trees per acre. The average density considering both species together was 673 trees per acre. This was significantly greater than the average density of 273 trees per acre for non-drumming logs (Table 9). Thirty-one per cent of the drumming logs had below-average tree densities. Figure 17 shows a typical drumming log with dense woody species around it.

Canopy cover

Canopy cover over the drumming position ranged from 0 to 98 per cent with an average of 62 per cent. Sixty per cent of the 32 drumming logs had above-average overhead cover.

Overhead cover was frequently in the form of an over hanging bough of a tree or from near by shrub cover. Several logs were located in a clump of maple or chokecherry.

The importance of canopy cover was demonstrated by a male grouse which used two drumming logs, one which yielded almost complete protection from above and the other which had some visible open area above it. After placing a mirror trap on the log with the most canopy cover, the male moved to his auxillary log and was subsequently removed from the population by an avian predator.

Table 9. A comparison of the characteristics of drumming logs with non-drumming logs

Log characteristic	Drumming log mean	Non-drumming log mean	t value
Length	30.4 feet	30.6 feet	0.11 (n.s.)
Vertical diameter	9.5 inches	7.6 inches	4.31**
Horizontal diameter	9.7 inches	7.5 inches	6.69**
Stand density	673.0 trees per acre	273.0 trees per acre	4.08**

*significant at the 1 per cent level

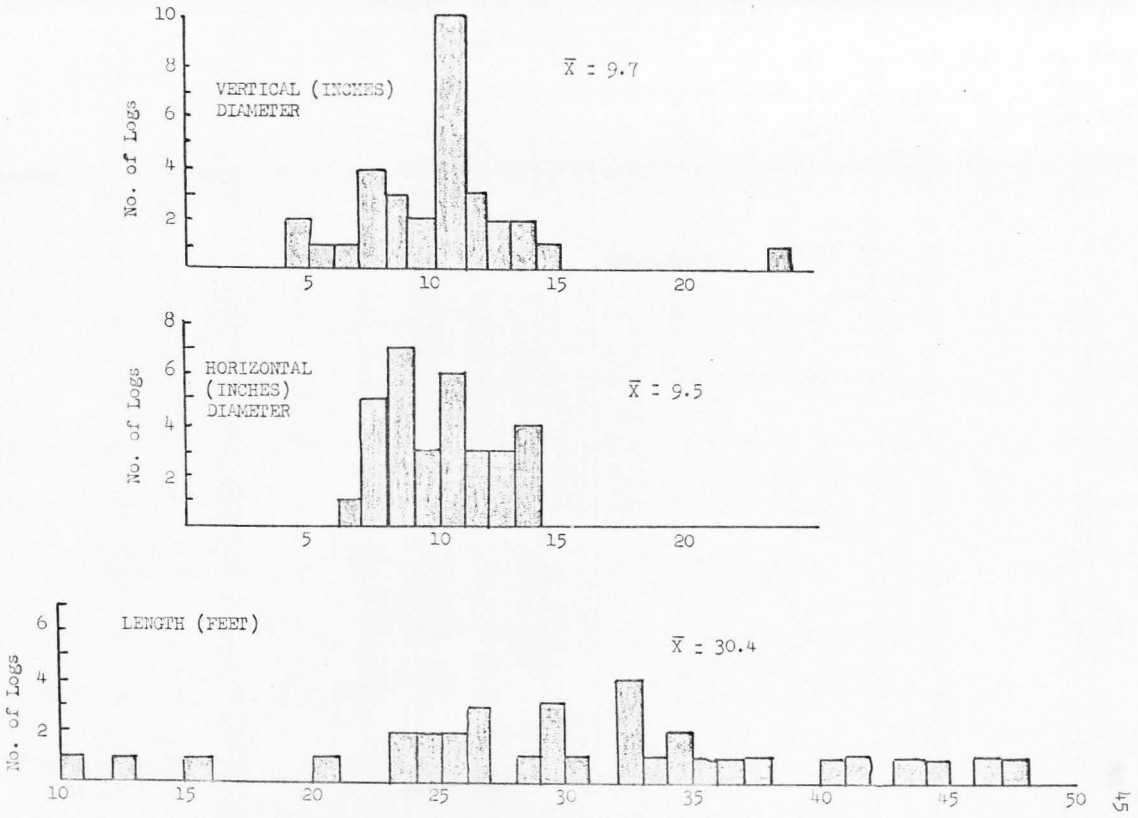

Figure 18. Plotted frequency distribution of width, height, and length of 32 ruffed grouse drumming logs in the Wellsville Canyon study area

Food Habits

Previous investigations on the food habits of gallinaceous game birds have shown their diets to be extremely varied from one region to another. This fact is undoubtedly true of the ruffed grouse because of their wide distribution.

Gilfillan and Bezdek (1944) in Ohio, Brown (1946) in Maine, and Marshall (1946) in Idaho have reported ruffed grouse food habits. The findings of each of these studies vary considerably because of geographic differences in plant distribution and abundance. In general, grouse feed on the fruits and leaves of numerous forbs and shrubs in the fall, and on dried fruits and buds during the winter.

Fall

Data were derived from 41 crops collected in September and October in northern Utah. Eight of these were from the study area. The remaining 33 were from other areas in the Cache National Forest.

Aspen leaves proved to be the most important item in the fall diet, followed by rose hips (Rosa woodsei) and the fruit of meadow rue (Thalictrum fendleri). Numerous other food items occurred in the crops, but were not as abundant or frequent (Table 10).

Winter

Five crops were collected during the winter in areas adjacent to the study area. The buds and twig tips of aspen and chokecherry were the only items present in the crops (Table 11). Aspen far exceeded chokecherry in per cent volume because one crop was full of swollen aspen buds. Both species were present in each crop.

Table 10. Food items in 41 ruffed grouse crops collected during the 1962-64 hunting seasons in northern Utah

Food Items	Parts utilized	Per cent of total volume	Per cent occurrence
PLANT FOOD			
Thalictrum fendleri	fruit	12.4	22.0
Prunus virginiana	fruit	7.1	6.5
Populus tremuloides	leaves	23.0	30.4
Amalanchier spp.	fruit	3.0	12.2
Rosa woodsei	fruit	28.4	14.6
Hieracium spp.	leaves	trace	2.4
Lactuca scariola	leaves, fruit	1.0	12.2
Cercocarpus spp.	leaves	5.0	2.4
Smilacina racemosa	fruit	trace	4.9
Symphoricarpos spp.	leaves, fruit	3.0	7.3
Actaea arguta	fruit	3.0	4.9
Aquilegia spp.	leaves	2.0	2.4
Medicago spp.	leaves	4.0	7.3
Sambucus spp.	fruit	2.0	4.9
Sorbus scopulina	fruit	trace	2.4
Agoseris spp.	leaves	trace	2.4
Unidentified leaves		6,0	9.8
Unidentified seeds		trace	4.9
ANIMAL FOOD			
Ants (Hymenoptera)		trace	4.9
Wasp (Hymenoptera)		trace	2.4
Beetles (Coleoptera)		trace	2.4
TOTAL		100.0	

Table 11. Food items in five ruffed grouse crops collected in Wellsville Canyon in February and March, 1964

Food Items	Parts utilized	Per cent of total volume	Per cent occurrence
Populus tremuloides	buds, twig tips	85.4	100.0
Prunus virginiana	buds, twig tips	14.6	100.0
TOTAL		100.0	

In a food-preference study chokecherry was the most preferred food item, followed by aspen and maple (Table 12). Willow and serviceberry also proved to be desirable foods, but were not considered important because of their low density.

Data from the preference study came from birds on the study area which were feeding on woody reproduction just above the snow level. Some grouse fed in trees as shown by the presence of swollen aspen buds in one crop. These enlarged buds were only available in large aspen trees, far above the reach of a grouse at snow level. Both sets of data (Tables 11 and 12) show the importance of chokecherry and aspen as winter foods. A larger sample of crops would be needed to show which species was the most important.

Table 12. Winter food preference of ruffed grouse in 62 sample plots in Wellsville Canyon

Species	Per cent frequency (A)	Per cent of plots in which species was utilized (B)	Preference rating (B/A)
Chokecherry	92	87	0.95
Aspen	42	31	0.74
Maple	87	21	0.21
Serviceberry	11	10	0.91
Willow	3	3	1.00

DISCUSSION AND RECOMMENDATIONS

The climax vegetation of the study area is a mixture of maple and aspen with each species dominating localized areas. Interspersion of aspen draws between maple ridges is the typical vegetation pattern on the Wellsville Range. Maple appears to be increasing slightly, with limited aspen reproduction.

A drumming site count in the spring of 1964 revealed a breeding season density of one grouse per 10 acres of woodland habitat. This was assuming a total count of the male segment of the population and an equal sex ratio. Bump et al. (1947) gave a spring density of one grouse per 13.5 acres as a 10-year average for the Connecticut Hill study area in New York. The highest spring density recorded is one grouse per 4 acres in northern Michigan (Palmer, 1954).

No estimates of spring density were made outside the study area. However, winter observations indicated that grouse were present in good numbers in areas near the study area. I would speculate that there are good grouse populations throughout the Wellsville Range.

One major factor influencing the differences between the vegetation of the Wellsville Range and the Bear River Range, east of Logan, is grazing. Understory vegetation is much more dense on the Wellsville Range which has received little grazing in the past 20 years. This thicker cover undoubtedly provides better habitat than heavily grazed

areas of the Cache National Forest. Future research on the habitat requirements of the ruffed grouse may answer the question of how grazing effects grouse density and distribution.

Although breeding season densities appeared to be high in 1963 and 1964, reproductive success was low. Few broods were found in either years of the study and average brood sizes were small. Ten broods averaged 4.0 young with a standard deviation of 1.6 in 1963 and 9 broods in 1964 averaged 3.4 young with a standard deviation of 1.5. The reasons for poor reproduction are not known. Numerous rains and low temperatures during the nesting and hatching season may have had detrimental effects. Predation may also have seriously limited reproduction and survival of grouse. Several species of hawks and owls were found on the study area. Nine predator kills found in the course of the study were attributed to avian predators. Possible mammalian predators were bobcats (Lynx rufus), coyotes (Canis latrans), and weasels (Mustela spp.).

Because the ruffed grouse is found in such remote and rugged areas, censusing is difficult. The only previous method used by the Utah Department of Fish and Game has been the roadside brood count made by conservation officers. It is doubtful if brood counts alone are sufficient to support management recommendations. I recommend that a spring drumming count also be used to determine trend in grouse populations. These counts could feasibly be made in such areas as Logan Canyon, Cowley Canyon, Wellsville Canyon, Mud Flat, and other readily accessible locations.

Carefully selected listening stations would eliminate the noise problem caused by the river and road traffic. The drumming count has proved to be an efficient census method in other states (Dorney, 1958; Ammann et al., 1963) and I feel sure it could be effectively used in Utah.

As the ruffed grouse gains importance as a recreational resource in Utah, habitat improvement might be feasible on a limited basis. The drumming log data indicated that male grouse choose a log with particular characteristics. It would be possible to manage forests so that suitable logs are available for drumming sites.

The dense cover of the Wellsville Range provides desirable habitat for ruffed grouse, but makes them extremely difficult to find and shoot. The construction of fire lanes at 300 yard intervals and seeding them with clover would make grouse more available to hunters and possibly increase the harvest.

Blue grouse (Dendrapagus obscurus) also inhabited the same range as ruffed grouse in Wellsville Canyon, although their numbers were fewer. Male blue grouse were heard hooting in the same general area as ruffed grouse were drumming. One brood of blue grouse was seen in the study area on four occasions. Blue grouse used the sagebrush-grass areas much more than ruffed grouse. During the winter no blue grouse were seen on the study area. They had presumably moved to the higher elevations.

The main limitation of this study was the great amount of interspersion of habitat types in the study area. This most likely raised the carrying capacity of the range, and also gave a bird the opportunity of being

present in several types within a short period of time. Many flushes in a particular type may have occurred by chance and therefore are of limited significance regarding habitat use.

Undoubtedly the vegetative features of the habitat types which were measured, somehow affected the density and distribution of grouse in the study area. It is difficult to say how characteristics of the vegetation affect its use by grouse. A combination of factors are probably responsible for a bird's choice of a specific habitat.

SUMMARY

A study of the seasonal habits and habitat of the ruffed grouse was conducted in Wellsville Canyon, 15 miles southwest of Logan, Utah.

Information was presented on the vegetative characteristics of four habitat types, seasonal distribution of grouse, drumming activity, physical features of drumming logs, and food habits.

Significant differences in species composition, per cent bare ground, and canopy cover were found between the habitat types.

Maple-aspen and aspen cover types were the most desirable habitats for drumming males. Transect data and general observations indicated that the pure maple type was most frequently used during the summer months. Grouse utilized the aspen and maple-aspen types during the winter, apparently because of the abundant food supply.

The first drumming was associated with the appearance of warm bare ground. The peak of drumming occurred between May 12 and May 18. Weather conditions had little effect on drumming activity.

All drumming logs were aspen. The average diameter of these logs was 9.6 inches. Stand densities around logs showed considerable variation as did canopy cover above the drumming position. Non-drumming logs had smaller diameters and less dense stands around the logs. Photos were included of typical locations of drumming sites.

Data on food habits came from crops collected in the Cache National Forest during the 1962-64 hunting season and from crops obtained from birds collected near the study area during the winter of 1964. The most

important fall food items were aspen leaves, rose hips, and the fruit of meadow rue. Winter food items consisted of buds and twig tips of aspen and chokecherry.

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APPENDIX

Table 13. List of plant species observed on the study area

Scientific name	Common name
Grasses	
Agropyron elongatum	Tall wheatgrass
A. subsecundum	Bearded wheatgrass
A. trachycaulum	Slender wheatgrass
Bromus commutatus	Hairy chess brome
B. polyanthrus	Mountain brome
B. tectorum	Cheatgrass brome
Elymus cinereus	Great Basin wildrye
E. glaucus	Blue wildrye
Hordeum jubatum	Foxtail barley
Melica bulbosa	Oniongrass
Phleum pratense	Timothy
Poa bulbosa	Bulbous bluegrass
P. pratensis	Kentucky bluegrass
P. secunda	Sandberg bluegrass
Carex spp.	Sedge
Forbs	
Achillea lanulosa	Western yarrow
Agastache urticifolia	Horsemint
Agoseris glauca	Mountain dandelion
Allium bisceptrum	Wild onion
A. campanulatum	Wild onion
Ambrosia psilostachya	Western ragweed
Apocynum androsaefolium	Dogbane
Arabis glabra	Rockcress
Artemisia ludoviciana	Louisiana sagebrush
Aster chilensis	Aster
A. engelmanni	Engelmann aster
Astragalus spp.	Locoweed
Balsamorhiza macrophylla	Cutleaf balsamroot
B. sagittata	Arrowleaf balsamroot
Brodiaea douglassi	Wild hyancinth
Brassica nigra	Black mustard
Castilleja linariaefolia	Wyoming paintbrush
Chenopodium album	Lamb's quarters
C. hybridum	Goosefoot
Circaea pacifica	Enchanter's nightshade
Circium spp.	Thistle
Chlorocrambe hastata	Chlorocrambe

Table 13. continued

Scientific name	Common name
Claytonia lanceolata	Lanceleaf springbeauty
Collomia tenella	Collomia
Comandra pallida	Common comandra
Convolvulus arvensis	Wild morning glory
Crepis acuminata	Tapertip hawksbeard
Delphinium nelsoni	Low larkspur
D. occidentale	Duncecap larkspur
Descurainia richardsoni	Western tasymustard
Epilobium augustifolium	Fireweed
E. paniculatum	Willow weed
Erigeron speciosus	Aspen fleabane
Eriogonum umbellatum	Eriogonum
Erysimum wheeleri	Wall flower
Erythronium grandiflorum	Troutlily
Fritillaria atropurpurea	Purplespot fritillary
F. pudica	Yellow fritillary
Galium boreale	Northern bedstraw
Geranium fremonti	Geranium
G. richardsoni	Richardson geranium
Gilia aggregata	Skyrocket gilia
Grindelia squarrosa	Curlycup gumweed
Hackelia floribunda	Large stickweed
H. patens	Stickweed
Helianthella uniflora	One-flower helianthella
Helianthus annuus	Sunflower
Heracleum lanatum	Cowparsnip
Hydrophyllum capitatum	Ballhead waterleaf
Lactuca serriola	Prickly lettuce
Lathrus pauciflorus	Utah peavine
Leonurus cardiaca	Motherwort
Linum lewisii	Lewis flax
Lithospermum ruderale	Wayside gromwell
Lupinus sericeus	Lupine
Madia glomerata	Cluster tarweed
Medicago sativa	Alfalfa
Melilotus alba	White sweetclover
M. officinalis	Yellow sweetclover
Orogenia linearifolia	Indian potato
Osmorhiza chilensis	Sweet cicely
O. occidentalis	Sweet cicely
Penstemon cyananthus	Wasatch penstemon

Table 13. continued

Scientific name	Common name
Perideridia gairdneri	Yampa
Potentilla pectinisecta	Cinquefoil
Pteridium aquilinum	Western bracken
Ranunculus jovis	Buttercup
Rudbeckia occidentalis	Niggerhead
Rumex crispus	Curly dock
Scrophularia lanceolata	Western figwort
Sedum debile	Stonecrop
Senecio integerrimus	Lambstongue groundsel
S. serra	Buttercup groundsel
Sisymbrium altissimum	Tumble mustard
Smilacina racemosa	False Solomon's seal
S. stellata	False Solomon's seal
Solidago missouriensis	Goldenrod
Taraxacum officinale	Common dandelion
Tragopogon dubius	Salisfy
Urtica gracilis	Stringing nettle
Valeriana occidentalis	Western valerian
Verbascum thapsus	Flannel mullen
Vicia americana	American vetch
Viguiera multiflora	Showy goldeneye
Viola vallicola	Yellow violet
Wyethia amplexicaulis	Mulesear wyenthia
Trees and Shrubs	
Acer grandidentatum	Bigtooth maple
Amelanchier alnifolia	Saskatoon serviceberry
Artemisia tridentata	Big sagebrush
Berberis repens	Oregon grape
Ceanothus velutinus	Snowbrush ceanothus
Cercocarpus ledifolius	Curleaf mountain mahogany
Chrysothamnus nauseosus	Rubber rabbitbrush
Juniperus spp.	Juniper
Physocarpus malvaceus	Mallow ninebark
Prunus virginiana	Chokecherry
Pseudotsuga menziesii	Douglas-fir
Rosa woodsei	Wood rose
Rubus parviflorus	Thimble berry
Salix scouleriana	Scouler willow

Table 13. continued

Scientific name	Common name
Sambucus glauca	Blueberry elder
Symphoricarpos oreophilus	Mountain snowberry

* Most plants were identified by Professor Arthur H. Holmgren, Curator, Intermountain Herbarium, Utah State University. Other sources of identification were Handbook of Vascular Plants of the Northern Wasatch and the Forest Service, Region 4, Checklist of Standard Plant Names

Table 14. Individual comparisons of growth form and habitat type

Comparison	X^2 value (1 d. f.)
Maple-aspen and maple	0.28
Maple-aspen and aspen	1.47
Maple-aspen and conifer	15.60**
Maple and conifer	10.61**
Maple and aspen	4.09*
Aspen and conifer	24.48

* significant at the 5 per cent level.

** significant at the 1 per cent level

Table 15. Analysis of variance table of per cent bare ground in four habitat types

Source of variation	Degrees of freedom	Mean squares	F test value
Habitat types	3	3691.2	11.63**
Sites/types	10	317.4	
Quadrats/sites	56	273.4	

** significant at the 1 per cent level

Table 16. Pertinent information for six planned comparisons of per cent bare ground in four habitat types

Comparison	Mean squares	F test value
Maple and conifer	2,550.5	8.04*
Maple and maple-aspen	519.2	1.63
Maple and aspen	2,859.8	9.01**
Maple-aspen and aspen	5,226.8	16.49**
Maple-aspen and conifer	673.6	2.12
Conifer and aspen	10,004.8	31.52**

* significant at the 5 per cent level.

** significant at the 1 per cent level.

Table 17. Analysis of variance table of per cent canopy cover in four habitat types

Source of variation	Degrees of freedom	Mean squares	F test values
Habitat types	3	5,279.9	10.59**
Sites/types	10	498.3	
Quadrats/sites	56	464.8	

** significant at the 1 per cent level.

Table 18. Pertinent information for six planned comparisons of per cent canopy cover in four habitat types

Comparison	Mean squares	F test value
Maple and conifer	848.0	1.70
Maple and maple-aspen	713.6	1.43
Maple and aspen	14,321.7	28.74**
Maple-aspen and aspen	12,286.5	24.66**
Maple-aspen and conifer	48.7	.10
Conifer and aspen	6,678.3	13.40**

** significant at the 1 per cent level.

Table 19. Analysis of variance of the average height of understory vegetation in four habitat types

Source of variation	Degrees of freedom	Mean squares	F test values
Habitat types	3	342.2	3.31 (n.s.)
Sites/types	10	103.3	
Quadrats/sites	56	46.2	