

THE RELATIONSHIP OF SAGE GROUSE TO UPLAND MEADOWS IN NEVADA

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Abstract: Meadow utilization by sage grouse was studied for two summers at three locations in Nevada. The principal methods used included observation and collection of birds and vegetational description of the meadow and surrounding sagebrush vegetation types. Movements to the meadow areas were apparently stimulated by the dessication of vegetation in the sagebrush types. Meadows were used almost exclusively by hens and young birds with only a few cocks being observed in the drier of two summers studied. A pattern of use was evident while the birds were on the meadows. Variations in use, however, occurred with varying climatological conditions. Segregation of cocks, hens with chicks and hens without chicks was evident, but the degree of segregation was also dependent upon climatological conditions. Hens and chicks, however, would congregate only at those portions of meadows having some meadow vegetation. Bare portions of the meadows or water sources lacking the desired vegetation would be ignored by this group. Food habits of the various ages and sexes of birds showed a high preference for certain species of succulent forbs by young birds and hens. The meadow, as a sole source of the desired food species became a necessity to these groups. Consumption of forbs decreased with age in the young birds and by fall with the older birds. Movement away from the meadows was associated with the decreasing temperatures and precipitation of fall.

INTRODUCTION

The sage grouse, Centrocercus urophasianus (Bonaparte), has declined from a position as one of the most abundant game birds in the Western United States to where, in many areas, its preservation is a matter of serious concern. Many factors influenced the decline, but probably the greatest is the elimination of their habitat (Patterson 1952, The Sage Grouse in Wyoming). A number of biological and ecological investigations of sage grouse have been made, however, until recently little work has been done to determine the

influence of past and present land management practices on this species. One segment of the bird's habitat, the upland meadow, has been studied only in passing, and never studied in detail. Observations by Nevada Fish and Game Commission personnel show a high use of meadows by sage grouse during the summer months. Annual field survey records show a gradual decline of sage grouse populations in areas where meadows have deteriorated or been completely eliminated. This situation indicates that meadows could play a vital role in sage grouse survival.

The objective of this study is to determine the relation of sage grouse populations to upland meadows and meadow conditions.

To accomplish this objective five meadow complexes in Northern and North-Central Nevada were studied (Figure 1). Each meadow depicts a different stage of meadow condition. Vegetation frequency and composition were obtained on each of several distinct portions of each meadow complex. Sage grouse were collected on a monthly basis during the period of meadow occupancy. Crops and gizzards were analyzed to obtain the quantitative composition of species consumed. Data on daily and seasonal sage grouse use on the meadows were obtained through observation.

The results of this study are intended to provide a more thorough understanding of the importance of meadows for sage grouse and help in future habitat management plans.

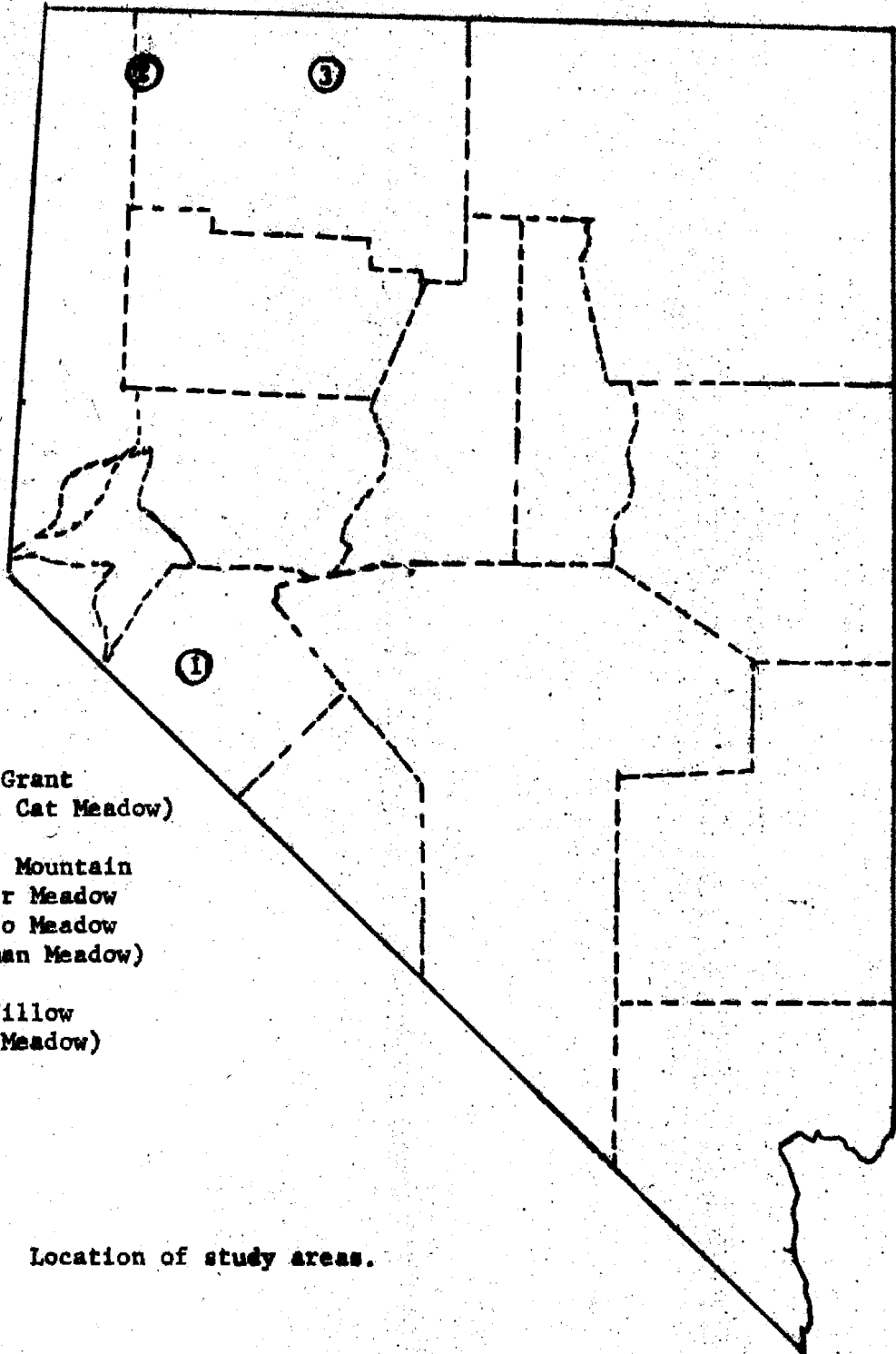
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FINDINGS

I. Vegetation Analysis

Three vegetation types (low sagebrush, big sagebrush, and meadow) were described in each of three study areas.

Low sagebrush. Artemisia arbuscula was the most frequent shrub at all areas. Other shrubs occurred but were unimportant. A large number of forbs occurred at all locations. Those of most importance at Mount Grant were Agoseris glauca, Aster scopulorum, Erigeron concinus, Eriogonum microthecum and Pllox stansburyi. Most frequent at Badger Mountain were Erigeron bloomeri, E. microthecum, P. stansburyi and



1. Mount Grant
(North Cat Meadow)
2. Badger Mountain
(Bitner Meadow
Rodero Meadow
Bateman Meadow)
3. Lone Willow
(Long Meadow)

Figure 1. Location of study areas.

Trifolium gymnocarpon. At Lone Willow seven forbs were frequent (A. glauca, Allium acuminatum, Astragalus sp., E. bloomeri, Phlox douglasii, P. stansburyi, and Senecio canus). Poa secunda and Sitanion hystrix were the most frequent grasses in all areas.

Big sagebrush. Artemisia tridentata was the most frequent shrub at Mount Grant. At Badger Mountain and Lone Willow, both A. tridentata and Chrysothamnus viscidiflorus were of importance. Many forbs were present at Mount Grant but only two, Agoseris glauca and Phlox stansburyi, occurred with significant frequency. Those of most importance at Badger Mountain were P. stansburyi, Trifolium gymnocarpon, Fritillaria pudica and Eriogonum umbellatum. P. stansburyi along with Arenaria kingii, Balsamorhiza hookeri, Lupinus sp., Senecio canus and T. gymnocarpon were the most frequent forbs at Lone Willow. The grasses Sitanion hystrix, Stipa thurberiana and Poa secunda were frequent at all areas.

Meadows. The vegetation of the five study meadows varied. At North Cat Creek (Mt. Grant) six species occurred with high frequency (Juncus balticus, Trifolium sp., Taraxacum officinale, Achillea lanulosa, Agoseris glauca and Carex sp.). J. balticus, Carex sp., T. officinale, A. glauca, Potentilla nutallii, Senecio integerrimus, Hordeum brachyantherum, Poa nevadensis and Scirpus olneyi were of importance at Bitner Meadow (Badger Mt.). At Rodero Meadow (Badger Mt.) only one forb, T. officinale, was frequent. Bateman Meadow (Badger Mt.) lacked any frequent occurring forbs. Numerous species occurred at Long Meadow (Lone Willow). The most important were A. lanulosa, Iris missouriensis, T. officinale, Trifolium sp., Agropyron trachycalum, Carex sp., H. brachyantherum, P. nevadensis and Sitanion hystrix. Shrubs were of little importance except for invasions of Artemisia cana at Bitner Meadow and Artemisia tridentata at Long Meadow. Total vegetative compositions at the meadows were 37.6% (North Cat Creek), 39.0% (Bitner), 37.5% (Rodero), 12.5% (Bateman) and 20% (Long). Abundant water was present at North Cat, Bitner and Bateman meadows but became limited at Rodero and Long meadows towards the end of the summer.

II. Late spring and early summer distribution

Prior to the movement of sage grouse to the meadows, they were found associated with the sagebrush vegetation. Hens without chicks occupied low sagebrush flats having scattered islands of big sagebrush. The adult males also occupied the low sagebrush type. These two groups were segregated. Hens with broods occupied the big sagebrush type with plants 20 to 30 inches tall. The author believes that this height sagebrush, with a fair abundance of forbs in the understory is the primary nest and

brood habitat type of Northwestern Nevada.

III. Period of meadow occupancy

Movement to the meadows appears to be stimulated by the desiccation of the vegetation in the sagebrush type and the consequent water stress placed on the birds. These factors are associated with an increase in summer temperatures and the amount of late spring-early summer precipitation. The need for succulent vegetation and water leads to the congregation of birds around the meadow areas.

Movements to the meadows closely follow drainages once occupied by a meadow type vegetation and suggesting that these areas are migration routes to the meadow areas. The few remaining succulent forbs present in the sagebrush are found in these lower drainages.

Once on the meadows a definite pattern of use occurs. Birds appear on the meadows shortly after sunrise, feed on the meadow vegetation up to the water source, drink, feed again, and then return to the sagebrush along the meadow edge to loaf. Approximately one hour before sunset a similar pattern of meadow use would occur. After the evening visit to the meadow the birds move to the ridges above the meadow to roost. This regular pattern of use is replaced by an irregular pattern during periods of hot, dry weather, when more time is spent visiting the meadows mainly for drinking water.

Individual broods remain closely together during the first portion of meadow occupancy. As the summer progresses the birds come together and form large flocks. Broods were found walking to and from the meadows but flying arrivals and departures occurred after the flocks had been formed. The evening roosting area was the same for each group using the meadow after the flocks had been formed. This suggests that meadows could serve as a preliminary flocking area prior to movement to the winter areas.

Definite segregation of birds into groups of hens without chicks, hens with chicks and adult males was evident while birds were using the meadows. The degree of segregation varied with existing climatic conditions. During periods of cooler temperatures and higher precipitation, sage grouse were segregated into different areas with hens with chicks occupying the major meadows. During periods of less precipitation and generally warmer temperatures, all groups tend to congregate at one available water site, which during the drier periods is usually a meadow. The groups are, however, segregated into different portions of the same area. The hens with broods occupy only those areas with some meadow vegetation present.

IV. Movement away from meadows and fall distribution

Decrease in the use of meadows occurred with the lower temperatures of late summer and early fall. Associated with the decrease in temperature was a decrease in the degree of water stress on the birds. Only occasional visits to free water were required to maintain the bird, therefore, only irregular visits to the meadow occurred.

During the time of irregular meadow use, sage grouse were distributed on the sagebrush ridges and flats in segregated groups. Integration occurred during the visits to the watering areas. These visits usually took place within the first two hours after sunrise. Apparently the pattern of irregular visits continues until constant cold temperatures and winter precipitation occur.

V. Food habits

- A. Plant food. Prior to the movement of sage grouse to the meadows, the bird's diet was composed of a large number of succulent forbs. These consisted mainly of species occurring in the sagebrush type such as Phlox stansburyi, Erigeron concinns, Agoseris glauca, Microsteris gracilis and Lomatium nevadense. Artemisia tridentata and Artemisia arbuscula were also a constituent.

Birds fed selectively from the meadow vegetation. Similar species were consumed at all study meadows regardless of meadow condition or abundance of other species. Of highest importance was the common dandelion (Taraxacum officinale). On the meadows of Badger Mountain a native aster (Aster occidentalis) was highly utilized. Yarrow (Achillea lanulosa) was of importance at all of the meadows. In addition to the meadow forbs, the big sagebrush (A. tridentata) and curl-leaf rabbitbrush (Chrysothamnus viscidiflorus lanceolatus) leafage was utilized. The moisture content of these shrub species occurring at the meadow edge was significantly higher than plants of the same species occurring on the ridges and flats. Sagebrush became of higher importance in the diets of sage grouse using stringer meadows which lacked abundant meadow forbs.

The species composing the majority of the summer diet of hens and chicks did not occur anywhere but in the meadow types. A decrease in the use of meadow vegetation occurred later in the summer after the birds established an intermittent pattern of use. Sagebrush and some curl-leaf rabbitbrush were the important food species during this period. The fall diet consisted mainly of sagebrush.

B. Animal Food. Animal food was important mainly to the younger birds. The ant Formica fusca was the most frequent insect utilized and the only species of ant occurring in the diet. Birds obtained these ants mainly from the ant nests. In the Badger Mountain area the nests of F. fusca were found associated only with the meadow ecotone or meadow remnants. In other areas they were found associated with the big sagebrush-rabbitbrush vegetation type occupying soils with fair fertility. Two members of the Coleoptera also occurred in the diet with high frequency. These were lady beetles (Hippodamea convergens) and darkling beetles (Family Tenebrionidae).

The importance of succulent forbs and insects is evident in the case of young birds. As the chicks grew older, however, more sagebrush and fewer insects were consumed (Table 1).

The diet of adult hens both with and without broods contained significantly more forbs than that of adult cocks. The speculated explanation for this situation is that hens have an instinct to feed on those species required by the young birds (Table 2).

VI. Importance of meadow to sage grouse

Three important functions of the meadow to a sage grouse population are evident. 1. Forbs are an important part of the summer diet especially of the younger birds. Meadows are a sole source of succulent forbs especially during dry years. 2. Free water supplies, within the study areas, were usually located on the meadows. 3. In the Badger Mountain area, the association of the ant Formica fusca (which is the most frequent insect item in the diet of sage grouse) with meadow ecotones and remnants is an attraction for the young birds to these areas.

VII. Degree of meadow utilization and meadow condition preference

Nearly all observations of sage grouse during mid to late summer were made near the meadow type. Brood surveys made in the Badger Mountain and Lone Willow area showed that 98% in 1967 and 95% in 1968 of the birds classified were associated with meadows. Nearly all of the above birds, with the exception of 19 cocks in 1968, were hens and chicks. Indications are that meadows are important chiefly to hens and young birds and to a lesser extent the adult cocks.

Several features appeared to be necessary before sage grouse would utilize a meadow as a congregation site and all area associated with water availability and vegetative growth and form. They are:

Table 1: Summary of food habits for juvenile sage grouse by age classes. (Birds from all study areas forming samples.) (Figures in % of food consumed.)

| Species | $\frac{1}{2}$ to $\frac{1}{2}$ Grown CLASS II (11) Crop/Gizzard | | $\frac{1}{2}$ to $\frac{3}{4}$ Grown CLASS III (10) Crop/Gizzard | | Adult Size CLASS IV (29) Crop/Gizzard | |
|-----------------------------|---|-------|--|-------|---|-------|
| | | | | | | |
| Achillea lanulosa | 15.29 | 16.60 | .41 | T | .55 | 3.0 |
| Agoseris glauca | 7.05 | 2.34 | .41 | | .14 | |
| Antennaria luzuloides | | | | | | |
| Artemisia arbuscula | T | | 9.54 | 9.95 | 3.45 | 10.34 |
| Artemisia tridentata | 1.17 | 1.04 | 10.37 | 13.27 | 39.75 | 29.81 |
| Artemisia cana | 14.12 | .52 | | | T | T |
| Aster occidentalis | 5.88 | 3.38 | 4.14 | 2.65 | 13.51 | .87 |
| Carex sp. | | | | | T | |
| Chrysothamnus viscidiflorus | .58 | .26 | 12.86 | 2.87 | 4.55 | 4.20 |
| Descurania sophia | | | 1.65 | 2.87 | .14 | .63 |
| Elatine sp. | | | | | | .16 |
| Erigeron concinus | 20.58 | 9.11 | | | | |
| Fritillaria pudica | | | | | | |
| Lomatium nevadense | .58 | | | | | |
| Microsteris gracilis | | | | T | | |
| Phlox stansburyi | 5.88 | 8.85 | 6.22 | T | 5.24 | .26 |
| Polemoniaceae (seeds) | | | T | T | | |
| Potentilla gracilis | | | | | | |
| Symphoricarpos longiflorus | | | 10.37 | T | 4.4 | 1.07 |
| Taraxacum officinale | 17.64 | 21.35 | 35.68 | 20.35 | 28.55 | 11.57 |
| Trifolium gymnocarpum | | | .82 | 1.10 | | .23 |
| Trifolium sp. | | | | | .27 | .73 |
| Gramineae | | | | | T | |
| Poa sp. | | | | | T | T |
| Coleoptera | T | .52 | T | T | T | T |
| Formica fusca | 2.35 | 6.77 | T | 1.10 | | .26 |
| Hemiptera | | | | T | | |
| Hippodamea convergens | .58 | .26 | T | T | | .03 |
| Lepidoptera (larvae) | | | | | | |
| Tenebrionidae | 8.23 | 2.08 | 5.80 | 1.10 | .41 | T |
| Insect galls | | | 1.65 | .80 | | |
| Unidentified | | | | | | |
| Unseparable | | 27.08 | | 44.69 | | 36.72 |

() = Number of Birds in Sample

Table 2: Summary of food habits for adult age class sage grouse by status (Brooded, unbrooded, male). Birds from all study areas forming the sample; figures in % of food consumed.

| Species | Hens w/chicks (5) | | Hens w/o chicks (14) | | Adult Males (5) |
|-----------------------------|-------------------|-------|----------------------|-------|-----------------|
| | Crop/Gizzard | | Crop/Gizzard | | |
| Achillea lanulosa | | .37 | .57 | .33 | .95 |
| Agoseria glauca | 13.33 | 15.60 | T | | |
| Antennaria luzuloides | | | 2.27 | .25 | .95 |
| Artemisia arbuscula | | | | 13.51 | 37.02 |
| Artemisia tridentata | 26.66 | 22.30 | 44.3 | 24.85 | 19.30 |
| Artemisia cana | | | T | 2.67 | |
| Aster occidentalis | | | 23.29 | 2.00 | |
| Carex sp. | | | .57 | T | |
| Chrysothamnus viscidiflorus | | 5.94 | 6.82 | 2.67 | .95 |
| Descurania sophia | | | | | |
| Elatine sp. | | | T | T | |
| Erigeron concinus | | | | | |
| Fritillaria pudica | 13.33 | T | | | |
| Lomatium nevadense | | | | | |
| Microsteris gracilis | | .74 | T | .58 | 1.26 |
| Phlox stansburyi | | | T | T | |
| Polemoniaceae (seeds) | | T | | | |
| Potentilla gracilis | | | | | |
| Symphoricarpos longiflorus | | | | 1.75 | |
| Taraxacum officinale | 39.99 | 21.93 | 11.93 | 8.92 | 6.65 |
| Trifolium gymnocarpum | | | 6.82 | T | |
| Trifolium sp. | | | | | |
| Gramineae | T | T | T | T | |
| Poa sp. | | T | T | | |
| Coleoptera | | T | | T | T |
| Formica fusca | | T | | T | T |
| Hemiptera | | | | | |
| Hippodamia convergens | | | | | T |
| Lepidoptera (larvae) | | | | | |
| Tenebrionidae | | | | | |
| Insect galls | | .37 | | .50 | .95 |
| Unidentified | | | | T | |
| Unseparable | | 32.71 | | 41.78 | 31.65 |

() = Number of Birds in Sample

1. Free water which is not confined to areas such as deep gullies.
2. Vegetation up to the water supply. Hens with chicks require that some meadow vegetation be around the water source.
3. Hens with broods required the presence of the preferred food species in the meadow vegetation. As a general rule, the more abundant the preferred food species are on the meadow, the greater is the utilization by hens with chicks.

In addition to the above, hens with chicks show a definite preference for those portions of the meadow having a low crown cover (5 to 10 per cent) by sagebrush.

VIII. Meadow utilization by other animals

In addition to sage grouse, numerous species of birds and mammals utilize the resources of the upland meadow. Undoubtedly the meadow is just as important to these animals as it is to the sage grouse.