Vertebrate fauna of Kalsow Prairie

Kathleen Marie Brennan

Iowa State University

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VERTEBRATE FAUNA OF KALSO\w PRAIRIE

by

Kathleen Marie Brennan

A Thesis Submitted to the
Graduate Faculty in Partial Fulfillment of
The Requirements for the Degree of
MASTER OF SCIENCE

Major Subject: Zoology (Ecology)

Approved:

Signatures have been redacted for privacy

Iowa State University
Of Science and Technology
Ames, Iowa
1970
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INTRODUCTION

Iowa's greatest wealth is its natural resources, primarily the soils which developed under prairie vegetation. These prairie soils are found mainly in the northern part of the state and once covered one-half the land area (Fig. 1). The massive conversion to cropland during and after both World Wars resulted in the loss of nearly all of the tall-grass prairie vegetation in Iowa. One of the few preserved remnants is Kalsow Prairie, situated in North Central Iowa. This virgin prairie has never been plowed, although it was mowed yearly for hay (Hayden and Aikman, 1949). Grazing was limited to the northwest corner. Thus it is a historic area, preserved for its unique floral, faunal, and soil characteristics.

Preservation of such prairie areas cannot be limited to mere protection of the land and its resident species. It must involve manipulation where necessary to prevent the intrusion of exotic, non-typical or "weedy" species such as thistle (Cirsium arvense), (species names after Gleason, 1952; documented by Brotherson, 1969), milkweeds (Asclepias verticillata, and A. syriaca), timothy (Phleum pratense) bluegrass (Poa pratensis) and even trees. Elimination of trees once was accomplished by periodic fires which also favored survival of fire-adapted forbs and grasses, removed excessive accumulations of dead material, and stimulated seed release by plants which normally reproduced vegetatively at a slow rate. Indians set fire to the prairie in early spring to induce green growth for agricultural and hunting purposes. Lightning-caused fires were associated with the dry summer months (Komarek, 1965).
Fig. 1. Pre-settlement vegetation in Iowa (After Kuchler, 1964)
This investigation was initiated to:

1. Prepare a faunal list of the vertebrates of Kalsow Prairie.

2. Compare population density of nesting birds and small mammals on recently burned prairie and unburned control areas.

3. Observe the distribution of vertebrates on the prairie in relation to vegetation.

Field data were gathered during the period March 1968 to June 1969. Controlled burning was used to manage vegetation in April of each of these years by plant ecologists from the Department of Botany and Plant Pathology at Iowa State University, in cooperation with the Iowa State Conservation Commission.

Field work on this study was financed by the Iowa State Preserves Advisory Board.
LITERATURE REVIEW

The fauna of tall-grass prairie is a product of mixing of species entering the area from the drier plains to the west and the deciduous forest to the east. Listings of the biota common in Iowa during the last century can be found in the writings of Brumfiel (1918) and Pammel (1926). Osborn (1905) and Pammel (1926, 1930) recorded the partial or complete disappearance of 18 species from the state.

Abel (1920), Guthrie (1928), and Kendeigh (1941) confounded their observations in Iowa to birds. Anderson (1907) gave a history of bird observations in Iowa from the 1804-1806 Lewis and Clark expedition to the founding of the Iowa Ornithologists Union in 1894. Dumont (1933) compiled a list of the birds of Iowa, and Stoner (1918) did the same for rodents.

Vegetative investigations of Iowa prairie areas were conducted by Shimek (1911) and Weaver (1958). Moyer (1953) and Brotherson (1969) described the species on Kalsow Prairie.

Marking techniques to permit individual identification of mammals were reviewed by Ashbrook (1936), Manville (1949), and Taber (1956). Scott (1942) and Eddy and Joyce (1944) devised the basic eartagging procedure for mice.

Methods of censusing avian populations were proposed by Lindsdale (1928), Breckenridge (1935), Lack (1937) and Kendeigh (1944). Sight observations, rope drags, and singing male counts were the major means employed.

In censusing small mammals, trapping has been the most popular way to estimate numbers or determine species composition in a vegetative
area. Bole (1939) introduced the quadrat method. Later workers (such as Goodnight and Koestner (1942) and Sealander and James (1958)) compared the effectiveness of different traps.

Tester and Marshall (1961) studied the effect of spring and fall fires on the animals of a 640 acre area in Minnesota, which included a 250 acre tract of unplowed native prairie. Ten acre plots were used as experimental and control areas. Birds were censused by counting singing males and mapping territories. Bobolinks (Dolichonyx oryzivorus) avoided the burned areas until litter cover was suitable; savannah sparrows (Passerculus sandwichensis) also showed some correlation with litter cover. Mammals were captured by a circular line of snap-traps in each plot. Numbers of meadow voles (Microtus pennsylvanicus) were found to be positively correlated with litter cover and depth; prairie deer mice (Peromyscus maniculatus) showed a negative relationship. Microtus left the burned areas; Peromyscus entered in greater numbers than were present before the fires. The masked shrew (Sorex cinereus) was present over most of the study area but there were larger relative populations in unmowed and unburned areas with a dense litter cover.

Schramm (1968) burned small areas of a restored prairie in Illinois, and noted a movement of Microtus out of burned areas and an increase in Zapus numbers within these plots.
DESCRIPTION OF THE STUDY AREA

History and Legal Description

Kalsow Prairie, a 160 acre tract, is located approximately 4½ miles northwest of Manson, Iowa. It comprises the NE ¼ of Section 36, Belleville Township, T 90N, R 32W, Pocahontas County. Records in the County Courthouse at Pocahontas show that the land initially was purchased by the P. L. Wells family in 1859. After 21 years and two transfers of ownership, the prairie became part of the large holdings of Colonel Leander Blanden. The Blanden homestead was a grain farming and stock breeding operation located near the present northern boundary of the prairie. An abandoned grain elevator and a few houses ¼ mile northeast of the prairie are all that remain of the small town of Blanden.

Title to the property changed hands several times after the death of Colonel Blanden until it was acquired by Rudolph Kalsow. It remained in possession of the Kalsow family until purchased from Otto C. Kalsow by the Iowa State Conservation Commission in September, 1948. The acquisition was part of the Commission's 25 Year Plan, initiated in 1933, to preserve Iowa prairie areas as outdoor museums, classrooms, and laboratories (Aikman, 1955).

Management Practices

A preliminary management program, combining protection and limited mowing, was established in 1949 until a long-term program could be planned on the basis of intensive study of the tract (Hayden and Aikman, 1949). Identification of plant species and soil types, and an overall
estimate of productivity and condition, was completed in 1953 (Moyer, 1953). Inadvertent burning occurred in 1956, when sparks from a fire on the farm to the south of the prairie started a blaze that spread over 112 acres (Galliart, 1956).

Topography, Soils, and Vegetation

Kalsow Prairie is part of a relatively flat glacial till plain or ground moraine, situated between the Humboldt end moraine to the north and the Altamont end moraine to the south (Fig. 2). This places it well within the Clarion-Nicollet-Webster soil association area, which corresponds closely with the Cary lobe of the Wisconsin glacial ice sheet, known as the Des Moines lobe in Iowa (Fig. 2).

Samples taken from the top 6 inches of soil in 1954 were analyzed by the radiocarbon dating technique (Ruhe, 1969). Organic matter in the Clarion loam from the high prairie of the southeast corner was found to be about 440 ± 120 years old, and that of the Webster silty clay loam from a nearby low spot was estimated at 270 ± 120 years. A limited soil survey was taken near the southeast corner in the summer of 1968 (Brotherson, 1969). Seventeen different soils were identified in a 20 acre area which includes the large potholes on the southern side of the prairie.

The highest points of the prairie are along the eastern and western borders. Upland or true prairie vegetation is found there, characterized by prairie dropseed (*Sporobolus heterolepis*), little bluestem (*Andropogon scoparius*), Junegrass (*Koeleria cristata*), and porcupine grass (*Stipa spartea*). Gravimetrically, foliage of these 4 species forms 45 per cent of
Fig. 2. Major end moraines of the Cary drift of the Des Moines lobe in Iowa (Modified from Ruhe, 1969)
the total plant cover of the prairie (Aikman, 1955).

The ground slopes from the eastern and western sides toward the central area where a low swale indicates the major drainage flow through the prairie. The swale begins near the center of the southern side, meanders diagonally northeast, expanding to include the majority of the potholes, and then turns northwest across the tract. Just west of center on the northern side it intersects a broad drainage ditch which runs diagonally northeast across the northwest corner (Fig. 3). This swale is vegetated with lowland, or tall-grass prairie. The vegetation is coarser as well as taller in the ditch, but there are fewer species. Sloughgrass (Spartina pectinata) grows in the most poorly drained areas, with switchgrass (Panicum virgatum), Canada wildrye (Elymus canadensis), Indian grass (Sorghastrum nutans), and big bluestem (Andropogon gerardi) occurring in sequence as the land rises and becomes drier. Approximately one-sixth of the total land area of the prairie is covered by these wet-prairie plants (Aikman, 1955). Included in this estimate are small areas around the potholes in the northeast and southwest corners, as well as the major pothole complex in the south central part of the prairie. The potholes themselves are ringed with a mixture of blue joint (Calamagrostis spp.), smartweed (Polygonum spp.), and sloughgrass. Sedges (Carex spp.) and bulrushes (Scirpus spp.) occupy their centers.

Aerial photos show the marks of two old fence lines which enclosed nearly one-sixth of the prairie in the northwest corner. This tract was grazed by cattle for an indefinite period, and now consists primarily of bluegrass. Milkweed, red clover (Trifolium pratense), quackgrass
Fig. 3. Vegetation of Kalsow Prairie
(Agropyron repens), and other plant indicators of disturbance also are present. Protection from grazing and disturbance has allowed big bluestem and other prairie plants to spread into this area. The boundary of this transition area is visible from the air, and is designated by a southwest to northeast diagonal line in Fig. 3.
METHODS

Species List

The species list includes not only vertebrates observed on the prairie, but also those seen on telephone poles, fences, and roads surrounding the area. Mobile, far-ranging predators such as hawks were added if found within a 1 mile radius of the prairie. Similarly, dens and tracks of mammalian predators were taken as positive indications of their presence on the prairie. Birds were identified by their songs, and by observation with binoculars.

Measurement of Avian Populations

A census of birds was taken four times during the breeding season, and the positions of singing males were plotted on an outline map. Each male was assumed to be associated with one female and a nest. Any nests discovered were checked for the presence of eggs or young. Location, species, and number of eggs or young were recorded on the map for each nest.

Measurement of Mammalian Populations

Live-trapping

Mammals were captured by two methods. To study the effect of burning on the distribution and abundance of small mammals, Hav-a-hart live-traps were set in both high prairie and bluegrass-prairie areas before the 1968 fire. These areas were separated from the rest of the prairie by a 50 foot lane mowed on a north to south axis (Fig. 4). Originally, 84 traps were used in these two quadrats, to mark as many
Fig. 4. Location of live-trapping and snap-trapping quadrats on Kalsow Prairie in 1968 and 1969.

1–X = Snap-trapping quadrats
3–5A = 1968 Live-trapping quadrats
1–1A = 1969 Live-trapping quadrats
animals as possible in the area to be burned. The traps were arranged in 7 east-west lines with 12 traps per line. Each quadrat enclosed 105,600 square feet, slightly less than 2 1/2 acres. The burned bluegrass-prairie quadrat was designated # 3, the burned prairie quadrat # 5. The quadrats were trapped alternately, for three-night periods.

After the burn, one half (42) of the traps were moved to identical quadrats directly across the mowed lane in unburned prairie. These quadrats served as controls. The entire unburned area became a refuge for animals leaving the burned area. The unburned bluegrass-prairie quadrat was designated # 3A, the unburned prairie quadrat # 5A. Following removal of half of the traps, it was necessary to cover the same area in the original quadrats with fewer traps. To do this, all odd-numbered traps were retained in the odd-numbered lines (1, 3, 5, and 7) and even-numbered traps were kept in lines 2, 4, and 6. Those traps removed were placed in the control quadrats in positions corresponding to those of the experimental quadrat traps. The lines were 15 paces apart (approximately 40 feet) in all four quadrats, and the traps in each line were positioned 30 paces apart (approximately 80 feet).

In 1969 pre-burn trapping the same experimental scheme was used on the eastern side of the prairie. Only one experimental quadrat, # 1, and one control quadrat; # 1A, were established in the high prairie vegetation near the potholes.

All traps were baited with peanut butter on the first night of each three-night trapping period. They were set in the evening at dusk and checked early each morning, but were not rebaited. All traps were closed by the investigator to prevent interference by diurnal
animals. Captured mammals were marked by toe-clipping and numbered ear tags. Species, weight, sex, age, reproductive condition, and trap location were noted for each animal before its release. Those which died in the traps or during handling were preserved by freezing for further study.

Snap-trapping

Snap-trapping was used to determine the distribution of small mammals in relation to vegetation. Five types of vegetation were chosen for study: burned prairie, unburned prairie, bluegrass, sloughgrass in the swale, and the pothole complex. Two replications of a five line quadrat were set up in each area. Roman numerals were assigned to the quadrats in a north to south pattern. Thus, I and II designated the bluegrass area, III and IV the sloughgrass, V and VI the burned prairie, VII and VIII the unburned prairie, and IX and X the potholes (Fig. 4). Ten trap stations were spaced at 20 foot intervals on each transect with 20 feet between transects. Two small Victor snap-traps were tied to each 5/16 inch dowel station marker to minimize loss. Each quadrat, therefore, covered 14,400 square feet (approximately one-third acre) and contained 100 traps. Each quadrat was trapped for four nights during each season of the year. The traps were baited with peanut butter on the first night of the period, and were checked as early in the morning as possible. All captures were recorded as to species, sex, age, reproductive condition, and trap locality. Most were frozen for further study, except those partially consumed by insects or shrews.

Data from 1968 and 1969 trapping periods were used in the construction
of chi-square contingency tables to analyze the distribution of mammals among the vegetation types and the effect of fire on that distribution.

Frozen specimens were combined with those which died in live-traps and examined to determine reproduction. Sex of the animals was determined internally. Female reproductive tracts were inspected for the presence of embryos.

**Reptiles and Amphibians**

Reptiles and amphibians were identified by examination of specimens captured by hand. No attempt was made to estimate their densities or distributions other than noting their locations within the study area.
RESULTS

Species List

The fauna of the prairie has undergone drastic changes since the coming of the white man and his implements. Bison (*Bison bison*) are no longer present. The wolf (*Canis lupus*) long has been extirpated, and the coyote (*Canis latrans*) is not abundant in the area. The greater prairie chicken (*Tympanuchus cupido*) has been replaced by the ring-necked pheasant (*Phasianus colchicus*), a non-native species. Those animals which remain are those which have adapted to cultivation and the presence of man.

All species seen on or near the prairie are recorded in the Appendix. Franklin's ground squirrel (*Citellus franklinii*) and the prairie vole (*Microtus ochrogaster*) were not seen, although they may be present. The entire state of Iowa is within the range of each species (Burt and Grossenheider, 1964). All mice of the genus *Peromyscus* are regarded herein as prairie deer mice.

Observations on the Effects of Fire on Prairie Vertebrates

On April 18, 1968 approximately 40 acres on the western border of the prairie were burned on a north to south axis by repeated ignition with a kerosene torch (Fig. 4). A 50 foot lane parallel to the western fence line had been mowed as a fire break, and large rubber "flappers" on poles were used as an additional fire control measure. One female ring-necked pheasant, several meadow voles, and three garter snakes (*Thamnophis sp.*.) were seen escaping ahead of the flames. Evidently, other animals had moved off due to human disturbance, or had entered burrows.
Two garter snakes were the only casualties found after the fire, although a systematic search was conducted.

The second experimental burn was conducted on April 24, 1969. Forty acres on the eastern side of the prairie were burned, again on a north to south axis, and under similar conditions (Fig. 4). The fire was allowed to burn through the eastern fence line and across the ditch to the gravel road, which acted as a fire break. A fire lane had been mowed previously, but was very irregular due to the extremely wet soil. Crows (Corvus brachyrhynchos), western meadowlarks (Sturnella neglecta), and savannah sparrows (Passerculus sandwichensis) flew into the standing corn on the eastern side of the prairie, but later they returned to the prairie through the smoke. Mourning doves (Zenaidura macroura) and grackles (Quiscalus quiscula) perched on fences and telephone lines bordering the prairie during the fire. A red-tailed hawk (Buteo jamaicensis) circled above the fire. Only one escaping garter snake was seen at the edge of the prairie along the road. Other snakes and one meadow vole were seen in the prairie, moving away from the line of fire, but no carcasses were found after the fire. Snakes were seen in the area on the second day after the burn, so they apparently escaped by going underground. Two meadowlark nests and one pheasant nest apparently burned in the fire. However, all had been extensively damaged by predators when found the day following the burn and it was not possible to determine which event occurred first.
Avian Populations

All singing male birds were plotted on an outline map of the prairie (Fig. 5). Locations of nests discovered during the study also are shown with the number of eggs or young present. Numbers of males of each species are presented in Table 1. Bobolinks (Dolichonyx oryzivorus).

Table 1. Census of singing male birds on Kalsow Prairie in 1969

<table>
<thead>
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<th>Species</th>
<th>Number</th>
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<tr>
<td>Bobolink</td>
<td>31</td>
</tr>
<tr>
<td>Redwinged blackbird</td>
<td>9</td>
</tr>
<tr>
<td>Western meadowlark</td>
<td>8</td>
</tr>
<tr>
<td>Yellowthroat</td>
<td>4</td>
</tr>
<tr>
<td>Lark sparrow</td>
<td>2</td>
</tr>
<tr>
<td>Grasshopper sparrow</td>
<td>2</td>
</tr>
<tr>
<td>Dickcissel</td>
<td>2</td>
</tr>
<tr>
<td>Long-billed marsh wren</td>
<td>2</td>
</tr>
<tr>
<td>Field sparrow</td>
<td>1</td>
</tr>
<tr>
<td>Savannah sparrow</td>
<td>1</td>
</tr>
<tr>
<td>American goldfinch</td>
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</table>

redwinged blackbirds (Agelaius phoeniceus), and western meadowlarks are the most common species on the prairie, in that order. Dickcissels (Spiza americana) are numerous in the vicinity but remain in cultivated areas, where they apparently nest in fencerows. The male bobolinks arrived on the prairie after the fire each year, and most set up territories in the unburned vegetation. Few nested on the 1968 burned area during that breeding season, but that area contained the highest population density on the study area in 1969. Two pairs utilized the recently burned area during the spring and summer of 1969.
Fig. 5. Location of bird nests on Kalsow Prairie in 1968 and 1969. Position of singing males in 1969.
Specific habitat and locality preferences are evident in Fig. 5. Meadowlarks, highly territorial and aggressive, were widely spaced in prairie vegetation, always near the borders where there were abundant songposts. Bobolinks, with small territories, nested in bluegrass or prairie areas. Redwinged blackbirds were found only in wet spots where marsh emergents like sedges and bulrushes provided opportunities for nesting near water. Yellowthroats (*Gleothlypis trichas*) and goldfinches (*Spinus tristis*) were found near tall brushy areas or willow clumps. Long-billed marsh wrens (*Telmatodytes palustris*) were seen in proximity to redwings in the potholes. Short-billed marsh wrens (*Cystothorus platensis*), observed only in 1968, inhabited damp sloughgrass areas. Lark sparrows (*Chondestes grammacus*), field sparrows (*Spizella pusilla*), savannah sparrows, and dickcissels always were found in prairie areas near the fence lines. Grasshopper sparrows (*Ammodramus savannarum*) were only seen in the central prairie region. Pheasants nested only in prairie vegetation.

**Mammalian Populations**

**Live-trapping**

Numbers of animals captured for the total period are given in Table 2. From the species distributions in the trapping areas, it is evident that the greatest concentrations of *Peromyscus* were in the burned areas; *Microtus* were concentrated in the unburned areas.

The first *Microtus* captured in the burned area was not found until 4 months after the fire on August 16. The meadow jumping mouse (*Zapus hudsonius*) was not caught in any quadrat until June, but it hibernates
Table 2. Number of small mammals captured in live-traps during spring and summer of 1968 and spring of 1969

<table>
<thead>
<tr>
<th>Vegetation</th>
<th>Quadrat</th>
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<tr>
<td></td>
<td></td>
<td>Microtus</td>
<td>Peromyscus</td>
<td>Sorex</td>
<td>Zapus</td>
<td>Mus</td>
</tr>
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<td>1968</td>
<td></td>
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<td></td>
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<td>14 nights</td>
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<td>I</td>
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and is not active until May (Quimby, 1951). The short-tailed shrew (Soricina brevicauda) was more abundant in the burned areas. Only one house mouse (Mus musculus) was captured near a fence line in burned bluegrass-prairie vegetation. The western harvest mouse (Reithrodontomys megalotis) was found in both burned and unburned prairie vegetation. The masked shrew (Sorex cinereus) was more abundant in unburned areas. The total of all animals in each of the bluegrass-prairie quadrats was similar, but the unburned prairie quadrat showed a much lower number of captures than did the burned prairie quadrat, which more nearly approximated the totals of the bluegrass-prairie areas.

Similar results were obtained in 1969. The first trapping period covered the 3 days before the fire. One Peromyscus was captured in the area to be burned, and one Peromyscus and one Microtus were obtained in the unburned prairie. One Microtus was captured May 5 in the burned area, 11 days after the fire, but it was found in a shallow, wet depressed area which had not burned and which contained much dead vegetation. Again, many more Peromyscus were captured in the burned quadrat. Nearly one-third were juveniles. No juveniles of any species were caught in the unburned area. Total numbers of captures are given in Table 2.

Snap-trapping

Table 3 shows the distribution of species in the five vegetative areas of the prairie, sampled twice per season. The data demonstrate a pattern similar to that of the live-trapping results. The potholes were not trapped in the winter due to snow accumulation and in spring due to subsequent high water levels. Also, the fall trapping figures are lower than the number of animals actually captured, due to severe
Table 3. Number of mammals captured in snap-traps during the summer, fall, winter, and spring 1968-1969

<table>
<thead>
<tr>
<th>Vegetation</th>
<th>Quadrat</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Microtus</td>
<td>Peromyscus</td>
</tr>
<tr>
<td>Bluegrass</td>
<td>I</td>
<td>2 6 - - - -</td>
</tr>
<tr>
<td>Bluegrass</td>
<td>II</td>
<td>2 4 2 - 2 -</td>
</tr>
<tr>
<td>Sloughgrass</td>
<td>III</td>
<td>12 2 8 - - 5</td>
</tr>
<tr>
<td>Sloughgrass</td>
<td>IV</td>
<td>3 1 3 2 - -</td>
</tr>
<tr>
<td>Burned prairie</td>
<td>V</td>
<td>- 17 5 4 1 -</td>
</tr>
<tr>
<td>Burned prairie</td>
<td>VI</td>
<td>1 17 1 3 - 3</td>
</tr>
<tr>
<td>Unburned prairie</td>
<td>VII</td>
<td>5 1 11 2 2 -</td>
</tr>
<tr>
<td>Unburned prairie</td>
<td>VIII</td>
<td>3 1 2 7 1</td>
</tr>
<tr>
<td>Pothole</td>
<td>IX</td>
<td>2 1 8 5 - -</td>
</tr>
<tr>
<td>Pothole</td>
<td>X</td>
<td>- 2 2 3 - 1</td>
</tr>
<tr>
<td>Seasonal Species Totals</td>
<td></td>
<td>28 53 43 19 5 14</td>
</tr>
<tr>
<td></td>
<td>Microtus</td>
<td>Peromyscus</td>
</tr>
<tr>
<td>-------</td>
<td>----------</td>
<td>------------</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>1</td>
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<td>-</td>
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<td>-</td>
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<td>1</td>
</tr>
<tr>
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<td>3</td>
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<td>2</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>19</td>
<td>3</td>
</tr>
<tr>
<td>Vegetation</td>
<td>Quadrat</td>
<td>Winter</td>
</tr>
<tr>
<td>---------------</td>
<td>---------</td>
<td>--------</td>
</tr>
<tr>
<td>Bluegrass</td>
<td>I</td>
<td>-</td>
</tr>
<tr>
<td>Bluegrass</td>
<td>II</td>
<td>-</td>
</tr>
<tr>
<td>Sloughgrass</td>
<td>III</td>
<td>-</td>
</tr>
<tr>
<td>Sloughgrass</td>
<td>IV</td>
<td>-</td>
</tr>
<tr>
<td>Burned prairie</td>
<td>V</td>
<td>-</td>
</tr>
<tr>
<td>Burned prairie</td>
<td>VI</td>
<td>1</td>
</tr>
<tr>
<td>Unburned prairie</td>
<td>VII</td>
<td>1</td>
</tr>
<tr>
<td>Unburned prairie</td>
<td>VIII</td>
<td>-</td>
</tr>
<tr>
<td>Pothole</td>
<td>IX</td>
<td>-</td>
</tr>
<tr>
<td>Pothole</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Seasonal Species Totals</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>months</td>
<td>Microtus</td>
<td>Peromyscus</td>
</tr>
<tr>
<td>----------</td>
<td>----------</td>
<td>-------------</td>
</tr>
<tr>
<td>Spring</td>
<td>25</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>22</td>
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<tr>
<td></td>
<td>11</td>
<td>-</td>
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<tr>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>109</td>
<td>22</td>
</tr>
</tbody>
</table>
weather conditions which necessitated leaving the traps set for four additional nights. A thaw during this time allowed increased small mammal movement, and many mammals were captured. Because the captures from this extended period could not be distinguished from those which took place during the normal sampling period, the data could not be included in the study. The removal of these animals may have affected the winter figures for quadrats II, IV, V, and VII.

In general, *Microtus* was most prominent in the bluegrass and sloughgrass, *Peromyscus* in the burned prairie, *Sorex* and *Zapus* in both burned and unburned prairie and the potholes and sloughgrass, and *Mus* in areas close to roads or farms (bluegrass and prairie). Slightly more *Reithrodontomys* were found in the unburned than burned prairie. *Reithrodontomys*, *Zapus*, and *Elarina* were not captured in either bluegrass quadrat during this part of the study. *Elarina* was seldom caught in any type of habitat.

Animals other than mammals caught by snap-traps were: long-billed marsh wrens, short-billed marsh wrens, yellowthroats, bobolinks, western smooth green snakes (*Ophiodrys vernalis blanchardi*), and crayfish. One pheasant toe and a few flight feathers were found in one trap.

**Statistical Analysis**

Contingency tables (Tables 4, 5, and 6) are based on live-trapping data from Table 2. Expected values are shown in parentheses. Chi-square values, degrees of freedom, and probabilities are given below each table.

Table 4 shows that *Microtus* was found in unburned areas in much greater numbers than would be expected on the basis of an equal distri-
Table 4. Number of captures of small mammals live-trapped in burned and unburned bluegrass-prairie and prairie quadrats in 1968 and 1969

<table>
<thead>
<tr>
<th>Vegetation</th>
<th>Microtus</th>
<th>Peromyscus</th>
<th>Sorex</th>
<th>Zapus</th>
<th>Mus</th>
<th>Reithrodontomys</th>
<th>Blarina</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burned</td>
<td>3(44.5)</td>
<td>120(76.3)</td>
<td>8(12.0)</td>
<td>1(3.0)</td>
<td>1(1.2)</td>
<td>5(4.8)</td>
<td>11(7.2)</td>
</tr>
<tr>
<td>Unburned</td>
<td>71(29.5)</td>
<td>7(50.7)</td>
<td>12(8.0)</td>
<td>4(2.0)</td>
<td>1(0.8)</td>
<td>3(3.2)</td>
<td>1(4.8)</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td>171.35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d.f.</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p</td>
<td>&lt; .001</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Number of captures of small mammals live-trapped in burned and unburned bluegrass-prairie quadrats in 1968

<table>
<thead>
<tr>
<th>Vegetation</th>
<th>Microtus</th>
<th>Peromyscus</th>
<th>Sorex</th>
<th>Blarina</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burned</td>
<td>1(24.4)</td>
<td>44(21.9)</td>
<td>3(5.4)</td>
<td>8(3.9)</td>
<td>2(2.4)</td>
</tr>
<tr>
<td>Unburned</td>
<td>49(25.6)</td>
<td>1(23.1)</td>
<td>8(5.6)</td>
<td>0(4.1)</td>
<td>3(2.6)</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td>97.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d.f.</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p</td>
<td>&lt; .001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 6. Number of captures of small mammals live-trapped in burned and unburned prairie quadrats in 1968 and 1969

<table>
<thead>
<tr>
<th>Vegetation</th>
<th>Microtus</th>
<th>Peromyscus</th>
<th>Sorex</th>
<th>Reithrodontomys</th>
<th>Blarina</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burned</td>
<td>2(16.9)</td>
<td>76(57.8)</td>
<td>5(6.4)</td>
<td>5(5.6)</td>
<td>3(2.8)</td>
<td>0(1.4)</td>
</tr>
<tr>
<td>Unburned</td>
<td>22(7.1)</td>
<td>6(24.2)</td>
<td>4(2.6)</td>
<td>3(2.4)</td>
<td>1(1.2)</td>
<td>2(0.6)</td>
</tr>
</tbody>
</table>

$\chi^2 = 70.09$  
\[ \text{d.f.} = 5 \]  
\[ p < .001 \]

Distribution in both vegetative types. More *Peromyscus* were captured in areas that were burned than would be expected. *Sorex* may have avoided the burned areas and *Blarina* may have increased in number within them, but the observed values for these species are similar to the expected values. The observed and expected values also are similar for each of the three other species.

Tables 5 and 6 show results which are similar to the results of Table 4: fewer *Microtus* than expected on burned areas, and more *Peromyscus*. *Sorex* and *Blarina* also follow the pattern shown in Table 4. *Zapus*, *Mus*, and *Reithrodontomys* values were too low to be considered separately and are grouped together as "others." Observed and expected values are similar for this category.

Table 7 is based on snap-trapping data from Table 3. It shows more *Microtus* than expected in bluegrass and sloughgrass areas, with fewer than expected in burned and unburned prairie. *Peromyscus* values are the reverse. *Sorex* and *Reithrodontomys* numbers correspond closely with expected values. *Zapus* numbers are higher than expected on burned prairie. There were too few *Mus* and *Blarina* captured by snap-trapping to indicate any pattern.
Table 7. Total number of small mammals captured by snap-trapping in 1968 and 1969, distributed according to vegetation type

<table>
<thead>
<tr>
<th>Species</th>
<th>Bluegrass</th>
<th>Sloughgrass</th>
<th>Burned prairie</th>
<th>Unburned prairie</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microtus</td>
<td>54(29.5)</td>
<td>48(31.1)</td>
<td>23(59.4)</td>
<td>8(12.9)</td>
</tr>
<tr>
<td>Peromyscus</td>
<td>13(22.4)</td>
<td>5(23.6)</td>
<td>72(45.1)</td>
<td>11(9.8)</td>
</tr>
<tr>
<td>Sorex</td>
<td>4(9.8)</td>
<td>13(10.3)</td>
<td>22(19.7)</td>
<td>5(4.3)</td>
</tr>
<tr>
<td>Zapus</td>
<td>0(3.6)</td>
<td>2(3.7)</td>
<td>13(7.1)</td>
<td>1(1.6)</td>
</tr>
<tr>
<td>Mus</td>
<td>2(1.6)</td>
<td>1(1.6)</td>
<td>4(3.1)</td>
<td>0(0.7)</td>
</tr>
<tr>
<td>Heithrodontomys</td>
<td>0(5.6)</td>
<td>6(5.8)</td>
<td>13(11.2)</td>
<td>6(2.4)</td>
</tr>
<tr>
<td>Blarina</td>
<td>0(0.7)</td>
<td>2(0.7)</td>
<td>0(1.3)</td>
<td>1(0.3)</td>
</tr>
</tbody>
</table>

$\chi^2 = 120.84$  d.f. = 18  $p < .001$

Reproduction

Data from preserved mammals are considered as one group regardless of date of capture or trap location (Table 8). The figures in parentheses are the totals of each species obtained in the four seasons of snap-trapping in all vegetative areas. The numbers of preserved specimens are very similar to these figures, and can therefore be considered as representative of the individual species populations.

In all species except Microtus and Blarina, the number of males was much higher than the number of females.
Table 8. Sex ratios and reproductive data based on mammals preserved in 1968 and 1969

<table>
<thead>
<tr>
<th>Species</th>
<th>Total examined</th>
<th>Snap-trap totals</th>
<th>Males</th>
<th>Females</th>
<th>Pregnant females</th>
<th>Average number of embryos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microtus</td>
<td>134</td>
<td>140</td>
<td>64</td>
<td>70</td>
<td>30</td>
<td>5.9</td>
</tr>
<tr>
<td>Peromyscus</td>
<td>92</td>
<td>105</td>
<td>64</td>
<td>28</td>
<td>5</td>
<td>6.8</td>
</tr>
<tr>
<td>Sorex</td>
<td>58</td>
<td>55</td>
<td>38</td>
<td>20</td>
<td>10</td>
<td>5.1</td>
</tr>
<tr>
<td>Reithrodontomys</td>
<td>38</td>
<td>37</td>
<td>23</td>
<td>15</td>
<td>2</td>
<td>4.5</td>
</tr>
<tr>
<td>Zapus</td>
<td>22</td>
<td>24</td>
<td>17</td>
<td>5</td>
<td>2</td>
<td>5.0</td>
</tr>
<tr>
<td>Blarina</td>
<td>7</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>5.3</td>
</tr>
<tr>
<td>Mus</td>
<td>12</td>
<td>12</td>
<td>10</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>363</td>
<td>376</td>
<td>219</td>
<td>144</td>
<td>52</td>
<td></td>
</tr>
</tbody>
</table>

*Excluding winter data*

Nearly half the female reproductive tracts contained embryos. The average number of embryos for all pregnant females was 5.43. The low percentages of pregnant females in Peromyscus and Reithrodontomys result from a high proportion of juvenile females captured.

Reptiles and Amphibians

Three snakes, one skink, three frogs, and one toad were collected on the prairie. Scientific and common names of these species are given in the Appendix. The snakes and the skink inhabited high prairie areas; the frogs and the toad were found in the swale and potholes. Most of the wet areas in spring and early summer contained large numbers of breeding toads.
DISCUSSION

There are no relict species of vertebrates present on Kalsow Prairie. Most are animals which have adapted to the farm-dominated environment, and many can be found in greater numbers elsewhere in the region. However, the bobolinks are more common on the prairie than in the surrounding intensively cultivated area.

Pheasants and white-tailed jackrabbits (*Lepus townsendii*) are the only hunted species, and they are found principally in cultivated fields and fencerows. These animals seldom were seen on the prairie and do not use it extensively for feeding or during periods of reproduction.

The most abundant small mammals on Kalsow Prairie are *Peromyscus* and *Microtus*. If the results of both trapping methods are combined, the figure for *Microtus* is slightly lower than that for *Peromyscus*, 214 versus 232. The difference is greater when only live-trapping data are examined, 74 *Microtus* captured compared to 127 *Peromyscus*. Just the reverse is true when the snap-trapping results are compared; 140 *Microtus* and 105 *Peromyscus* were obtained by this method. *Blarina* is the only other mammal to show a higher number of live-trapping captures (12) compared to 3 captured in snap-traps.

The disappearance of *Microtus* and the increase of *Peromyscus* in the burned quadrats follow the same patterns of movement reported by Tester and Marshall (1961) in similar post-burn studies on natural prairie vegetation in Minnesota. Schramm (1968) noted the same behavior in *Microtus* after burning of a restored prairie area in Illinois.
Most *Zapus* captured in burned and unburned prairie areas on Kalsow were on or near mounds of soil built up by excavating pocket gophers (*Geomys bursarius*). This agrees with the findings of Tester and Marshall (1961), who thought the jumping mice might burrow into the mounds to hibernate. However, these mice were found in equal numbers in Kalsow pothole areas which do not have mounds.
RECOMMENDATIONS

If no more than one-fourth of the prairie (40 acres) is burned each year, there will be little damage to avian and mammalian populations. The adult mammals and birds move away before the fire reaches them; nestling mammals are usually protected in underground nests. Only those birds which are early nesters seem to be adversely affected and, of the three principal species (pheasant, meadowlark, and redwinged blackbird), the blackbirds nest in wet areas which rarely burn. Probably both pheasants and meadowlarks renest if the first nest is destroyed early in the breeding season. The toads and frogs are located in wet areas which do not burn, and the majority of the snakes and skinks can maneuver away from the fire or enter mammalian burrows.

In the future, a soil survey of the entire prairie should be taken. Comparisons could then be made between the soil patterns and the distribution of flora and fauna.

Teachers and the general public should be encouraged to use Kalsow Prairie as an outdoor classroom and nature study area. Historical information and species descriptions could be provided for visitors by the use of signboards or trail markers. Precautions must be taken, however, to avoid damage to the plant and animal populations by excessive collection or vandalism.
SUMMARY

A faunal survey of the vertebrates of Kalsow Prairie, a 160-acre virgin prairie situated in North Central Iowa, was combined with experimental burning of selected areas as a vegetative management technique. The distribution of the vertebrates in relation to the vegetation types and the effects of fire on this distribution were observed, with the following results:

1. Resident, neighboring, and transient species numbered 4 reptiles, 4 amphibians, 20 mammals, and 48 birds.

2. Most of the vertebrate animals were not harmed by the burning. Two dead garter snakes, two burned meadowlark nests, and one burned pheasant nest were found after the burns.

3. Singing-male counts and sight observations showed bobolinks to be the most numerous avian species, followed by redwinged blackbirds and western meadowlarks. The bobolinks nested in bluegrass or prairie areas. Meadowlarks were found near the borders, mainly in prairie vegetation. Redwings were primarily associated with the potholes. Other species also were limited by habitat preference.

4. Live-trapping of small mammals in prairie and bluegrass-prairie transition areas before and after controlled burning showed a movement of Microtus pennsylvanicus out of the burned areas and a correlated increase of Peromyscus maniculatus in these areas. Zapus hudsonius and Sorex cinereus showed a slight
decrease in the burned areas, and *Blarina brevicauda* and *Reithrodontomys megalotis* a slight increase.

5. Snap-trapping of small mammals was carried out in five types of vegetation: burned prairie, unburned prairie, bluegrass, sloughgrass, and the pothole complex. In general, *Microtus* was most prominent in the bluegrass and sloughgrass, *Peromyscus* in the burned prairie, *Sorex* and *Zapus* in both types of prairie and the wet spots (potholes and sloughgrass), and *Mus* in areas close to roads or farms (bluegrass and prairie). Slightly more *Reithrodontomys* were found in the unburned than burned prairie. The most abundant small mammals on the prairie were *Peromyscus maniculatus* and *Microtus pennsylvanicus*.

6. Chi-square analyses based on species habitat preferences and numerical distributions supported conclusions based on both groups of trapping data.

7. It was concluded that burning no more than 40 acres of the prairie in one year would not cause significant damage to the vertebrate populations resident there.
LITERATURE CITED


DuMont, P. A. 1933. A revised list of the birds of Iowa. Univ. of Iowa Stud. in Natur. Hist. 15: 4-164.


APPENDIX

The following is a species list of the vertebrates of Kalsow Prairie. Reptilian and amphibian nomenclature is after Conant, 1958. Mammalian nomenclature follows Hall and Kelson, 1959. Avian nomenclature is from the A. O. U. checklist, 1957. The symbols represent residency of the species: \( R = \) resident, living and breeding on the prairie; \( N = \) neighboring, living in the vicinity of the prairie; \( T = \) transient, migrant passing through the area.

CLASS Reptilia
Order Squamata
   Family Scincidae
      Northern prairie skink (Eumeces septentrionalis septentrionalis) \( R \)
   Family Colubridae
      Red-sided garter snake (Thamnophis sirtalis parietalis) \( R \)
      Western Plains garter snake (Thamnophis radix haydeni) \( R \)
      Western smooth green snake (Opheodrys vernalis blanchardi) \( R \)

CLASS Amphibia
Order Salientia
   Family Bufonidae
      American toad (Bufo americanus) \( R \)
   Family Hylidae
      Blanchard's cricket frog (Acris crepitans blanchardi) \( R \)
      Western chorus frog (Pseudacris triseriata triseriata) \( R \)
   Family Ranidae
      Northern leopard frog (Rana piniens piniens) \( R \)

CLASS Mammalia
Order Marsupialia
   Family Didelphiidae
      Opossum (Didelphis marsupialis) \( N \)
Order Insectivora
   Family Soricidae
      Masked shrew (Sorex cinereus) \( R \)
      Short-tailed shrew (Blarina brevicauda) \( R \)
Order Lagomorpha
  Family Leporidae
    - Eastern cottontail (*Sylvilagus floridanus*) N
    - White-tailed jack rabbit (*Lepus townsendii*) N

Order Rodentia
  Family Sciuridae
    - Woodchuck (*Marmota monax*) N
    - 13-lined ground squirrel (*Citellus tridecemlineatus*) R*
  Family Geomyidae
    - Plains pocket gopher (*Geomyys bucculentus*) R
  Family Cricetidae
    - Western harvest mouse (*Reithrodontomys megalotis*) R
    - Deer mouse (*Peromyscus maniculatus*) R
    - Meadow vole (*Microtus pennsylvanicus*) R
    - Muskrat (*Ondatra zibethicus*) R
  Family Muridae
    - House mouse (*Mus musculus*) R
  Family Zapodidae
    - Meadow jumping mouse (*Zapus hudsonius*) R

Order Carnivora
  Family Canidae
    - Domestic dog (*Canis familiaris*) N
    - Red fox (*Vulpes fulva*) N
  Family Mustelidae
    - Badger (*Taxidea taxus*) N
    - Striped skunk (*Mephitis mephitis*) N
  Family Felidae
    - Domestic cat (*Felis catus*) N

Order Artiodactyla
  Family Cervidae
    - White-tailed deer (*Odocoileus virginianus*) N*

CLASS Aves
Order Ciconiiformes
  Family Ardeidae
    - American bittern (*Botaurus lentiginosus*) T

Order Anseriformes
  Family Anatidae
    - Mallard (*Anas platyrhynchos*) N
    - Blue-winged teal (*Anas discors*) N

Order Falconiformes
  Family Accipitridae
    - Sharp-shinned hawk (*Accipiter striatus*) N
    - Red-tailed hawk (*Buteo jamaicensis*) N
    - Rough-legged hawk (*Buteo lagopus*) N
    - Marsh hawk (*Circus cyaneus*) N
  Family Falconidae
    - Sparrow hawk (*Falco sparverius*) N

*Terminology for these species does not follow Hall and Kelson.
Order Galliformes
   Family Phasianidae
      Ring-necked pheasant (Phasianus colchicus) R

Order Gruidae
   Family Phasianidae
      Virginia rail (Rallus limicola) T
      Sora (Porzana carolina) T

Order Gruiformes
   Family Rallidae
      Virginia rail (Rallus limicola) T
      Sora (Porzana carolina) T

Order Charadriiformes
   Family Charadriidae
      Killdeer (Charadrius vociferus) N
      Upland plover (Bartramia longicauda) N
   Family Scolopacidae
      Greater yellowlegs (Totanus melanoleucus) T
      Lesser yellowlegs (Totanus flavipes) T
      Pectoral sandpiper (Erolia melanotos) T
      Semipalmated sandpiper (Ereunetes pusillus) T
   Family Laridae
      Ring-billed gull (Larus delawarensis) T

Order Columbiformes
   Family Columbidae
      Rock dove (Columba livia) N
      Mourning dove (Zenaida macroura) N

Order Strigiformes
   Family Strigidae
      Short-eared owl (Asio flammeus) N

Order Caprimulgiformes
   Family Caprimulgidae
      Common nighthawk (Chordeiles minor) N

Order Piciformes
   Family Picidae
      Yellow-shafted flicker (Colaptes auratus) N
      Red-headed woodpecker (Melanerpes erythrocephalus) N

Order Passeriformes
   Family Tyrannidae
      Eastern kingbird (Tyrannus tyrannus) N
   Family Alaudidae
      Horned lark (Eremophila alpestris) N
   Family Hirundinidae
      Barn swallow (Hirundo rustica) N
   Family Corvidae
      Common crow (Corvus brachyrhynchos) N
   Family Troglodytidae
      Long-billed marsh wren (Talpomytes palustris) R
      Short-billed marsh wren (Cistothorus platensis) R
   Family Turdidae
      Robin (Turdus migratorius) N
   Family Sturnidae
      Starling (Sturnus vulgaris) N
   Family Parulidae
      Yellowthroat (Geothlypis trichas) R
Family Ploceidae
- House sparrow (*Passer domesticus*) N

Family Icteridae
- Bobolink (*Dolichonyx oryzivorus*) R
- Western meadowlark (*Sturnella neglecta*) R
- Red-winged blackbird (*Agelaius phoeniceus*) R
- Common grackle (*Quiscalus quiscula*) N
- Brown-headed cowbird (*Molothrus ater*) N

Family Fringillidae
- Dickcissel (*Spiza americana*) N
- American goldfinch (*Spinus tristis*) R
- Savannah sparrow (*Passerculus sandwichensis*) R
- Grasshopper sparrow (*Ammodenasmus savannarum*) R
- Vesper sparrow (*Poecetes gramineus*) N
- Lark sparrow (*Chondestes grammacus*) R
- Field sparrow (*Spiza pusilla*) N
- Song sparrow (*Melospiza melodia*) N
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