

Vertebrate Mortality During the Burning of a Reestablished Prairie in Nebraska

ABSTRACT: Evidence of direct mortality to vertebrates was gathered following controlled spring burns in a reestablished prairie in eastern Nebraska. During 3 years (1974-1976) in which observations were made, several species were killed by fires, including: cottontail rabbits (*Sylvilagus floridanus*), western harvest mice (*Reithrodontomys megalotis*), voles (*Microtus pennsylvanicus* and *M. ochrogaster*), bull snakes (*Pituophis melanoleucas*), plains garter snakes (*Thamnophis radix*) and red-sided garter snakes (*T. sirtalis*). Young harvest mice pups were particularly susceptible to spring prairie fires; mortality to these on a 22.8-ha section burned 26 April 1976 was estimated at between 208 and 522 individuals. Many eggs of ground-nesting birds were destroyed by the fires; species included were ring-necked pheasant (*Phasianus colchicus*), bobwhite quail (*Colinus virginianus*), mallard duck (*Anas platyrhynchos*) and meadowlark (*Sturnella neglecta*).

INTRODUCTION

A number of investigators have evaluated the effects of fire on vertebrates in various communities. Most reports indicate that the major factor affecting vertebrates is the abrupt habitat change following the fire, rather than direct mortality during the fire itself (Arata, 1959; Tester, 1965; Vogl, 1967; Schramm, 1968; Edwards and Ellis, 1969; Gorsuch, 1969; Komarek, 1969; Beck and Vogl, 1972). Only a few papers present evidence of direct fire mortality to vertebrates. Tevis (1956) reported finding a few dead wood rats (*Neotoma fuscipes*) following a slash fire in California. Keith and Surrindi (1971) searched 17.8 ha of a severely burned boreal forest and found three dead voles (no reference to species). Hakala *et al.* (1971) reported direct mortality to red squirrels, snowshoe hares, voles, shrews and some birds during the 1969 fire that burned 34,804 ha of the Kenai National Moose Range in S-central Alaska. There are also some reports citing mortality of ectotherms in fires (Howard *et al.*, 1959; Kahn, 1960; Bigham *et al.*, 1965). Few papers, however, have dealt with fire and animals in lowland prairie vegetation (Vogl, 1973).

This study was concerned with direct mortality or injury to vertebrates during the burning of a reestablished prairie with upland and lowland areas.

METHODS

The study was conducted at the Allwine Prairie Preserve of the University of Nebraska at Omaha, located ca. 8 km NW of Omaha in Douglas Co., Nebraska. The 65-ha area was seeded to native grasses in 1970 and since then a variety of management practices have been implemented to favor the restoration of prairie vegetation. During the course of this study the dominant warm-season grasses were big bluestem (*Andropogon gerardii*), little bluestem (*A. scoparius*), Indian grass (*Sorghastrum avenaceum*) and switch grass (*Panicum virgatum*). Beginning in 1974, annual fires in early spring were conducted on certain sections of the area to reduce competition from cool-season grasses and weeds. For a complete description and history of the study area, see Bragg (1978).

This study is the result of observations made during and after the controlled burns of 4 May 1974, 27 April 1975 and 26 April 1976. After each of these fires the burned area was searched for evidence of vertebrate mortality. Although only casual observations were made in 1974 and 1975, a 22.8-ha burn area in 1976 was systematically searched for a week after the fire. This burn area consisted of a S aspect of 3-15% slope (referred to as upland) and a flat lowland associated with a drainage area. Areas where ashes accumulated were probed and raked. Dead animals were collected and identified. The remains were frozen and stored for later identification at the laboratory. The number of harvest mouse nests in both the upland and lowland areas was estimated by a quadrat sampling technique.

RESULTS

Several mice (*Peromyscus* sp.) were observed running through the grass just ahead of the fire during the 1974 and 1975 burns. Apparently most of these mice found underground shelter. After the fire of 1974, one *Peromyscus* was observed in the smoking ashes; the animal seemed to be disoriented, but it was able to find a hole and retreat underground. In 1975 a vole (*Microtus ochrogaster*) was observed running through red glowing ashes only a few yards behind the fire line. Despite the apparent high temperature, the vole appeared to be healthy

and escaped with only slight singeing of its pelage. Searches of the burned areas in 1974 and 1975 provided no specimens of dead mammals, but a meadowlark nest (*Sturnella neglecta*) with four eggs was destroyed by the fire.

The spring burn of 1976 yielded considerable evidence of direct animal mortality. A burn around the boundary region during the 1st week of April resulted in severe burns to a litter of young cottontail rabbits (*Sylvilagus floridanus*) in a hedgerow nest. The young rabbits were almost of weaning age. One was badly burned and screaming, and was humanely killed. The others were able to run off; their injuries and eventual fate are unknown. During the main fire of 26 April 1976, an adult cottontail rabbit was observed immediately behind the fire line. It was disoriented and showed signs of burned pelage. Upon approach it jumped through the fire line and was not seen again.

Highest mortality during this fire was to young harvest mice pups (*Reithrodontomys megalotis*). A total of 536 harvest mouse nests were opened after the fire and examined. Eight nests contained 27 dead pups of all ages from newborn to almost weaned. One nest contained a dead full-term pregnant female harvest mouse with four fetuses. Most of the dead mice had burns on their bodies, but a few showed no evidence that they had been in direct contact with flames. Of 94 nests observed in detail, 72 (76.6%) had been burned through to the central chamber. The estimated number of harvest mouse nests was 5658 ± 1706 nests on the 6.9-ha lowland area and 1590 ± 1418 nests on the 15.9-ha upland area (95% confidence interval estimate using Student *t* distribution). The total number of harvest mouse nests on the burn area was estimated to be between 4124 and 10,372. Extrapolating the mortality rate of the 536 nests examined after the fire to the interval estimate results in a mortality of from 208-522 harvest mice pups on the entire burned area.

An additional 24 nests presumed to be meadow voles (both meadow voles, *Microtus pennsylvanicus*, and prairie voles, *M. ochrogaster*, are present on the study area) were examined; one dead young meadow vole was found beside a nest. This animal was almost of weaning age. A charred adult prairie vole was found on the ground far away from any nest. The number of vole nests on the burned area was estimated to be 366 nests. Since the number of vole nests per quadrat was so small and observed mortality was so low, no meaningful estimates of vole mortality on the entire burned area could be made.

Three dead snakes were collected after the 1976 fire; these included a bull snake (*Pituophis melanoleucas*) of 1.07 m, a plains garter snake (*Thamnophis radix*) of 0.33 m, and a red-sided garter snake (*T. sirtalis*) of 0.34 m. All of these were badly burned and charred. Three live bull snakes and a red-sided garter snake were captured on the burned area during the week after the fire. One of the bull snakes had burns on its dorsal surface, but otherwise it was in good health.

No direct mortality of birds was observed in 1976, but a considerable number of nests of ground-nesting birds were destroyed. Included were 38 ring-necked pheasant (*Phasianus colchicus*) nests containing a total of 336 eggs; two bobwhite quail (*Colinus virginianus*) nests each with three eggs, and a mallard duck (*Anas platyrhynchos*) nest with three eggs. The reaction of pheasants and quail to the fire was similar: the birds flew from the grass only after the fire had approached to within a few meters. Several times both quail and pheasants were observed flying through flames that at times reached 5-7 m in height. This apparently did not harm the birds. One pheasant hen flew through the flames and landed in the smoking ashes just behind the fire line. Although she appeared to be confused, she did not appear to be injured.

DISCUSSION

Most studies have demonstrated that there is little direct fire mortality to vertebrates and this is probably true for most species. Some animals, however, may be more susceptible to fire mortality because of certain aspects of their biology. This susceptibility may be different at various times of the year or even at different times of the day. Although our data indicated that ectotherms such as snakes and the young of several species of small mammals were sometimes killed by fire, the preweaned young of the western harvest mouse were particularly vulnerable to spring prairie fire. Other small mammal species common to the area (*Peromyscus maniculatus*, *P. leucopus*, *Perognathus flavescens*, *Blarina brevicauda*, *Sorex cinereus*, *Cryptotus parva*, *Spermophilus tridecemlineatus*) mostly utilize underground nests. No evidence of direct mortality to these species was observed.

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Allee *et al.* (1949) contended that grassland animals survive fires because of their adaptations to fires. But Handley (1969) questioned whether a particular adaptation of a species such as burrowing is an adaptation to fire or to other environmental factors. Shump (1974) has commented on some of these factors in regard to western harvest mouse nests. The western harvest mouse produces a nest that is well adapted to dense lowland vegetation. Our data suggest that the nest is poorly adapted to the relatively infrequently occurring environmental factor of fire.

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