EFFECTS OF HIGHWAY CONSTRUCTION ON GAME ANIMALS

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Abstract: Distributions of game animals in relation to a four-lane, limited-access highway were monitored before, during, and after highway construction along Appalachian Highway 48 in northern West Virginia from 1971 to 1975. All game species monitored were affected as a result of habitat loss due to the highway itself occupying land but none exhibited a chance in distribution due to highway construction. Only the wild turkey (*Meleagris gallopavo*) seemed to avoid the highway.

Proc. Ann. Conf. S.E. Assoc. Fish & Wildl. Agencies 32: 48-52

Studies concerned with highway mortalities (vehicle-wildlife encounters) or utilization of highway rights-of-way by animals have been conducted but information on effects of highways upon game populations is limited. A few studies relating population densities to highways are currently being conducted but only preliminary results are available (Leedy 1975, Ferris 1977). Wildlife are affected in part because of the loss of the area occupied by the highway pavement. The completed interstate highway program will include 66,000 km of road, encompassing 610,000 ha of land (Hancock 1963, Scheidt 1967, Oetting and Cassel 1971). The impact of increased traffic flow on human intolerant species may be even more important than direct mortality or immediate removal of habitat. Bailey and Rinell (1968) emphasized the wild turkey's requirement for minimum human contact and observed that thriving turkey populations do not exist where roads exceed 24 km per 4,000 ha. The black bear (*Ursus americanus*) may be equally dependent upon wilderness areas and will not tolerate human disturbance during certain seasons of the year (Bailey 1954). Miller (1975) conducted a study of black bear in West Virginia and found that bears seemed to avoid intensively-used highways. However, in some portions of their range turkey and black bear have adapted to man's presence and are much more tolerant of human disturbance than they were formerly.

Several benefits, both direct and indirect, may result from highway construction. Several studies have substantiated the beneficial aspects of highway rights-of-way due to increased food and cover (Egler 1957, Richter 1958, Goodwin and Niering 1959, Hankla 1959, Oetting 1971, Snyder 1974).

The primary objective of this study was to determine the effects of the construction and presence of this super highway on certain game populations. The study was funded by the West Virginia Department of Highways in cooperation with the U.S. Department of Transportation, Federal Highway Administration. This is Scientific Paper No. 1574, West Virginia University Agricultural and Forestry Experiment Station.

METHODS

This study was conducted at Coopers Rock State Forest, in northcentral West Virginia where Corridor "E" (Appalachian Highway 48), a high-speed, limited-access highway was constructed. The portion of Corridor "E" which passes through the study area is 8.7 km in length, 75-90 m wide and occupies an area of approximatly 101 ha. Timber in the area consists of 30 to 40 year old, pole-size, even-aged hardwoods. The major cover types are cove hardwood and mixed oak.

The first phase of construction for Corridor "E" began in 1970 with a land survey and the removal of a few trees. Actual construction began in 1971, and continued in 1972, with heavy equipment work, including blasting, taking place throughout the entire study portion of Coopers Rock State Forest. The highway was opened to traffic in December 1973. Limited vehicular traffic was present in the study area prior to constructing Corridor "E". A narrow, winding, secondary road (Route 73) roughly parallels Corridor "E". The distance between the 2 roads varies from 75m to approximately 800m.

Right-of-way vegetation consisted primarily of Kentucky 31 fescue which was hydro-seeded on all exposed faces of cuts and fills. In addition to this new grassy habitat, a second habitat type was created where the right-of-way vegetation met the forest. Vegetation density in this ecotone was 36 stems per milacre compared to 17 stems per milacre for the forest. Average width of the right-of-way vegetation ws 53 m and average depth of the ecotone was 3 m.

Data were collected along 4 transect lines, each 1.6 km long, and extending perpendicular to the highway. A total of 307 censuses were conducted monthly from September 1970 through December 1974. Censuses were conducted throughout all daylight hours in 2 different ways. When snow was present 1 person walked along the transect line and recorded all tracks and all sightings of animals. During periods without snow, animal droppings were counted by 3 or 4 persons walking approximately 6m apart along the transect line. Droppings and any other sign such as feathers, bedding sites, and turkey scratchings were recorded in each 160 m segment.

Game animals recorded in this investigation were: cottontail rabbit (*Sylvilagus floridanus*), gray squirrel (*Sciurus carolinensis*), ruffed grouse (*Bonasa umbellus*), wild turkey, white-tailed deer (*Odocoileus virginianus*) and fox. Both red (*Vulpes fulva*) and gray (*Urocyon cinereoargenteus*) foxes were present but they were classified as fox in this paper.

Data were analyzed by 2 different methods: (1) percentage distribution and (2) adjacent-distant comparison. Changes in actual population densities could not be compared due to data collection techniques, but relative densities in each 160 m segment of a transect line could be statistically compared.

The percentage distribution method evaluated distribution shifts in relation to the highway by comparing percentages of total sign present in each segment of a transect line (Michael 1976). For example, if prior to construction 10% of all deer sign recorded along a transect was located within the first 160 m segment as compared to a significantly lower percentage in the same segment after construction the conclusion would be that construction adversely affected this species. The adjacent-distant method tested differences between actual numbers of animal sign found within the first 320 m of the highway and numbers within the last 320 m. The end of the transect line served as a control. Data were tested by chi-square and analysis of variance at the 0.05 probability level of significance.

RESULTS AND DISCUSSION

The number of "sign" recorded for each game species during each phase of construction is presented in Table 1. Due to age of the timber (30-40 years), which results in very little mast being produced and little understory being present, most game animals, especially rabbits, squirrels and grouse, were at low population levels.

Due to the nature of sign, data must be interpreted differently for each species. Sign were more numerous for deer than for all other species combined. Almost all fox and squirrel sign was in the form of tracks in the snow, with only a few droppings and few observations of animals being recorded. Distributions for foxes and squirrels are indicative only of the winter situation. Turkey sign included observations, droppings, tracks in the snow, scratchings (in leaves and snow) and calls made by gobblers during the mating season. Thus, turkey sign is more representative of distribution during the entire year than is that for other animals. Sign for rabbits and grouse was in the form of droppings and tracks, with only a few actual observations of each species being made.

Only 1% of all turkey sign was within 160 m of the highway as compared to 15% for rabbits, 12% for fox, 11% for grouse, 10% for deer, and 4% for squirrel. Absence of turkey sign from the area adjacent to the highway suggests they were avoiding the secondary road even before construction began on Corridor "E". Distribution along the transect lines did not change significantly for any animal except deer (Fig. 1). Deer distribution

Table 1. Total number of "sign" recorded for each game animal throughout the four phases of the study.

	Pre-Construction	*Construction*		*Post-Construction*	*Total*
		Heavy Equipment	*Paving*		
Deer	1074	3159	3632	3377	9696
Fox	195	214	357	182	948
Squirrel	105	164	279	86	634
Grouse	95	54	103	69	321
Turkey	2	46	95	158	301
Rabbit	9	113	64	109	295

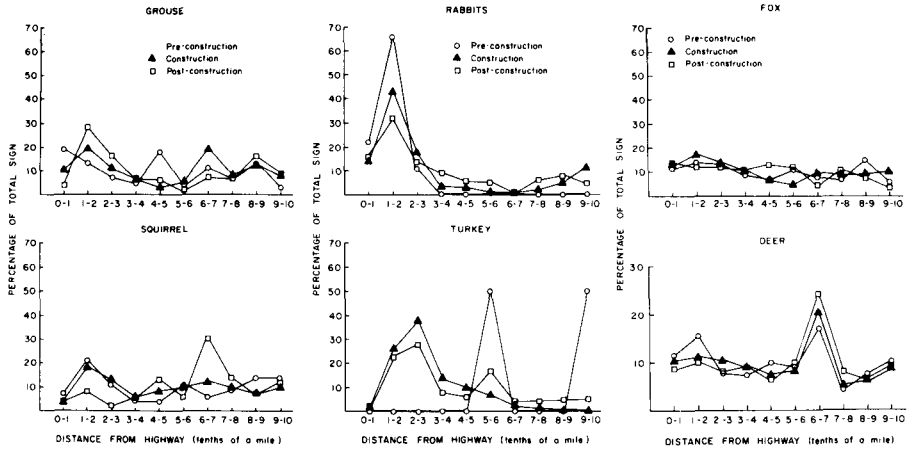

Fig. 1. Distribution of game animals along a 1.6 km transect perpendicular to a high-speed highway.

only changed significantly during winter when they were closer to the highway after construction started than they were during the pre-construction period. These differences were due to deer responses to snowfall rather than to highway development. Deer concentrated along certain portions of the transect lines during deep snow because of the presence of streams and dense thickets of rhododendron (*Rhododendron maximum*). The amount of animal sign near the highway did not differ significantly from the amount 1.6 km from the highway for any species (Fig. 2).

CONCLUSIONS

Populations of game animals present were not affected by highway construction. We had hypothesized that populations in general would decrease during the first phase of construction (blasting, heavy equipment, etc.), then increase during later stages of construction (paving, sign erection, etc.), and decrease when traffic became heavy. Foxes were the only animal which followed a pattern similar to what was hypothesized. However, this pattern was similar for foxes 1.6 km from the highway; thus, it seems that population changes were not due to highway development.

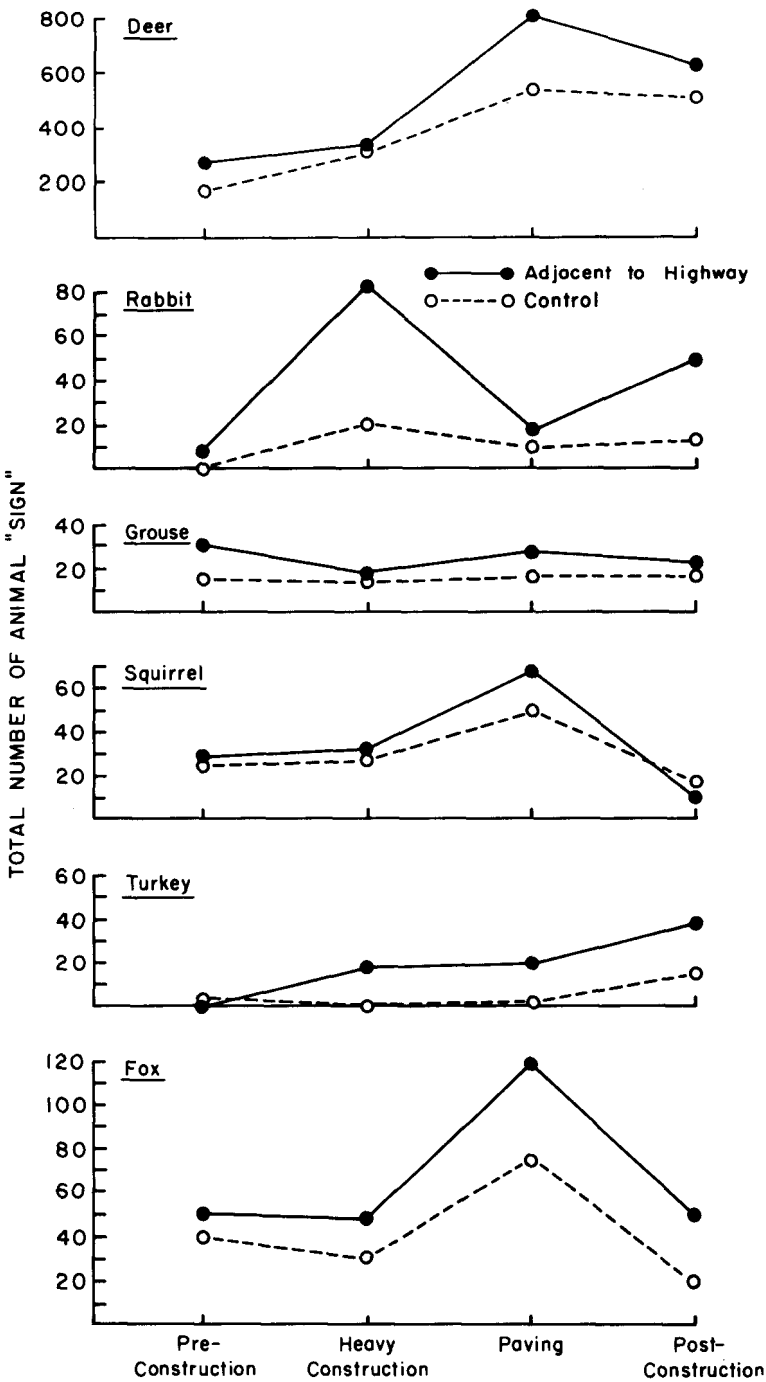

Fig. 2. Population changes for game animals before, during, and after construction of a high-speed highway.

Our study was involved with immediate effects of highway construction. However, the data we did collect provide a good base for estimating long-term effects. It would seem that any adverse effects in animals moving away from the highway would be most pronounced during the years of construction, and the first few years of traffic. For most animals it is doubtful whether adverse effects would show up later if they were not evident during the first 4-5 years after highway construction started. Long-term effects could be more beneficial than harmful. Development of the right-of-way and ecotonal vegetation may result in increases of those animals which frequent such habitat types.

Our major concern prior to beginning this study was that the effects of highway construction and presence might extend beyond the edge of the right-of-way vegetation. For the animals in our study area it appears that habitat loss is restricted to the area occupied by the paved portion, berm and (for some species) right-of-way vegetation. This loss is certainly of major importance and should not be minimized. However, it is partially compensated for through the addition of the right-of-way vegetation and ecotonal areas which are created. Impacts of highway construction in this region were probably more severe in wetlands than in upland habitats. Construction did modify drainage patterns and the associated aquatic habitats but this study was not designed to monitor these changes. As with most projects which have an impact on the environment a trade-off of species occurs. Some species (mostly non-game) increase as a result of highway construction, while other decrease.

LITERATURE CITED

Bailey, R. W. 1954. Are we losing the black bear in West Virginia? W. Va. Cons. 17(11):4-9, 28-29.

_____and K. T. Rinell. 1968. History and management of the wild turkey in West Virginia. W. Va. Dept. of Nat. Res. Bull. 6.

Egler, R. E. 1957. Right of ways and wildlife habitat: A progress report. Trans. N. Am. Wildl. Conf. 22:133-142.

Ferris, C. R. 1977. Effects of Interstate 95 on songbirds and white-tailed deer in northern Maine. Ph.D. Thesis, Univ. of Maine, Orono. 48 pp.

Goodwin, R. H., and Wm. A. Niering. 1959. The management of the roadside by selective herbicide techniques. Proc. Ann. Meeting N.E. Weed Control Conf. 13:530-532.

Hancock, N. J. 1963. Impact of interstate highways upon the wildlife resource. Proc. Ann. Conf. West. Assoc. State Game and Fish Comm. 43:183-187.

Hankla, D. 159. Utility rights of way—wildlife lands of promise. Wildl. in N.C. 23(1):18-19.

Leedy, D. L. 1975. Highway-wildlife relationships, Vol. 1, A State of the Art Report. Rept. No. FHWA-RD-76-5, Fed. Highway Admin. 183 pp.

Michael, E. D. 1976. Effects of highways on wildlife. W. Va. D. H. Research Project 42. W. Va. Dept. Highways, Charleston. 89 pp.

Miller, T. O. 1975. Factors influencing black bear habitat selection on Cheat Mountain, West Virginia. M.S. thesis, West Virginia Univ. 61 pp.

Oetting, R. B. 1971. Right-of-way resources of the prairie provinces. The Blue Jay. 179-183.

_____and J. F. Cassel. 1971. Waterfowl nesting on interstate highway right-of-way in North Dakota. J. Wildl. Manage. 35(4):774-781.

Richter, W. C. 1958. Wildlife food and cover by the mile. Pa Game Nes. 29(5):43-44.

Scheidt, M. E. 1967. Environmental effects of highways. J. Sanitary Eng. Div. Proc. Am. Soc. Civil Engineers. 93:17-25.

Snyder, E. D. 1974. Pheasant use of roadsides for nesting in northeast Colorado. Col. Div. Wildl. Special Rept. No. 36. 24 pp.