Wildlife—An Essential Consideration Determining Future Highway Roadside Maintenance Policy

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•PRIMARILY because of economic considerations, many states are altering their programs of vegetation management on highway roadsides by reducing the frequency of mowing. This change in maintenance policy will result in substantial increases in acreages of nesting cover along highway roadsides for songbirds and game birds. In the Midwest the ring-necked pheasant (Phasianus colchicus) could be a prime beneficiary, but at the same time may cause some concern for motorist safety. This report traces the history of roadside development, and discusses newly emerging concepts of roadside vegetation management and the resulting implications for ground-nesting birds and small mammals in the Midwest.

HISTORICAL BACKGROUND OF ROADSIDE DEVELOPMENT

The first hard roads constructed in the United States followed the shortest and most direct routes, without regard for trees or other natural features, and resulted in "railroad cross section" types of roadbeds (12). In 1924, the first public motor parkway in America (the Bronx River Parkway in Westchester County, New York) was opened to traffic. Here, for the first time, the roadway was the primary feature in parkway design (65), and represented ". . . the forerunner of our nationwide system of controlled-access highways" (30).

Concepts that emerged from the construction of early parkways were the stimulus for three periods in the evolution of roadside development between 1930 and 1965 (66). The period of interpretation (1930-1946) saw the coordination of roadside development with roadway construction programs. Roadside development started with erosion control along the first all-weather roads constructed in the 1920's (30). The concept of the "complete highway," first delineated by the Highway Research Board in 1943 (30), included 4 points:

1. Utility—The ability to serve commercial, recreational, local, interstate, and other categories of traffic.
2. Safety—The orderly movement of vehicular and pedestrian traffic. . . .
3. Beauty—. . . a basic element in the harmonious integration of engineering, architectural, and landscape techniques. . . .
4. Economy—A combination of effective design and pleasing appearance at a reasonable cost for construction and maintenance. . . .

Miller (55) wrote that the central idea of the complete highway is ". . . the adaptation of an artery of motor traffic into the natural setting of the countryside, thereby conserving both the beauty of the countryside and the land values for future generations." This concept has greatly influenced the planning for construction of new highways.

The period of communication (1947-1965) "among the States in the buildup of experience for progress in esthetics and roadside development" (66) featured the 1956 Act for the National System of Interstate and Defense Highways. When completed, the

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Interstate System will consist of 41,000 miles of mostly divided four- or six-lane limited-access highways. This program is bringing aesthetics to the forefront in highway construction as ". . . some hard looks were taken at the concept that highways were not merely pavements in selected right-of-way corridors but important elements in the environments they passed through" (62). Guidelines established for design of highways in the Interstate System stressed the four points of the complete highway. For example, the U. S. Bureau of Public Roads approved the "Geometric Design Standards" adopted by the American Association of State Highway Officials (1), which stated, "Divided highways should be designed as two separate oneway roads to take advantage of terrain and other conditions for safe and relaxed driving, economy, and pleasing appearance. . . ." Haile (28) stated that this proposal means that the approach to design held in the past, which was to adopt a fixed cross section, a constant width of median, and identical gradelines on the two roadways, should be discarded and that each one-way road should be located and designed independently of the other.

The policy on landscape development for the Interstate System published by AASHO (2) stressed, among other things, the following points: (a) conservation of "all desirable landscape features and land values"; (b) variation in width of right-of-way "to conserve landscape features and to fit the localized requirements of grading, drainage, erosion control, and planting for each portion of the highway"; and (c) provision of "at least 50 feet of roadside border. . . beyond the outer edges of roadway shoulders." But on rural highways, there should be acquisition of "additional right-of-way to natural demarcation lines such as streams, shorelines, cliffs, and tops of ridges. . . ." These changes in the concepts of highway design and associated roadway development resulted in substantial acreages in roadsides, medians, and interchanges created in conjunction with highways now being constructed, particularly those in the Interstate System.

The period of action for highway natural beauty (1965), according to Simonson (66), "witnessed a dynamic acceleration of pace in highway landscape planning and construction. . ." and was "a period of intense action for highway esthetics and roadside development." The White House Conference on Natural Beauty resulted in the President's submitting to Congress a bill of consequence to roadside development, recommending legislation on (a) control of outdoor advertising, (b) control of junkyards, and (c) broadening of existing authority to use federal funds for the cost of landscape and roadside development. This proposal was enacted into law by the 89th Congress as the Highway Beautification Act of 1965. The sections of the Act serving to control outdoor advertising and junkyards concern not only the area along the roadside, but that beyond the normal right-of-way line.

VALUE OF WIDE RIGHTS-OF-WAY

Fulfilling the four requirements of the complete highway is, to a great extent, contingent on having adequate rights-of-way. Acquisition of wide rights-of-way for modern highway construction can usually be justified for reasons of economy alone. Many older roads had a standard 66-foot width, and when it became necessary to add lanes or widen a road, adjacent property had to be purchased at high cost. Engineers now consider it good practice to require rights-of-way wide enough to accommodate the ultimate expected development (57). A cross section with flat slopes, possible on wide rights-of-way, minimizes the need for expensive guardrails and provides roadside slopes that may be mowed easily and rapidly with mechanized equipment instead of hand labor (51).

Many safety features of highways are enhanced with wide rights-of-way. Deakin (16), Gnau (27), Ives (42), and Stonex (71) have mentioned the safety benefits of flat, well-rounded side slopes and wide, gently rounded drainageways that help prevent the overturning of out-of-control vehicles. Substantial rights-of-way allow functional as well as aesthetic plantings. Vegetation may be planted to direct the line of sight of the motorist around the highway curvature (25) and to accent danger areas (bridge abutments, culvert head walls, etc.) near the outer edge of the shoulder (19, 42). Sufficient width of right-of-way and controlled marginal lands will provide drivers with safe sight distances commensurate with the design speed (4, 18, 42).

Noise abatement by border plantings and provision for rest areas and safety turnouts are possible utility features of liberal rights-of-way (2, 5, 49).

Wide rights-of-way are important from the standpoint of preserving and developing roadside beauty. In rural areas they permit blending the road into the natural landscape and provide space to plant screening vegetation in front of objectionable and unsightly objects (4, 57).

TRENDS IN ROADSIDE MAINTENANCE PRACTICES

Prior to 1940, the quality and quantity of highway roadside turf management were negligible. Maintenance consisted of a few mowings a year, weed control was just starting, and the requisite labor was available. It was difficult to control erosion along new highways where little attention was given to roadside development during the construction phase. As development of vegetation on roadsides became integrated into the construction phase, increased attention was given to roadside maintenance, which centered around mowing and weed control. Today, control of roadside vegetation (primarily mowing) constitutes a sizable portion of maintenance operations.

Roadsides are mowed to improve appearance, control noxious weeds, aid drainage, improve turf density, reduce fire hazards (10, 47), and "because it is considered desirable to keep the neatness and well-kept appearance of adjacent fields unbroken" (59).

Development of Roadside Vegetation Management

Management of roadside vegetation became a significant segment of total highway maintenance costs as the number of highways increased. Ohio cut maintenance costs by restricting the mowing schedule in at least one division as early as 1943 (10). The 1950's saw a surge of activity in chemical weed and brush control as it became apparent that chemicals were often more effective and economical than mechanical methods (26, 72). Despite rapid development of methods of chemical weed control, improvement in maintenance equipment, and changes in highway design favoring easier roadside maintenance, highway administrators were listing rising maintenance costs second only to highway safety as their most important problem by the early 1950's (64, 79).

Impact of the Interstate System on Concepts of Roadside Maintenance

Completion of the Interstate System will provide an additional 1 million acres of roadside area. When added to the estimated 3.5 million acres already being mowed each year (13), the economic aspects of this added maintenance burden become awesome. The growing maintenance problem emphasized the need to modify existing concepts of roadside management. Parker (58) cited Paragraph 109, Public Law 85-767 (1958), which called for "economy of maintenance" and "maintenance at a reasonable cost" as requirements for approval of projects on any federal-aid system. Because a direct reference to the need for economy in maintenance operations did not appear in previous federal highway legislation, Parker concluded that "the law surely points out that there was dissatisfaction with previous roadside concepts and that maintenance could be performed at a reasonable cost."

Typical of many published accounts calling for a new approach to highway roadside management on the Interstate System, particularly intensive mowing, was the comment by Gordon in the discussion moderated by Brant (11): "On extensive roadside areas. . . maintenance of closely mown lawn-type areas will often be unnecessary, particularly in wide operation country at a distance from metropolitan population centers." Hottenstein (31), in discussing the implications of the 1 million acres of roadside to be added by the Interstate System, stated:

> Considering the fact that these many acres of roadside are being added to the maintenance engineer's responsibility without a corresponding increase in his budget, it is almost inconceivable that so little has been done to develop management standards....Mowing to achieve a lawn or fairway appearance from fence-line to fence-line through rural and forested countryside belongs in the luxury category, and besides, it cannot be justified aesthetically.

Strangely, such practices evoke favorable comments for the reason that they create a neat appearance. Such high-class, city-park type mowing is not within the capacity of the maintenance engineer's budget. Even from an appearance standpoint such practices cannot be justified. Many of the roadside areas within the right-of-way should be managed to achieve a natural effect, thus making them an integral part of the adjoining countryside. The picture of mile after mile of neatly maintained turf areas resembling lawns and fairways is neither distinctive nor indicative of the character of the natural environment of the State or locality the motorist views.

The basic elements of a common sense mowing program are as follows:

1. It is not necessary to mow every acre of roadside vegetation in order to maintain properly the right-of-way of a modern highway.
2. The mowing program must be planned. Roadside areas should be arranged in categories and a vegetation management program prepared to fit the needs. Cultural practices and land-use patterns along the right-of-way should dictate the roadside treatment. As a general rule it should not be necessary to mow the following locations: slope areas 2.5:1 and steeper; roadsides adjacent to natural woodland and swamp areas; and areas in agricultural sections with dense uniform stands of desirable species of grasses and legumes beyond ditch lines.
3. There must be a reason, a justification, for mowing the various areas comprising the roadside.

Hottenstein (31), citing "Guide for Roadside Mowing" by the maintenance standards committee of AASHO (3) as encouraging "evidence of positive action to develop control policies for turf management. . .," nevertheless felt that the document does not entirely clarify the big question, "Where to mow?"

Fundamental changes in concepts of turf management were no doubt partially prompted by public acceptance and by success of minimum mowing schedules on such privately financed and operated highways as the Illinois Tollway (48), the New York Thruway (50), and the Ohio Turnpike (80). Even rural or local road jurisdictions have been called on to eliminate unnecessary mowing (6).

Current Roadside Management Practices

During December 1966, questionnaires were sent to the Chief Highway Engineers in 13 states and to two turnpike commissions. Included in the survey were Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Nebraska, North Dakota, Ohio, South Dakota, Pennsylvania, Wisconsin, and the Ohio and Pennsylvania turnpikes. Portions of each of these states possess sizable populations of ring-necked pheasants. The questionnaire was designed (a) to obtain information on current practices of roadside maintenance and (b) to determine the attitude of highway administrators regarding management of highway roadsides for nesting birds. All 15 questionnaires were returned.

Of the 15 respondents, 5 (33 percent) reported that highway roadsides were mowed from fence to fence, beginning with the first mowing each summer. Six (40 percent) mowed beyond the ditch only once, in late summer, and four (27 percent) carried out no mowing beyond the ditch. Thus, 10 of 15 respondents were, in effect, employing minimum mowing schedules beyond the ditch.

Eleven respondents (73 percent) reported that spraying was used to supplement mowing, and five reported that spraying was used to eliminate one or more mowings. Ten respondents revealed that changes had been made in mowing policy over the last 10 years; however, 13 (87 percent) did not anticipate any further changes in the near future. One of the two respondents that expected changes to be made anticipated less mowing; the other expected more mowing in areas where herbicides have proved ineffective.

Eight (73 percent) of the 11 responding to a question on changing costs of mowing reported increases in mowing costs; three (27 percent) reported decreases. According to these estimates, per-acre mowing costs increased an average of 5 percent each year since 1960. Ten respondents provided figures on mowing costs. Annual per-acre mow-

ing costs for two-lane highway roadsides were $11.86, and for four-lane and Interstate roadsides, $17.78; the average cost for all highways was $15.19 per acre. Butler and Yoerger (13), reporting on data collected in 1959 and 1960, calculated total mowing costs of $10.21 per acre per year.

Two significant points can be made from these data: (a) the trend toward increased costs of vegetation control along highways shows no signs of abating without major changes in maintenance policies; and (b) through the use of selective herbicides and realistic mowing programs, many states among those surveyed are attempting to place costs of roadside vegetation management in a better perspective relative to the total highway maintenance budget.

Published data from the Illinois Department of Public Works and Buildings, Division of Highways (32, 33, 34, 35, 36, 37, 38, 39, 40, 41), provide an example of rapidly rising costs of roadside maintenance (Table 1). Illinois follows a policy of mowing virtually all accessible areas within highway rights-of-way two to four times each summer. The cost of clearing and cutting vegetation along "regular highways" increased from $221 per mile in 1955 to $446 per mile in 1964, an increase of over 100 percent. Data on roadside vegetation control along Interstate Highways in Illinois are limited to only 3 years, but show a cost of $950 per mile in 1962, $989 per mile in 1963, and $1,026 in 1964, an increase of $76 per mile over the 3 years. Cutting and clearing vegetation along Interstate highways represented 23.6 percent of total maintenance costs for these roads in 1962, 22.7 percent in 1963, and 21.5 percent in 1964. These rapidly rising mowing costs come at a time when Illinois highway administrators are increasingly concerned over high maintenance costs (54, 67).

Construction of additional four-lane highways in many parts of the country can be expected after the completion of the Interstate System. For example, the Illinois Legislative Highway Study Commission has before it a proposal for the construction of 2,175 miles of supplemental freeways to be added to the 1,623 miles of road in the Interstate System still under construction (68). Many existing two-lane highways may be upgraded and expanded in Illinois, as elsewhere. Because of mounting costs, the increased acreage of roadsides resulting from improved highway systems will probably receive even less intensive maintenance (primarily mowing) than is true today in at least one-third of the states contacted. The result will no doubt be substantial acreages of largely undisturbed grassy vegetation along most highways. In the Midwest, such areas will provide an additional source of nesting cover for the primary game bird of the region, the ring-necked pheasant. This prospect may be encouraging to game managers, but the safety implications of this development will require close scrutiny by highway administrators.

TABLE 1

COST OF CUTTING AND CLEARING ROADSIDE VEGETATION IN ILLINOIS

Year	Regular Highways (1955-1963)		Interstate Highways (1962-1964)	
	Cost per Mile ($)	Percent of Total Maintenance Budget	Cost per Mile ($)	Percent of Total Maintenance Budget
1955	221	13.8	—	—
1956	245	15.0	—	—
1957	242	14.1	—	—
1958	280	14.9	—	—
1959	301	15.4	—	—
1960	344	15.4	—	—
1961	338[a]	15.4	—	—
1962	330	13.0	950	23.6
1963	413	15.6	989	22.7
1964	446	15.7	1,026	21.5

[a]Includes Interstate Highways.

HIGHWAY ROADSIDES AND WILDLIFE

Wildlife as a Hazard to Traffic

During the 1930's, when wildlife research and management were still in the formative stages, several papers were published documenting the destruction of wildlife on highways. Dickerson (17), Linsdale (52), Scott (61), and Starrett (69), among others, presented data revealing that substantial numbers of birds, mammals, reptiles, and amphibians were killed on highways. Today, with a much greater volume of traffic and higher speeds, wildlife mortality on highways continues.

The growing acceptance of minimum maintenance procedures intensifies the need for investigating the possible safety implications of increased use of highway roadside cover by nesting game birds, particularly in the Midwest. The literature reveals that this question has received little attention. A recent Highway Research Board publication summarizing current knowledge on roadside development (30) discusses safety in roadside development during the planning, design, construction, and maintenance phases; the publication calls for minimum mowing of highway roadsides, but makes no mention of any safety problems that might be created from increased utilization of unmowed roadsides by wildlife. Similarly, Hottenstein (31), while advocating nonmowing of areas beyond the ditch in agricultural regions where grasses and legumes exist, does not refer to possible safety problems in the pheasant states.

Of all wild and domestic animals that cause accidents on highways, deer constitute the greatest menance. Nearly 200 deer were reported killed on Wisconsin highways in 1937 (14); Jahn (44) reported that 6,416 deer were killed on the highways in the state between 1946 and 1955; mortality of deer on highways was 29,129 for the 3 years 1964 through 1966 (75, 76, 78). In Michigan (19) the number of highway-killed deer increased each year from 1959 (2,761 killed) to 1966 (6,290 killed). Data from turnpikes and tollways reveal the magnitude of accidents involving deer (Table 2). Between 1964 and 1966, of the 31,601 accidents occurring on seven such highways, 1,984 or 6.3 percent were caused by deer. Problems arise in wooded terrain where deer travel-lanes intersect highways (7, 8, 73), and the danger is increased during the breeding season and when the animals seek salt spread on roads for snow and ice control. In Wisconsin (77), biologists feel that the primary reasons deer are found along highways are (a) to feed during spring, summer, and fall; (b) because of normal daily movements (including rutting season activity); (c) to escape insects; and (d) to obtain salt. Jahn (44) and Wilson (74) also report that utilization of roadside cover by deer is responsible for some accidents.

TABLE 2

VEHICULAR ACCIDENTS INVOLVING DEER AND OTHER ANIMALS ON EIGHT TOLL ROADS AND TURNPIKES, 1964-1966

Toll Road/Turnpike	Total Accidents	Accidents Involving Deer	Accidents Involving Animals Other Than Deer	Accidents Involving Deer and Other Animals
Illinois State Toll Highway	3,522	75(2.1)[a]	—	—
Indiana Toll Road	2,688	188(7.0)	—	—
Kansas Turnpike	1,765	96(5.4)	3(0.2)	99(5.6)
Massachusetts Turnpike	2,204	73(3.3)	—	—
New Jersey Garden State Parkway	4,988	281(5.6)	54(1.1)	335(6.7)
New Jersey Turnpike	5,088	—	—	36(0.7)
New York State Thruway	13,236	1,197(9.0)	105(0.8)	1,302(9.8)
Ohio Turnpike	3,198	74(2.3)	17(0.5)	91(2.8)
Totals	36,689	1,984	179	1,863
Proportion of appropriate total (percent)		5.7	0.8	8.0

[a]Percentages are in parentheses.

Whereas the hazard of deer to vehicles is obvious, the significance of small mammals and birds as a safety threat is less clear. Few data are available on accidents caused by animals other than deer. Here again, the turnpikes and tollways are the best sources of information, although only four of the eight contacted could provide specific information. On the New York Thruway between 1964 and 1966, 105 accidents were caused by animals other than deer, accounting for approximately 0.9 percent of all accidents during the period; involved were 72 dogs, 9 cows, 2 birds, and 22 other animals. The Kansas Turnpike reported there were no accidents caused by animals other than deer in 1964 and 1965, but there were three in 1966 (one coyote, two steers) accounting for about 0.2 percent of all accidents over the 3-year period. Small mammals caused 54 accidents on the New Jersey Garden State Parkway between 1964 and 1966, or 1.1 percent of all accidents during that time. Those involved were "dogs, raccoons, and skunks, etc.," but no birds were known to have caused accidents. The Ohio Turnpike reported 17 of 3,198 accidents (0.5 percent) caused by small mammals and birds, usually pheasants, over the 3-year period.

Several studies in recent years have shown that sizable numbers of small mammals and birds are killed on highways, although none discussed the implications for traffic safety. Jackson (43) reported that during 1948, 14,096 wild birds and mammals were killed on highways in seven northwestern Pennsylvania counties, with rabbits being the most frequent victims. Another study in southern Minnesota (70) showed that 3,356 small mammals and birds were found dead in 153,000 miles of driving between 1947 and 1952. From 1932 to 1950 Schorger (60) kept a record of all dead birds on the highway between Madison, Wisconsin, and Freeport, Illinois, which he traveled 693 times during the period. A total of 64 species of birds were observed dead on the road, with pheasants constituting 5 percent of the total killed and songbirds the balance. In Minnesota, a 1949 through 1951 study reported by Longley (53) showed that pheasants, striped skunks, and rabbits were the species most frequently killed. Other Minnesota workers (24) found an average of one dead pheasant every 235 miles over 113,000 miles of highway throughout the pheasant range in that state.

Roadside Management Considerations for Wildlife

The primary concern of highway administrators has justifiably been for the safe, efficient movement of the increasing volume of traffic. Conservation considerations, as related to highways, have been almost entirely confined to those having direct bearing on the highway user (e. g., roadside erosion control, functional control, functional plantings). Development of habitat for wildlife on highway rights-of-way has been rarely, if ever, undertaken. Conservationists have argued for roadside management practices beneficial to game birds and mammals (15, 21, 22, 23), but have generally not called for specific projects for development of wildlife habitat along highways.

Dreesen (20) saw the need for a national policy on highway roadside management in relation to wildlife. In discussing the future of chemicals in roadside maintenance programs, he stated, "Some of the most important questions that require answers are concerned with the relationship of wildlife to roadside rights-of-way. . . . Will future highway management policies in this era of high speed transportation dictate that wildlife must also be excluded from the highway rights-of-way as a safety measure?" Seeker suggested (63) that removing roadside cover with herbicides "constitutes a service to the interest of conservation" because roadkills of game birds and mammals were reduced.

Implications of Changing Roadside Management Practices

Changing concepts of maintenance applied to newly constructed and existing roadsides can and are resulting in substantial increases in acreages of undisturbed highway roadside cover. At the same time in the Midwest, agricultural land-use changes are affecting the quantity and quality of cover available to nesting pheasants and songbirds. For example, in the four counties constituting the major center of pheasant abundance in Illinois, recent trends in land use reveal increased acreages in row crops (corn and soybeans) at the expense of small grains (oats and wheat) and the prime pheasant nesting

covers of tame hay and pasture (45). Concurrent with the decrease in hay and pasture is an accelerated trend toward agricultural use of other pheasant nesting cover such as fencerows and similar areas not previously farmed. As more intensive land-use practices develop, pheasants are being forced to make greater use of the remaining nonfarm land for nesting. Roadsides along both secondary roads and highways will be important in this regard, and in the near future could constitute virtually the only nesting habitat in some parts of the Midwest. Thus, the occurrence of substantial acreages of undisturbed roadside cover along highways coincides with a greater need for such cover by pheasants and songbirds.

Greater use of highway roadsides by wildlife in the Corn Belt may have significant safety implications. Of the small mammals and birds that frequent roadside cover, only the pheasant appears capable of constituting a serious hazard to traffic. Pheasant-auto collisions probably will continue to occur irrespective of agricultural land-use trends or roadside maintenance practices. At least some of these collisions result in property damage to vehicles and can cause personal-injury accidents. Beyond this, the literature reveals that little is known about the pheasant as a hazard to traffic. Previously cited studies of pheasant roadkills provide little basis for detailed evaluation of the safety problem. That the greatest number of roadkills occurs during the spring and summer is evident from the work of Norstog (56), who showed that the greatest frequency of pheasant roadkills in South Dakota occurred in May during the reproductive season; in Michigan, roadkills were highest in August (29).

Since 1954, the Illinois Department of Conservation and the Illinois Natural History Survey have conducted pheasant research on a 23,200-acre study area in Ford and McLean counties in east-central Illinois. Illinois Highway 47 passes through the study area for 6 miles. This highway has provided limited data on the temporal distribution of pheasant roadkills and on association of such kills with roadside mowing dates. During 1962 and 1963, 28 and 90 pheasant roadkills, respectively, were located on Highway 47 in the study area between April 15 and August 1. In both years a greater proportion of roadkills occurred during May than in other months (Fig. 1). Mowing of the roadsides apparently failed to cause an increase or decrease in the number of roadkills. For those years, the peak had been reached and a downward trend had begun prior to the time mowing took place. Because the decline in roadkills began prior to mowing, it appears that standing cover along the highway had little effect on the number of birds killed.

Although not definitive, these data may provide an insight, which might be borne out by more detailed studies, into an important characteristic of pheasant-auto collision: of pheasant roadkills, a substantial proportion is a result of breeding behavior rather than of a direct association of the bird with roadside cover. This does not imply that pheasant use of highway roadside cover never results in roadkills, but that factors implicit in pheasant behavior could be of greater significance in causing most highway kills. One of the questions asked of the highway administrators in the mail survey was whether they had data indicating that the hazard to motorists from wildlife was in any way affected by curtailed mowing schedules or partial mowing of roadsides. All 15 respondents answered in the negative.

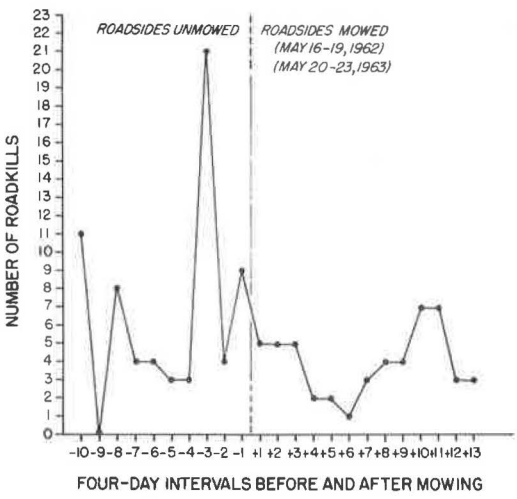

Figure 1. Distribution of pheasant roadkills along Highway 47, Sibley Study Area, 1962 and 1963 combined.

Since 1962, research has been under way in and near the study area to determine the feasibility of establishing and maintaining grass-legume cover on roadsides for nesting pheasants. The bluegrass-broadleaf

weed composition of most east-central Illinois roadsides does not generally constitute high-quality pheasant nesting cover. This research seeks to determine if the quality of roadsides as pheasant nesting cover can be improved by seeding with a mixture of tame grasses and legumes. Nearly 11 miles of secondary (township) roadsides (22 acres) have been seeded with a grass-legume mixture (brome, alfalfa, orchard grass, timothy, and red clover); adjacent roadsides equivalent in acreage, left unseeded, were designated as managed control roadsides. Seeded and managed control roadsides were left unmowed until late summer and searched for pheasant nests during June and July each year beginning in 1963. Searches were also made in a sample of agricultural cover types in the study area, which included roadsides designated as unmanaged control (some were mowed and some were not mowed during the summer). During the 5-year period of 1963 through 1967, densities of pheasant nests established on seeded roadsides (2.9 per acre) exceeded those on managed control (2.0 nests per acre) and unmanaged control roadsides (1.3 nests per acre). Seeded plots had a substantially larger number of hatched nests than either managed or unmanaged control plots. The hatch of pheasant nests on seeded roadsides, on a per-acre basis, exceeded that in all other cover types on the study area during 4 of the 5 years.

This research has not been completed, but it is possible to conclude tentatively that grass-legume seedings on roadsides constitute a habitat that is attractive to nesting pheasants and in which they are successful. The research has also demonstrated that pheasants attracted to seedings adjacent to secondary roads do not constitute a hazard to motorists on these roads.

Secondary roadsides, by virtue of their greater mileage, provide more potential for management than do highway roadsides, but highways, with their wide rights-of-way, also provide interesting possibilities for management. Within the context of the current trend toward minimum maintenance of highway roadside vegetation, it seems appropriate that the relationship between utilization of highway roadside cover by pheasants and traffic safety be investigated in detail. It should be determined by controlled field tests whether roadside management practices along high-speed highways that unintentionally (through minimum mowing) or intentionally (through seeding grasses and legumes) result in greater use of these roadsides by wildlife constitute an increased hazard to motorists.

RESEARCH NEEDS

Safety ramifications of the use of highway roadsides by nesting pheasants should be investigated from the following standpoints:

1. The distribution and characteristics of roadkills as a function of (a) pheasant population densities, (b) traffic volume and speed, and (c) pheasant behavior;
2. The number of personal-injury and property-damage accidents involving pheasants; and
3. The effects of roadside management on the frequency of pheasant roadkills.

Distribution and Characteristics of Roadkills

In Illinois, there is some evidence that the frequency of roadkills is higher on US 66 (four-lane highway), in an area with relatively few pheasants, than on two-lane highways farther to the east in an area of higher pheasant population levels with lower traffic volume. When related to traffic volume, however, the probability of hitting a pheasant is still higher on these two-lane highways than on US 66. This suggests that pheasant utilization of roadside cover along Interstate or limited-access highways may be no more hazardous to motorists than along two-lane highways. The evidence indicates that the breeding season is the time when most birds are hit on highways. What is not known, however, is what proportion of the birds hit by vehicles are associated with roadside cover, and what proportion are birds crossing between fields completely unassociated with roadside cover.

Number of Accidents Involving Pheasants

Data on the number of accidents involving pheasants are virtually nonexistent because highway departments generally lump reports of such accidents into larger categories, making analysis difficult. The Illinois Division of Highways has undertaken a study of accident report forms to determine the number of accidents involving pheasants during April, May, and June in four counties for 1967, 1968, and 1969. Property damage claims to insurance companies may also provide data on pheasant-auto collisions. In Illinois, however, only those accidents resulting in personal injuries or property damage in excess of $100 would appear in Division of Highways records.

Effects of Roadside Management Practices on the Frequency of Roadkills

Extensive field tests are needed to determine the effect of various roadside maintenance practices on the frequency of pheasant roadkills. These practices to be studied are (a) intensive mowing of the entire roadside, beginning in late May; (b) mowing of the entire roadside once in late summer (August) only; and (c) intensive mowing of shoulder and foreslope, combined with late-summer mowing of the area beyond the ditch. These three mowing programs should be carried out along two- and four-lane highways where "natural" and seeded grasses and legumes are present under conditions of differing traffic volumes and speeds and high, intermediate, and low pheasant population levels. Such research should help determine if any of these management practices increase or decrease, or leave unchanged, the degree to which the pheasant already is a hazard to traffic.

Data from the questionnaires sent to the Chief Highway Engineers in states with sizable pheasant populations show that 10 of 15 agencies employed minimum mowing beyond the ditch. This practice has no doubt already improved pheasant nesting cover along many of the highways in those states. Yet, none of the respondents felt they had sufficient data to demonstrate whether curtailed mowing schedules of highway roadsides affected the frequency of pheasant-auto collisions. Three reasons for this dearth of information may be that (a) few objective data are available about the pheasant as a hazard to traffic, (b) the hazard from pheasants is considered relatively inconsequential compared with the lower costs of minimum mowing, and (c) little or no discernible change in the frequency of pheasant-auto collisions has been attributed to the reduced mowing programs. Some states evidently do not consider the pheasant hazard excessive, because 6 of the 15 agencies had formal or informal agreements with their respective conservation departments to delay mowing to provide undisturbed nesting cover for game birds. However, 9 of the 15 agencies felt it would not be compatible with the primary function of highways to provide roadside nesting cover for birds in conjunction with efforts to reduce mowing costs or with programs for roadside beautification, even if research showed that greater use of highway roadsides by birds did not increase the hazard to motorists. (Two of these nine agencies were also in the group of six having agreements with their state conservation departments to delay mowing during the summer nesting season.)

A recent study was carried out (46) to ascertain "present experience in the multiple use of lands within controlled-access highway rights-of-way for purposes other than the movement of traffic." In this study, a questionnaire sent to 49 state highway departments and 16 toll road authorities identified over 20 types of multiple uses that employed all portions of highway rights-of-way; these included uncommon uses, such as agriculture and stream-access sites, in addition to the usual safety rest areas and service plazas. No states reported wildlife utilization of roadsides as a multiple use. This is of interest in view of the agreements to leave highway roadsides unmowed during portions of the summer months, as reported by six states in the present survey.

Whether management of highway roadsides for nesting birds will be accepted and practiced as a multiple use will depend on the results of research that should be undertaken to determine the safety implications of such management. Conservationists are not justified in arguing for the development of highway roadside cover for nesting birds without regard to these safety implications; similarly, highway administrators who

arbitrarily preclude wildlife considerations from roadside management programs without evidence that a hazard is created lack a substantive basis for their stand.

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