

THE RELATION OF ANIMAL PEST CONTROL TO CONSERVATION.

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To the average citizen conservation means the protection or saving of our natural resources, as forests, oil, mineral deposits, and fur-bearing animals. However, we find, among the plants for example, those which are harmful or noxious to mankind and should be held in check, as well as those which are useful and should be preserved and protected; in the field of bacteriology we recognize bacteria which are valuable and others which are deadly; in entomology we find insects which are beneficial and useful and also those which are destructive because they injure crops or animals or carry disease. So also among the higher animals we find certain kinds which are constantly a menace to crops and other resources of man, and on the other hand we find those which are generally beneficial. Furthermore, some which are usually beneficial or useful may become, either because of agricultural conditions or excessive increase of the species, noticeably harmful. A radical organization with one viewpoint might easily go to the extreme of advocating the protection of all animal life regardless of the habits and activities of the individual, while another equally radical group might take the opposite view and advocate the destruction of all animal life because certain animals are harmful. This is not conservation in any sense. As I understand conservation of animal life, it is, in part, the protection of those animals which are useful, either because of their value as fur-bearers, as game, or as destroyers of noxious insects and weed seeds. But conservation certainly has a wider application, for it means just as certainly the lessening of numbers of those kinds which are habitually destructive or which become occasionally destructive because of unusual increase in numbers. Therefore the destruction of harmful kinds is just as much conservation as the protection of the beneficial species, for certainly that is protecting our resources.

The problem of conservation of animal life is not merely determining the kinds which are beneficial and those which are harmful as a basis for action, but requires a more careful study than has ever been made of the various ecologic factors involved. As a beginning for such a study we have made an earnest endeavor to secure data on the animals which are occasionally or habitually harmful and the relation they have to our economic resources. To this end a questionnaire was submitted to the county agricultural agents of Indiana, and where they were not available to vocational teachers. Of the 92 counties in Indiana, replies were received from all but nine. The questionnaire asked definite questions as to the importance of rats, field mice, groundhogs, rabbits, ground squirrels, moles and sparrows, in the respective counties. An additional question asked if other important vertebrate pests

occurred in the county. The questionnaires have been summarized diagrammatically in the accompanying maps.

From a glance at figure 1, we find that rats and mice were reported as important pests in all but two of the counties reporting. By far the greatest loss is to stored grain, although many report considerable losses to chickens, buildings, and feed. The rat losses to the poultry industry alone amounts to \$1.00 per farm or \$200,000.00 annually for the state, according to Mr. L. L. Jones of the Poultry Department of Purdue University. Plants in greenhouses are frequently damaged by mice; thus, Mr. H. F. Dietz of the State Conservation Commission advises us that mice destroyed about 4,000 carnation buds in a few days in one greenhouse at Evansville, Indiana. Where estimates of money losses for rats and house mice have been given, they ranged from \$25,000 to \$100,000 per county annually, or perhaps a total of \$6,000,000 annually for the state.

Field mice of one species or another are common throughout the state, but a study of figure 2 shows them to be more prevalent, judging from their destructiveness, in the orchard districts of the state. Although recognized primarily as pests of fruit trees, the surface and underground trunks of which they gnaw and girdle, they were also reported from some sections as serious pests of seed and of seedlings in hotbeds, of melons, and of shocked corn and wheat in the field.

Groundhogs or woodchucks were recognized as next in importance to rats, according to the reports submitted. Figure 3 shows the range of destructiveness of this animal to be pretty general throughout the state and many reports indicate increasing trouble from this source. This animal causes an average annual loss of approximately \$1,000,000 in Indiana. Probably the greatest damage comes from its attacks on growing crops, principally legumes such as soybeans, clover, and alfalfa, but also to cantaloupes, watermelons and corn, and to a lesser extent to other crops. The girdling of fruit trees is sometimes a significant item in certain localities. Two dens of groundhogs will destroy $\frac{3}{4}$ acre of melons and one groundhog may destroy $\frac{1}{2}$ of an acre of young soybeans. Their burrows in pastures and other fields are hazards to stock, and those in graveyards and similar places are a continual annoyance. In some areas the burrows are responsible for soil erosion and in other sections, for example in Morgan County, the burrows are the cause of breaks in levees which often result in considerable loss.

Rabbits occur commonly throughout the state (fig. 4), and do some damage in every county, but are especially recognized as important pests in the orchard sections. By far the greatest loss comes from damage to nursery and young planted fruit trees, the animals eating the bark and frequently completely girdling the trees, major damage being done under heavy snow conditions. Field crops, such as soybeans, and garden crops in general are damaged to an appreciable extent. Rabbits are protected by law and although they cause a damage amounting to many thousand dollars a year in Indiana, it is true that they offer one of our best hunting sports and are of considerable

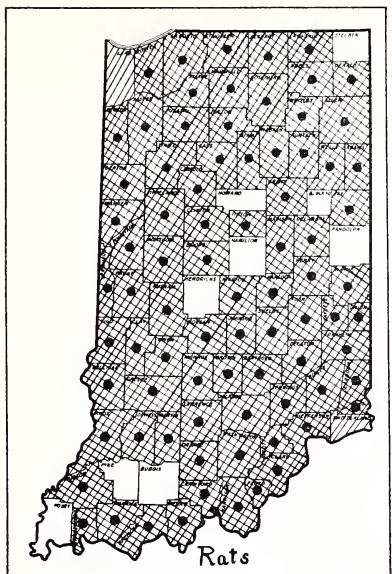


Fig. 1.

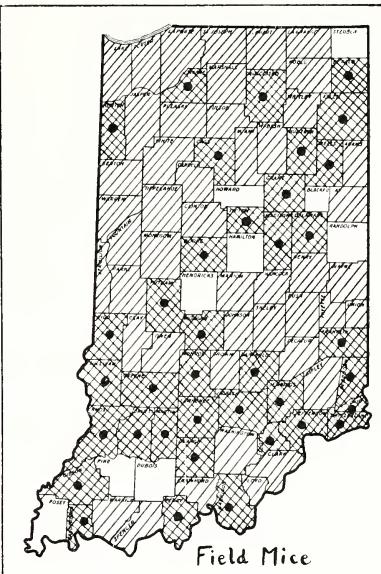


Fig. 2.

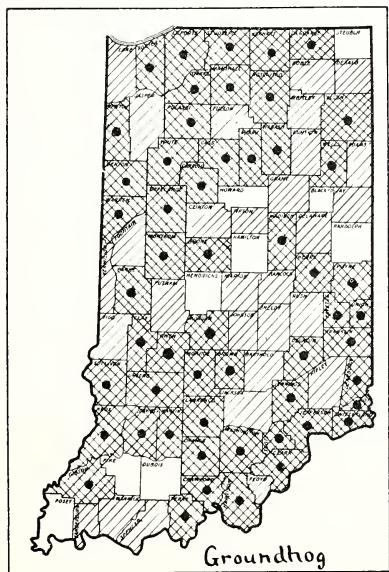


Fig. 3.

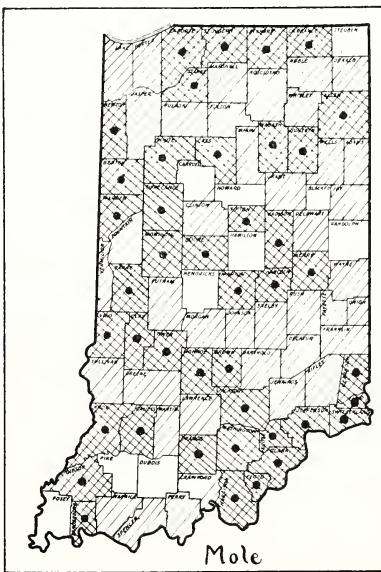


Fig. 4.

Figs. 1-4. Importance of rats, field mice, groundhog, and mole, respectively, as reported on questionnaires. Double cross-lined with black spot indicate counties reporting animal as an important pest; single diagonal lines no report or indicated as unimportant; blank counties, no reports received.

value as a source of meat and possibly deserve protection under certain conditions.

Moles are also abundant throughout Indiana (fig. 5), and the numerous inquiries received are a continued reminder of their importance. They are essentially a pest in lawns and gardens and newly seeded fields. In some sections of the state they are undoubtedly a significant factor in soil erosion. On the other hand, it should be remembered that moles are carnivorous and destroy large numbers of harmful soil-infesting insects. Damage to corn is probably due largely to burrowing in search of root-infesting insects, such as white grubs, rather than direct attack on the plant.

As will be seen in figure 6, ground squirrels or so-called "gophers" (*Citellus tridecemlineatus* Mitch.) occur commonly in the northern counties of Indiana. According to the reports received, they are principally pests of corn by taking the recently planted seed.

Two-thirds of the counties reporting, indicated the sparrow as an important pest. Their range is general as shown in figure 7. Sparrows are recognized as a nuisance, as driving out useful birds, and as eating much grain, especially grain in the shock. It is also possible that these birds are responsible for much more serious trouble, that of carrying fowl tuberculosis.

In answering the last question where a request was made for information on any other vertebrate pest of importance in the county, ten reporters indicated the crow, four the fox, two coyote, two hawks, one skunk, one opossum, and two squirrels. Had specific requests been made for information on the importance of these animals as was done with the seven already referred to, no doubt more would have indicated the importance of certain ones such as crows and foxes. Crows were mentioned as pests of poultry and corn; hawks as enemies of chickens; pigeons as carriers of poultry diseases; fox, weasel and skunk as destroying chickens; and coyotes as attacking lambs and pigs.

The following table (Table 1) gives a summary of the questionnaires discussed above.

TABLE 1. SUMMARY OF QUESTIONNAIRES FROM COUNTY REPRESENTATIVES IN INDIANA.

ANIMAL	Counties reporting as important.	Counties reporting unimportant or questionably.	Counties requesting control demonstrations. ¹
Rat and Mouse.....	80	2	37
Field mice.....	32	50	4
Groundhog.....	49	33	17
Rabbit.....	36	46	1
Ground squirrel.....	8	74	2
Mole.....	36	46	4
Sparrow.....	54	28	8
Crow.....	14 ²	.....	1
Fox.....	4 ²	.....	1
Coyote.....	2 ²	.....	1
Hawks.....	2 ²	.....	1
Skunk.....	3 ²	.....	.....
Opossum.....	1 ²	.....	.....
Squirrel.....	2 ²	.....	.....
Pigeon.....	1 ²	.....	.....
Weasel.....	1 ²	.....	.....

¹ Nine other counties requested demonstrations on rodent pests in general.

² Information as to the importance of these animals not specifically requested.

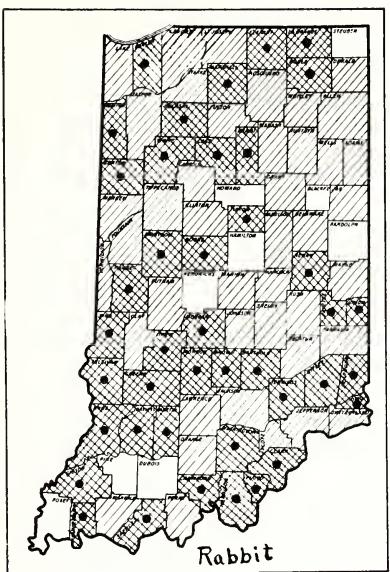


Fig. 5.

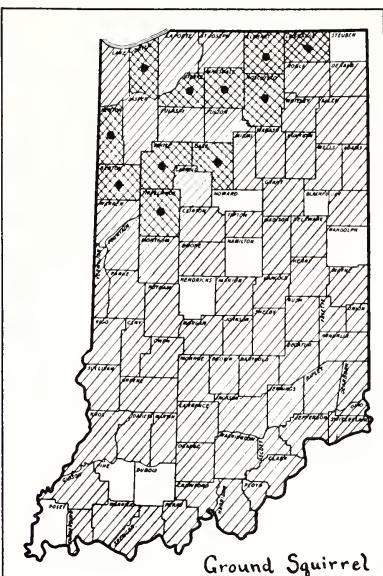


Fig. 6.

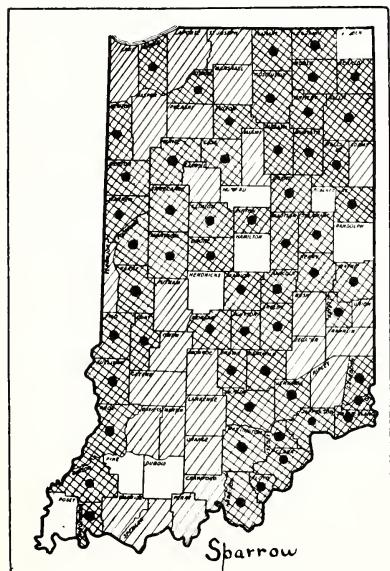


Fig. 7.

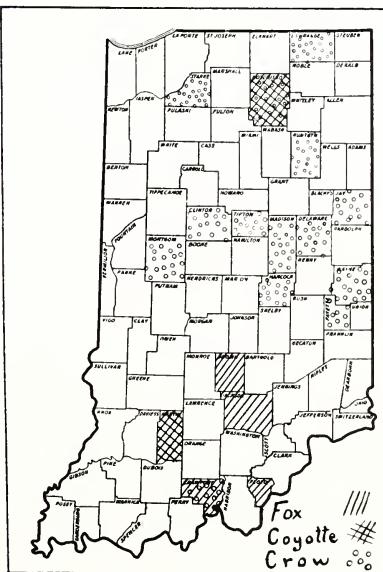


Fig. 8.

Figs. 5-7. Importance of rabbit, ground squirrel, and sparrow, respectively, as reported on questionnaires. Double cross-lined with black spot indicate counties reporting animal as an important pest; single diagonal lines no report or indicated as unimportant; blank counties, no reports received.

Fig. 8. Counties reporting the fox, coyote, and crow as important pests, in answering the question, "Are there other important vertebrate pests in your county?"

With the information already presented a review of the activities of the animals reported by county representatives will clarify some of the inquiries which have been called to our attention and will show the further need of a more careful study of the ecologic relations of the commoner animals which may be generally or occasionally considered pests.

First of all let us remember that agriculture is our basic industry, and in considering any well-balanced program in conservation we must consider carefully the interests of the farmer as well as those of the sportsman and trapper.

Rats and house mice are outstanding pests, for aside from their destruction of property they are carriers of human disease. No one has, to our knowledge, stood for the protection of these animals. The various poison baits, traps, rat dogs and cats, and rat-proofing of buildings are the recognized standard controls, the poison baits being pre-eminently the most important. Rat viruses have not proven successful.

Field mice also are recognized as pests without an alibi. The oatmeal bait used in standard stations, which was developed and is being recommended by the U. S. Biological Survey, is the standard control. We have reports of deaths of dogs which had been attracted to this bait and secured a fatal dose by nosing into the station which is so devised that birds will not reach the poison bait. Such reports are, however, infrequent and apparently insignificant.

That groundhogs are very destructive has already been shown, and that they are increasing on many farms in numbers beyond endurance is evident from letters of inquiry received and from personal contact. So far as we know, there has been no logical argument raised for the protection of these animals, inasmuch as they have no value as game, as fur-bearers or otherwise; indeed, we know of no state which gives them special protection. It has been claimed that groundhogs make burrows in which skunks and foxes hibernate and that therefore the lessening of numbers of groundhogs will automatically lessen the numbers of skunks and foxes, but this is not correct either in theory or in actual practice. Results of experiments conducted in Indiana show that fumigating groundhog burrows with carbon bisulphid or calcium cyanide is effective and more satisfactory than poison baits or traps. Inasmuch as the groundhog burrows are easily distinguished from the burrows of other animals, and that an inhabited groundhog burrow does not offer quarters for other animals during the breeding season (April, May and June) when fumigation is recommended, there is little likelihood of other animals, such as foxes and skunks, being killed in the process of fumigation.

Undoubtedly the principal game animal of the state, the rabbit, is generally recognized as a pest as is evident from the questionnaires, for 36 counties out of the 82 reporting recognized this animal as an important pest. As has been pointed out, rabbits are responsible for considerable loss, especially to fruit trees. In Indiana they are protected as a game animal from January 9 to April 1, which is the period

of heaviest snows and freezes and therefore the period of greatest injury. Poisoning and trapping, as well as shooting, during the closed season are illegal. The only means of protection which is practical under Indiana conditions is the use of a wire or paper protector around the trunk of the tree or the use of a repellent wash, such as concentrated lime-sulphur. It is difficult to estimate the damage in dollars but it will average many thousands. On the other hand, this animal is seriously destructive only in the orchard and nursery districts, while in these as well as almost all other areas in Indiana, it furnishes a supply of meat which undoubtedly is considerable³, at the same time providing a sport and recreation available to the majority of the citizens of the state. We are unable to compare the value of the meat supply provided with the damage done, but probably they balance fairly equally and if we include the sport and recreation which they provide, their value throughout the state as a whole no doubt would exceed the damage done. Upon this basis there would be reason for protection in some sections of the state and an equally good argument for permitting unrestricted killing of rabbits in other sections.

Ground squirrels are destructive in northern Indiana, and, so far as we know, they have no useful purpose other than their aesthetic value. Calcium cyanide used in the burrows is an effective control, without danger to useful animals. The poison grain bait, which is most generally used, is effective and if properly applied, that is broadcasted, there is no danger to the larger native or domestic animals and if picked up by the larger birds, such as quail, will not be harmful.

The destructiveness and usefulness of the common garden mole has already been referred to. We have here an animal of little commercial value but useful in destroying insects and under certain conditions harmful in one way or another. Our observations would lead us to believe that control measures should be practiced wherever the mole becomes a nuisance, even though it is a recognized destroyer of harmful soil-infesting insects.

Fifty-four of the eighty-two counties recognized sparrows as important pests. They are generally disliked because they are abundant and a nuisance although some direct damage is evident from their work in grain shocks. Because of their habits they are also harmful by discouraging and driving out useful and desirable birds. Control of sparrows should be encouraged. Certain sparrow traps are effective and have no undesirable features but are expensive. Poison grains scattered broadcast is an effective control under some conditions and there is little danger of poisoning beneficial birds.

The status of the crow has been argued pro and con. Undoubtedly it is often destructive by pulling recently planted corn and killing chickens, but it is likewise of definite value in destroying noxious insects. With our present knowledge of the interrelations of the crow it would appear that it should not receive legislative protection and that every effort should be made to control it wherever it occurs as a pest.

³ Mr. James Silver of the U. S. Biological Survey (*in litt.* Nov. 12, 1924) estimates the value of the meat supply furnished by the rabbit as not less than \$5,000,000.00 annually for the United States.

Hawks are generally considered pests, and yet no distinction is usually made between those kinds which are harmful and those which are beneficial, in fact in Indiana only three kinds,—the goshawk, sharp-shinned and Cooper's hawks—are of economic importance as pests, the other species being beneficial as destroyers of field mice and other harmful rodents. Careful distinction should therefore be made, and indiscriminate killing of hawks in general should certainly be discouraged, in fact, it would be safest and best to shoot only those actually observed as pests.

Probably none of the vertebrate animals occurring in Indiana are so much in dispute as to the need of protection or control as the fox. Although only four counties referred to the fox as an important pest, our personal knowledge shows it to be a pest of reasonable importance in a number of additional counties. Their ability and inclination to kill poultry cannot be set aside as insignificant. On the other hand there is some value for the fur and the comparatively few "fox-chasers" secure a recreation and sport from this source. The benefits derived are not, however, comparable with the destructiveness of this animal in southern Indiana counties where it commonly occurs and there seems to be no reasonable explanation for protecting laws under such conditions.

With regard to the other animals listed in the questionnaire the valuable service of the opossum and skunk probably appreciably overbalance the damage they may do and therefore, in general, they should be protected. However, when they do become abundant and destructive, there should be no legal restrictions to prevent the immediate protection of property. The weasel is probably not sufficiently common in Indiana to cause great losses and is of no great importance.

Summarizing the facts as they are available we find the pests grouped into two classes; 1, those which are constant menaces and should be aggressively fought, such as the rat, house mice, field mice, groundhog, ground squirrel, coyote, certain hawks and sparrow; and 2, those which have valuable uses but which should be destroyed whenever they occur as destroyers of property and the animals included in this category are the rabbit, mule, crow, fox, certain hawks, and skunk. In the first group we would except animals having any aesthetic value, such as the groundhog and ground squirrel, where they are not abundant or destructive.

Our general observations and studies lead us to conclude that state legislation is not as a rule based on a fundamental knowledge of animal life and the ecologic factors involved and that they too often are written from one point of view.

These introductory notes are presented to show the need of more carefully studying the animal fauna of our state, and to ask several questions, such as the best method of conserving species which are recognized as beneficial, or the best methods of holding in check those which are harmful, and also whether state-wide legislation is desirable for certain animals such as rabbits and foxes. And above all we wished to emphasize, as already stated, that the interests of the farmer must be recognized in considering any well-balanced program in conservation; neither should we lose sight of the recognized value of all animal life, whether aesthetic, sport or recreation.