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RESEARCH STUDIES IN THE CONTROL OF DESTRUCTIVE MAMMALS 1/

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It is with some degree of trepidation that I come before this group of naturalists, whose main endeavor is to conserve wildlife and who may not appreciate the necessity of the effort to reduce animal populations under certain economic conditions. It may appear paradoxical that the Bureau of Biological Survey should on the one hand exert every effort possible to study and protect birds and mammals, and on the other hand conduct control operations to reduce the numbers of certain groups of animals. On further thought, however, this dual effort is not so strange. It has its parallel in human affairs. There are religious, medical, and social organizations whose members are using their fullest knowledge and strength to make the character, health, and living conditions of the human race better. At the same time there are other organizations--Federal, State, and private--that are making every possible effort to control or remove individuals and groups who have criminal tendencies.

Most birds and mammals in their natural way of living are not excessively destructive either to other useful species of animals or to mankind. This fact has been learned by observation and through careful detailed studies of the habitat, food, and general habits of the different species. This research work has been and is being done under the leadership of the United States Biological Survey in cooperation with many other organizations also interested in wildlife, and through it sufficient information is gathered to determine the economic status of the species of birds and mammals. Such studies also furnish facts of value in planning either protective or control measures.

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These studies have shown that some species of mammals have habits that cannot be made to fit in harmoniously with such economic interests as stock raising and crop farming. These are chiefly the rodents--ground squirrels, prairie dogs, rats, mice, pocket gophers, and rabbits--and the carnivorous animals--coyotes, bobcats, and mountain lions. If they remained at a nominal population, where their depredations would be small, stockmen and ranchers would have little objection to them. But in the case of these animals, nature does not regulate the population to a level satisfactory to man.

Conditions Favoring Pest Increases

Observations show that animal populations respond to increase in food. A low population may be rapidly increased when a liberal food supply causes an increase in the size of their litters. The introduction of field crops into an area often results in an increase of rodent pests to a point where they would take the greater part of the products if effort was not made to reduce their numbers. Bringing domestic stock (especially sheep) on a Western range soon causes an increase in the coyote population. These conditions have made it necessary to carry on artificial control measures for carnivorous animals and rodents.

The Bureau of Biological Survey has research units whose investigations proceed along two lines: (1) To study the habits of the animals that have become pests to learn if there are some natural methods of control that will stop their depredations; (2) to devise artificial methods when natural control is not effective. To aid the effectiveness of natural control may require years of research, so the two lines of study are carried on simultaneously. Artificial methods, which generally can be devised more quickly, are used to stop the damage to crops, livestock, and game without endangering the existence of any species.

Meadow Mouse Control

To develop a method of reducing the numbers of a species of animal and the damage inflicted by it, a careful and detailed study must be made of its habitat, its food, and its relations to other animals, in order to determine why it selects a particular kind of place in which to live. For instance, the meadow mouse (Microtus), which often inhabits fruit orchards, chooses a place where there is vegetative cover under which its extensive feeding runways on the surface of the ground connect with its shallow burrows. The mice do not often come out into open, clear spots to feed, although such places may be only a few feet wide. They will at times make shallow tunnels under ground to the trunk and roots of a tree, if it is not too far away.

A simple method of controlling these mice in an orchard is to employ cultural practices to keep the ground free of grass and mulch during as much of the year as possible, so there will be no cover under which the mice can feed and build their nests. Fence rows and types of fences should be such that they do not furnish cover. If the topography of the orchard and the climatic conditions are such that grass has to be used to prevent erosion and to retain moisture, it can be kept short throughout the growing season. Orchards should not be located in or adjacent to meadows infested with mice. Orchards have been freed of mice by taking these precautions. These methods of control may obviate the need of using poisoned baits.

Combating Pocket Gophers

Pocket gophers are very destructive to grazing lands where conditions are favorable. In studying their habits, it has been observed that in those parts of infested meadows where the old native sod, composed of climax kinds of grasses is still present, there are few if any pocket gophers; while in the parts where these grasses have been replaced by secondary perennials and annuals, pocket gophers are abundant. This is because many of these secondary plants have fleshy or bulbous root systems, which furnish food for the pocket gophers. This inferior condition of range is generally started by overgrazing. Where the original native sod is broken, the seeds of weeds have a chance to grow, and it is not long before the pocket gophers find such areas and dig in. As the pocket gophers extend their runways, they undermine the sod, after which trampling stock break through and destroy it. This makes conditions more favorable for pocket gopher activity, with a still further decrease in the quality of the plants and the density of vegetative cover.

It would thus seem that the best method of controlling pocket gophers would be to manage grazing so that the meadows would continue to have a close cover of grazing grasses and so naturally keep the animals out. Pocket gophers occur throughout the timbered glades, but generally not in sufficient numbers to do serious damage. Whether this kind of grazing management is feasible remains to be determined.

A study of this phase of the pocket gopher problem has been made in the Ochoco National Forest by A. W. Moore, of the Control Methods Research Laboratory, by means of a series of quarter-acre plots, which have been protected or unprotected from the grazing of stock and game, with and without the presence of pocket gophers. These plots have been under study for the past five years (1932-37). In the meadow where the tests are being made most of the sod had been destroyed by the combined effects of stock grazing and pocket gopher burrowing. The density of the vegetative cover in the meadow

had been reduced to 30 percent or less, and in some places to no coverage, and erosion was taking place. This latter condition is shown in the photograph of quadrat No. 11, taken in 1932, when the experiment began (fig. 1, A). All grazing and pocket gopher activity in this quadrat was excluded, and by 1936 the density of the vegetative cover had increased from almost nothing to 30 percent and the kinds of plants that returned belong to the better forage varieties for sheep, such as mountain dandelions, bluebells, and yarrow, as shown in figure 1, B.

Another plot (quadrat No. 6) also was selected in an area where grazing and pocket gopher activity had been progressing with the usual results. At the beginning of the study it had a vegetative density of about 2 1/2 percent (fig. 2, A). The plants present were a few mountain dandelions and bluebells, and a few sprigs of melica (nut grass). Pocket gophers are fond of the roots of dandelions and bulbs of melica. Grazing was permitted on this quadrat, but pocket gophers were excluded. By 1936 the density of the vegetative cover had increased to 20 percent. Melica grass and mountain dandelions had greatly increased, owing to release of pocket gopher pressure; bluebells, which are good forage for sheep, had increased somewhat; and a little bluegrass had put in appearance (fig. 2, B). The history of this plot shows how much interference pocket gophers offer to the revegetation of an area that has been denuded. With grazing continuing in a moderate way, the range will gradually come back part of the way at least toward a climax condition. Further observation will reveal how far.

Quadrat No. 48 was selected from an area on which stock grazing and pocket gopher activity were in progress, but where the density of the vegetative cover was still about 20 percent. Alpine smartweeds (the roots of which the pocket gophers consume), one of the senecios, a few sprigs of melica grass, and some bluebells and dandelions were present, as well as a few Collomia plants of no forage value. These conditions are shown in figure 3, A. Grazing was excluded from the quadrat, but the pocket gophers were left unmolested. During four years (1932-36), the vegetative cover remained at about the same density, but was reduced in variety so that about the only plant left was the annual, Collomia grandiflora, worthless except for its pretty flowers (fig. 3, B). This result indicates that limited grazing is an advantage.

Ranges in the conditions described will be a long time returning to their greatest usefulness unless pocket gophers are entirely removed and only moderate grazing permitted.

An interesting and valuable experiment would be to fence completely this meadow in the Ochoco National Forest against grazing by stock

and keep all pocket gophers out, divide it into two equal parts by a stock fence, allow controlled grazing on one-half and no grazing on the other, and then check closely the plant successions as the vegetation returns to its old native sod condition.

Other Rodents

Beavers may well be controlled by trapping them alive in localities where they are destructive to crops, roads, or timber and transplanting them in new areas where they will not be objectionable.

Damage by snowshoe hares to conifer seedlings has been somewhat controlled by felling small aspens in areas not far distant from the tree plantings; the hares are fond of the aspen and are lured away from the seedlings--not entirely, but to a considerable extent.

Similar studies of other species of rodents might be cited, but time will not permit. It is planned to continue these studies with the view of determining to what extent rodent pests may be controlled by preventive methods based on ecological relationships.

Studies for Suppressing Coyotes

Investigations along this line are being made of the natural drift movements of coyotes to learn the reason for the continued abundance of coyotes in certain sections and to what extent their migrations are influenced by the movements of game and domestic stock. This is done by tagging coyote pups about the time they are ready to shift for themselves and then releasing them at the home den.

Within one year after the release of the coyote pups about 45 percent of the tags had been recovered by Government and private hunters. Of the 40 pups tagged and released in May and June of 1935 and 1936, 17 returns were received. These returns may be grouped according to four types of drift as follows:

1. Coyotes recovered at the same altitude and locality in which released. Six of eighteen released were caught within an average of 1-1/2 miles from point of release. There were both natural wild food and domestic stock in the vicinity of the point of release so the coyotes did not need to go far for food.

2. Coyotes recovered at the same altitude at which released but in a different locality. Six of eighteen released were caught within an average of 27 miles from the point of release. The sections in which

they traveled contained game, rodents, and sheep, so they did not have to travel far for food.

3. Coyotes released on lower levels along river bottoms and recovered at the headwaters of the same river or adjacent headwaters. Four of nine released were caught within an average of 51¼ miles from point of release. The river bottoms in which they were released in May and June were near cultivated lands and hay meadows. The latter contained rodents. Most of the domestic stock as well as game were up on the higher ranges. The coyotes drifted to these ranges and were caught there from October to December.

4. Coyotes released in high country and recovered at lower altitudes. Only nine coyotes so far have been tagged for this kind of drift. One of a group of four released at one place is included under group 1, and was caught in September, but another belongs here and was caught in the following January 90 miles distant in an airline from point of release and on the winter range of sheep about 3,500 feet lower and on a different watershed.

These records indicate that there may be an extensive drift of coyotes and that the activities of the animals may be influenced by seasonal movements of stock and game. Extensive studies of the activities of individual animals are planned, and it is hoped that by learning the factors influencing drift it will be easier to direct control campaigns.

Methods Employed

As already stated, the time required for thorough study of the habits of destructive mammals as a basis for correct deductions is so great that it is necessary meanwhile to practice available methods of control to check depredations until preventive methods can be developed. Probably there will always be localities and conditions where no preventive measures can be employed, and eliminative methods will have to be used.

The procedure followed in developing artificial methods of control is to consider first nonpoison, and then poison, devices. The possibilities of trapping and shooting are first studied to learn if these methods can be made effective and are sufficiently economical. It has been found that most of the rodents are too numerous or too

shy of trap and gun to make the use of these methods effective and that their control by trapping and shooting is also too slow and expensive. These methods, however, are the most effective and satisfactory for the control of the carnivores--coyotes, bobcats, and mountain lions. Mountain lions are hunted quite successfully with dogs. Coyotes can be hunted with dogs, but because of their abundance and because of the large scale on which the control work has to be done, this method is impracticable and uneconomical.

Gassing has long been employed as a method of controlling burrowing rodents. It has the advantage of being quite selective, endangering no other wildlife except a few forms that use burrows made by ground squirrels and prairie dogs. Moreover, such animals are usually in inactive burrows, which are not treated. The disadvantages of gassing are the cost of materials and the expense of application in the field. Liquids, like carbon bisulphide and hydrocyanic acid, require considerable equipment to apply in the field, so their utility is limited. Gassing compounds in the form of solids depending on moisture in the ground or atmosphere to release toxic gases that disperse of their own accord through the air of the burrow also are limited in their use to localities where there is sufficient soil moisture.

During recent years the Control Methods Research Laboratory has been endeavoring to develop a pyrotechnic type of cartridge, which being lighted at the time it is placed in the burrow burns with sufficient heat to generate deadly gases and to force them into the runways. This cartridge is giving promising results: it is inexpensive, and requires no field equipment but a cigarette lighter to ignite it and a shovel with which to close the burrow. More general use of this fumigating device will greatly reduce the quantity of poisoned grain used. The chief obstacle to its use is the character of the soil in which the burrows are made, which sometimes is so porous as to permit too rapid escape of the toxic gas.

Selective Poisons Developed

We now come to the preparation of the poisons used in rodent and predatory-animal control. Frequently much time is spent in the development of a single formula and many toxic agents have been and are being tested for their effectiveness. At the beginning, the dose of each toxic agent required to kill 90 percent of the animals is ascertained. The systemic effects of each poison on animals are then studied, such as speed of action, warning factors and the possibility of their being disguised, and selective action as concerns all the birds and animals likely to be exposed to it, if used.

The food habits of the animal to be controlled are then studied, and those foods that appear to be preferred and that will mix well with the poison are used. One exception is made where a choice of baits is possible, especially when grain is used, and that is to select the one least likely to be taken by birds. There are cases, for example, where wheat could be used to advantage, but steam crushed oats are employed because they are less likely to be eaten by birds.

After the bait is selected, the quantity that the animal will take at one time is ascertained. The bait is then treated with the poison to be used and the quantity of this poisoned bait that the animal will eat at one feeding is learned. Then the quantity of poison that is required to kill the heaviest adult of the particular species of animal involved is combined with the quantity of bait that the animal will readily eat. In this way the strength of the poisoned-bait material is determined for each of the rodents and the carnivores.

Along with the factors mentioned there are several others that have considerable influence upon the building up of a formula. With a toxic agent, like strychnine, that is very bitter and has other warning features, it is necessary to use chemicals to delay detection by the animals. This calls for a long series of experiments to find the best chemical for the purpose and the proper proportion to be used.

After a formula has been developed, it is then given extensive tests in the field, where not only its effectiveness in killing the particular animal is studied but also the possibility of killing innocent species of wildlife. When poisoned grain is being tested, a careful search is made over the treated area to learn whether any birds are being killed and, if so, what kinds and how many. This is checked at different seasons. If it is found that birds are killed at one season but not during others, the time of operations is adjusted accordingly. Attention is given also to the location of the bait spots, so that the poisoned baits will be most readily taken by the rodents and least likely to be eaten by birds.

Protecting Innocent Species

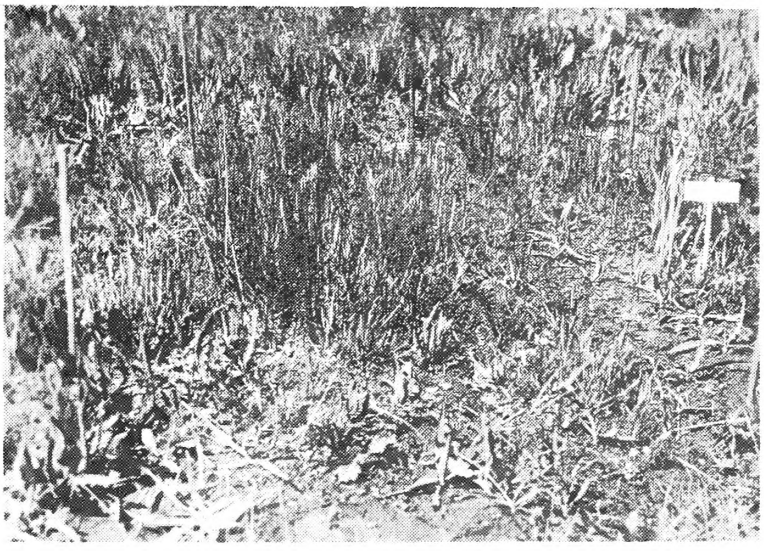
In the case of coyote poison operations, the definite station method of exposure was adopted for several reasons. First, by using the whole or a part of a carcass as a lure for coyotes, a station could be placed at a distance from stock or wild-animal trails and only a few, if any, of the smaller carnivorous animals would find it. Secondly, by locating the station away from creek bottoms, where skunks

generally live, these animals are not endangered. Finally, by using a small and definite number of baits, a careful check can be kept of all baits placed.

In an experiment conducted on the Whitman National Forest, Oregon, covering about 50,000 acres, 19 stations were established, using the precautions described. About half were in draws, canyons, and meadows and the remainder on the ridges. Careful checks of the skunks, beavers, minks, muskrats, and badgers present were made before, during, and after the completion of the experiment. No diminution in the numbers of these animals was observed. Two badgers and four skunks were found dead; the skunks were killed at test stations placed in meadows along creeks, and the badgers near stations deliberately placed in the midst of colonies of badgers. The badger colonies remained as active as usual, so it is believed that the two individuals mentioned were the only ones that took the poisoned baits. It was of interest also to note that no coyotes were found at those stations where the skunks and badgers were poisoned. This indicated that the stations were not properly located.

From a study of trapping records it is believed that more of the smaller fur bearers are caught in traps than are killed in poison operations where the stations are properly placed, for so few of them are found in the experimental work, during which constant checks are made for dead animals other than coyotes.

Figure 1.--Views of quadrat No. 11: A, taken in 1932; B, taken in 1936.



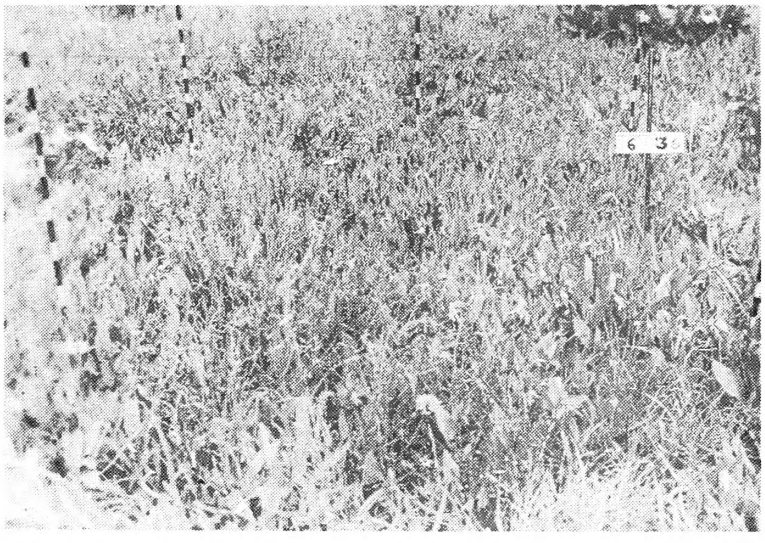


Figure 2.--Views of quadrat No. 6: A, taken in 1932; B taken in 1936.

Figure 3.--Views of quadrat No. 48: A, taken in 1932; B, taken in 1936.