



UNITED STATES  
DEPARTMENT OF THE INTERIOR  
FISH AND WILDLIFE SERVICE

BUREAU OF SPORT FISHERIES AND WILDLIFE

IN COOPERATION WITH

NEW MEXICO COLLEGE OF AGRICULTURE AND MECHANIC ARTS EXTENSION SERVICE

BRANCH OF PREDATOR AND RODENT CONTROL

210 LOMAS BLVD., NW. POST OFFICE BOX 1389

ALBUQUERQUE, NEW MEXICO

September 15, 1959

Mr. Eliot F. Porter  
Route 1, Box 33  
Santa Fe, New Mexico

Dear Mr. Porter:

Concerning the additional information requested in your letter of September 11, we are enclosing two bulletins which will be very valuable to you in your efforts to evaluate predator-prey relationship or related effects.

In connection with the area mentioned in our previous letter, Clines Corners to Carlsbad, the following tabulation taken from the weekly reports submitted to this office by a hunter employed in cooperation with the Penasco Cattle and Wool Growers Association of Hope, New Mexico shows the number of coyotes and also miscellaneous animals taken on an annual basis for the fiscal years 1949 to 1959, inclusive:

<u>Fiscal Year</u>	<u>Coyotes</u>	<u>Miscellaneous Animals</u>
1949	74	3
1950	68	-
1951	33	226
1952	6	263
1953	15	285
1954	9	324
1955	16	225
1956	18	300
1957	18	557
1958	37	287
1959	16	157
	<u>310</u>	<u>2,627</u>

The animals reported as miscellaneous include skunks, badgers, foxes, ringtail, etc., all of which are the smaller predators.

The decrease in coyote numbers 1949-1950 was in our opinion attributable to the use of "1080" control stations on adjacent areas, particularly on the Mescalero-Apache Reservation, thus reducing the migration of coyotes from the Reservation into the fenced area covered by the hunter employed.

Mr. Eliot F. Porter

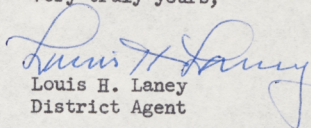
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September 15, 1959

In connection with your request for additional literature, an article appeared in the Journal of Forestry, Volume 51, Number 12, December 1953, which refers to the studies made concerning the effects of coyote control on the smaller predators. Some information is also given in the article by Weldon B. Robinson entitled "Coyote Control by Poisons" (page 5). The other bulletin is "Policies and Philosophies of Predator and Rodent Control" by Clifford C. Presnall, Fish and Wildlife Service, Washington, D. C., which cites various other publications and was delivered to the Fourteenth North American Wildlife Conference in Washington, D. C., on March 9, 1949.

If we can be of further assistance to you or can recommend additional literature we shall be glad to do so.

Very truly yours,

  
Louis H. Laney  
District Agent

Encls. (3)

P.S. A copy of the bulletin "Coyote Control with Compound 1080 Stations in National Forests" reprinted from Journal of Forestry, Volume 51, Number 12, December 1953 is also enclosed as we find we have a few surplus copies.



## Coyote Control with Compound 1080 Stations in National Forests<sup>1</sup>

Weldon B. Robinson

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*Through the earlier history of the American livestock industry, particularly in the West, the control of canine predators was of paramount concern to users of the range. Sheepmen especially were subject to ruinous losses from marauding coyotes and wolves; and "killer lobos," or packs led by such wolves, sometimes spread destruction in cattle herds. The demand for control funneled inevitably into the Congress and to western state assemblies. As a matter of course, control was provided, often in cooperation with state agencies, by the Federal Bureau of Biological Survey (now Fish and Wildlife Service), and by trappers hired by stockmen themselves. Steel traps and poisons were the principal control methods, the latter being employed officially by the Biological Survey and too often promiscuously by others. Very appreciable predator control was achieved but unfortunately at the expense of other wildlife. Since much of the poisoning was in the national forests and on public domain, fur trappers, foresters, mammalogists, and conservationists generally became concerned; and in the controversies that followed charges and countercharges were leveled and denied. Somewhat later, in researches concerned with World War II, very potent toxicants were discovered, among them the one now popularly known as "1080." This compound proved deadly to members of the dog family with the inevitable result that many conservation groups became concerned. The Fish and Wildlife Service, through the Denver Wildlife Research Laboratory, had initiated a carefully-planned series of experiments designed to measure the toxicity of 1080 to common forest wildlife and to determine means of employing it as a livestock predator control with the least possible threat to fur and game species. Later ecological studies on forest lands were undertaken. The results, indicating very encouraging progress in protection of forest wildlife, are given in this article.*

EARLIER RESEARCH with Compound 1080 stations dealt largely with the use of this chemical in controlling coyotes on the plains, deserts and non-infested forested foothills of the West (13). During the past five winters (1947-48 to 1951-52) the Wildlife Research Laboratory of the U. S. Fish and Wildlife Service has intensified studies of the hazards of such stations to beneficial wild mammals and birds in forested and mountainous re-

gions.<sup>2</sup> Because of the complexity of the problem, which involves a knowledge of the effect of the toxicant on the various species as well as an understanding of their foraging habits, ranges and preferred habi-

<sup>2</sup> Biologist Maynard W. Cummings participated in the field studies in 1947-48 and 1948-49; Fred Eggert, also of the Laboratory, assisted in 1949-50; Jack D. Remington, student at Colorado A. & M. College, and Jay S. Gashwiler, Biologist of the Section of Wildlife Investigations on Public Lands, aided briefly during 1950-51. Acknowledgement is also made to D. A. Spencer, D. G. Crabtree and W. H. Robinson of the Laboratory staff, who conducted many of the bioassays reported herein, and to E. R. Kalmbach and Dr. Lee E. Yeager for critically reviewing this paper.

<sup>1</sup> This paper deals with the dangers of 1080 stations only to wild mammals and birds and not to domestic dogs and cats which normally are protected by the distant location of stations from human habitations.

tats, the data are still incomplete in many respects. Research is continuing, but in the meantime coyote control problems must be faced annually in many mountainous regions. The Fish and Wildlife Service frequently must consider employment of 1080 stations in these localities, and foresters must approve or disapprove such programs. The studies to date point to certain precautions that should be taken in exposing lethal stations in such environments, and the available data are herein presented to aid responsible officials in making decisions. Some tentative conclusions or suggestions, however, may need later revision.

Experiences of the Fish and Wildlife Service over a period of many years have shown that poisoning, although objectionable, is often the most effective, and at times the only effective means of coyote control. Furthermore, lethal agents can be employed under many conditions with a considerable degree of selectivity. Studies in Arizona (1) and Wyoming, Colorado and New Mexico (14) show that coyote numbers were greatly reduced following the employment of 1080 stations, but gray foxes, badgers, skunks, bobcats and raccoons were more numerous than before. These population increases may have been due, at least in part, to less commercial trapping because of low fur prices.

Compound 1080, although highly toxic to a wide variety of mammals and birds, is particularly deadly to members of the canine family. In preparing stations for field use, the meat is treated with minimum amounts of the chemical so as to give as much protection as possible



to those creatures having greater tolerances (13). The margin of safety for most mammals, however, is so narrow that they are likely to be killed if they eat large amounts of the treated meat. Variation in susceptibility to the poison, therefore, is of questionable value in preventing unintentional poisonings by the station itself, but is of considerable importance in limiting so-called secondary poisonings.<sup>3</sup> Whereas lethal amounts of the meat can be obtained by feeders at the station, it is not always available in such quantities from secondary sources.

Tests have shown that the muscular tissue of 1080 victims does not contain dangerous amounts of the poison. The toxicant is found largely in the alimentary tract of the dead animal or in regurgitated station meat; of the two, the latter material doubtless is the more dangerous. Although some creatures, particularly the more susceptible canines and cats, may be killed through secondary poisonings, the danger to most wild carnivores does not appear to be so great as to appreciably alter the selectivity of the 1080 method of coyote control. Field experiences have shown that the station itself is the major point of danger. The previously cited population increases of long-haired fur bearers in Arizona, Wyoming, Colorado and New Mexico occurred not only in the presence of 1080 stations, but also while the animals involved were exposed to all the dangers of so-called secondary poisonings.

If 1080 stations are employed for coyote control, knowledge of the habits and habitats of the various creatures likely to be endangered is needed to safeguard populations of the desirable ones. On the following pages data are presented which have a bearing on the possible effect of 1080 stations upon populations of martens, weasels,

<sup>3</sup>Secondary poisoning is construed to include all cases in which creatures are poisoned by feeding on the bodies or vomitus of victims killed by eating station meat.

minks, red foxes, bears, and some of the carrion-eating birds encountered in the vast western mountain areas.

### Martens

The marten—one of the most prized of the mountain fur bearers—is primarily a wilderness inhabitant. From Colorado, Yeager, *et al.* (18) report that the marten is indigenous to the spruce-fir type, which limits its range to the higher mountains. Marshall (6) found that in Idaho these animals ranged almost entirely in Alpine fir, Englemann spruce, and Douglas-fir stands; open areas were not entered in the winter, but occasionally martens have been reported seen there in the summer. From Washington and Ontario, de Vos and Guenther (2) reported that Douglas-fir, hemlock, cedar and cedar swamp types were hunted most frequently.

It is apparent that the marten prefers timber, perhaps because of an abundance of prey there. In studies by the Wildlife Research Laboratory, unpoisoned horse meat exposed in such locations was readily eaten, especially when placements were made along marten "runs." It may be concluded, therefore, that lethal stations placed for coyotes in these habitats would likely be found and fed upon by martens.

Furthermore, the range of these fur animals is so great that a considerable portion of the local population potentially could be in the vicinity of stations placed on the recommended average of one per township. Marshall (6) reported that 2 martens each ranged over 10 to 15 square miles of territory. Six of 19 tagged martens recovered by de Vos and Guenther (2) traveled 3 to 12 airline miles, the other 13 being recovered 1¼ mile or less from the tagging points. With these animals feeding so readily on large mammal carrion and having such large ranges, lethal stations thoughtlessly placed for coyotes in timber could greatly endanger marten populations.

Field men, however, have reported that martens seldom enter open

areas to feed. Extensive studies were conducted by the laboratory to determine whether there are such locations within marten ranges where lethal stations could safely be exposed for coyotes. These mostly involved offering unpoisoned horse meat to martens along their runs in timber, then progressively dragging the meat out into open areas. In several trials made during the winter in regions of rather dense timber and scattered open parks, martens showed a marked aversion to leaving cover to feed. Two examples are given:

1. A marten first fed on meat placed 100 yards back in the timber from the edge of a large open park in the vicinity of Rabbit Ears Pass, Colorado. The meat was dragged daily in the snow toward and, finally, into the park. The animal followed to feed, successively, 25 yards inside the timber, 8 feet in the open and 25 yards in the open. When the meat was dragged 50 yards more to a point 75 yards from timber, the marten came out 18 yards into the open, then scampered back. On two later occasions, as the animal hunted through that vicinity, it did not go 75 yards into the open to the meat.

2. In the Buffalo Park region of Colorado, marten tracks were noted 9 times throughout the winter in timber surrounding an open park, 100 yards wide by 300 yards long. On none of these occasions did the animals visit a clean meat station 50 yards from the timber in three different directions.

Martens may be more inclined to feed in open areas during periods when the vegetation is not covered with snow. Marshall (6) stated that they have been reported foraging in meadows in the summer. Thus, there may be greater danger of these fur bearers reaching stations in open areas in the late fall and spring than in the winter. Also, there may be some danger through the scattering of vomitus by coyotes poisoned by 1080.

Studies were conducted in the laboratory to determine the hazard to individual martens should they reach stations or find regurgitated

meat. In limited bioassays it was found that martens are about 10 times as resistant to 1080 as coyotes. Theoretically, a minimum of 1-2 ounces of station meat may be lethal to a 2-3 pound marten and also to a 20-30 pound coyote. In further cage tests, three martens were prebaited with clean, frozen horse meat for several days and then, overnight, were given carefully prepared samples of station meat poisoned with 1080. Each ate much less of the poisoned than of the clean meat, and only one of the three martens was killed. It was evident that these animals are deterred by the taste or some physiological reaction of 1080. Under field conditions the tendency to consume lethal amounts of the station meat probably would vary depending upon scarcity or abundance of more acceptable foods, and the degree of hunger experienced by the marten.

In field studies a few 1080 stations were placed in open areas of various sizes within marten ranges. There were no records of these fur animals feeding on the baits, but limited data were obtained showing that martens survived in the immediate vicinity. Their tracks frequently were noted throughout the winter one to two miles from two stations, and there was marten activity in that general area the following year.

### Weasels

The weasel, an active little predator and fur animal, is well distributed over mountainous areas. It is found even above timber line in midwinter. In Gunnison county, Colorado, Quick (11) estimated the population density to be 2 weasels per square mile, or 8,000 for the county.

Although subsisting almost entirely on freshly killed prey, weasels will eat horse meat such as is used in stations. In field studies evidence of their feeding upon clean horse meat was noted, but at other times they showed no interest in the station material. Nothing is known regarding the tolerance of these animals for 1080, but being closely related to the marten they

probably have a somewhat similar resistance. In that event, some may be killed by feeding on 1080 stations, while others eating smaller amounts may not be fatally poisoned.

The individual weasel, however, maintains such a limited range that relatively few could ever come in contact with stations widely spaced for coyotes (one per township). In studying the least weasel in Iowa, Polderboer (9) found that: "The maximum home range of each of the four least weasels was approximately two acres. The greatest distance traveled from the center of their home ranges seldom exceeded 10 rods." In Utah, Rabb (12) found the daily ranges of 13 of the larger, long-tailed weasels to be 24 acres or less, while that of 1, thought to represent mating activities, was 131.5 acres. Quick (10), in studying the long-tailed weasel in Michigan, concluded that: "The home range of each weasel was about 300 acres, and the average cruising radius 0.3 mile from the den." He (11) estimated similar seasonal ranges of 200 to 300 acres for the long-tailed weasel in Colorado. With poison stations placed at the recommended average of one per 36 square miles, or one per 23,040 acres, only a very small proportion of the total weasel population would be endangered. Furthermore, Rabb (12) reported that "... weasels showed a decided cover-type preference, 43 percent of the recorded tracks appearing in 5 percent of the cover (brush)." Stations ordinarily are placed in the more open areas, and avoidance of brushy habitats would further minimize the dangers to these fur bearers.

In field studies weasel sign was recorded at various locations near experimental stations. The sign apparently disappeared from the immediate vicinity of one station, and it was presumed that the animal was poisoned; however, weasel tracks were noted intermittently throughout the winter a quarter mile away in two directions. At five other locations where records were maintained, weasels lived unharmed throughout the winter a

few rods to a quarter mile from station sites; their sign was recorded many times over a six month period while the lethal baits were exposed.

### Minks

From Colorado, Yeager, *et al.* (18) state that: "The mink is well adapted to land foraging but, essentially, is dependent on water, and for this reason it is never found in permanent status far from water bodies." They further point out that minks inhabit small mountain streams as well as larger bodies of water, but generally are found in association with muskrats.

Information about the range of minks, and indirectly the distances that lethal stations should be removed from mink inhabited waters, is contained in the literature. McCabe (7), in studying minks in Wisconsin, concluded that the female ranges only about one-fourth mile but the male probably much farther. Marshall (4) likewise noted a difference in the ranges of the male and the female. As a result of his studies in Michigan, he reached these tentative conclusions: "The winter territory of the female mink tends to be restricted to an area of approximately 20 acres" and that "... of the males is much more extensive." He followed males that traveled ½ mile, ¾ mile and 3 miles along streams. From California, Grinnell, *et al.* (3) report that: "Although usually staying close to streams or marshlands, minks are known occasionally to wander some distance away."

The picture that emerges from these studies is that minks inhabit open waters and do most of their hunting there, but occasionally some individuals—probably males—wander away. Marshall (4) reports that minks are promiscuous in their mating behavior, which may account for the extended movements of the males.

It would seem that lethal stations well removed from mink-inhabited waters would not endanger mink populations, but conceivably some wandering individuals



might find and feed upon stations. There are no bioassay data for minks, but it may be presumed that they have a tolerance for 1080 similar to that of martens. If so, some, but probably not all, feeders would be killed.

Not much information on the dangers of stations to minks was obtained by the laboratory in field studies, due to scarcity of these animals and some uncertainty in the identification of tracks. A mustelid, presumed to be a mink, fed upon clean horse meat 100 yards from a stream. Another such animal fed on a lethal station 50 yards from a stream; its sign was not observed there again, but conceivably, if not poisoned, the animal could have moved to lower water as the nearby stream was quickly frozen over. In three other instances, however, mustelids—thought to be minks—survived a mile or less from lethal stations. The sign of one was observed 9 times between October 24 and April 14 along a stream one-fourth mile from a lethal station, and 2 others lived unharmed along main streams with stations being placed in side canyons about 1 mile away.

#### Red Foxes

In California, Grinnell, *et. al.* (3) noted that: "It seems probable that although the Sierra Nevada red fox forages well above timber line during the fall and even in mid-winter, it breeds lower down amid the white-barked pines and alpine hemlocks." From Colorado, Yeager, Denney and Hammit (18) report that the red fox occurs principally above 7,000 feet.

It is the opinion of trappers of the Fish and Wildlife Service in Colorado who work on the higher sheep ranges during the summer and adjacent lower areas during other seasons, that most red foxes remain high in the mountains the year around. They cite the fact that many foxes are unintentionally taken with traps and coyote-getters near and above timber line in the summer, but that relatively few are encountered during the winter in the lower mountains. Similar ranges for the red fox were

noted by the writer in Yellowstone National Park.

Although factors such as food conditions and character of terrain may influence the range of the fox, the literature indicates that the animal has a relatively small home range compared to that attributed to the coyote. Scott (16), in writing of the range of the red fox in Iowa, concluded that "... an arc drawn on a one-mile radius would ordinarily circumscribe the movements of the resident individual, pair, or family." Murie (8) noted that 2 foxes in Alaska lived in given locations for continuous periods of at least 2 years and 3 months, and that 1 easily recognizable animal "was always seen in an area about 3 miles across." Should the maximum range of about 9 square miles observed by Murie be applied to foxes in the West, theoretically only 1 of 4 resident animals would find lethal stations placed on an average of 1 per 36 square miles. Sheldon (17), however, found that in New York, young foxes dispersed in the fall, and some adults traveled widely at that time. Several tagged animals moved more than 15 miles, and 1 adult was recovered 40 miles away 3 months after release. Such wandering individuals, of course, could easily reach one or more stations placed for coyotes.

In field studies red foxes fed on clean meat or lethal stations whenever such material was placed on their ranges. Being members of the canine family, foxes are highly susceptible to 1080, and those feeding on the poisoned meat are certain to be killed. At three such locations, fox activity in the nearby vicinity was later surveyed, with the result that tracks of these animals frequently were recorded  $\frac{1}{4}$  to  $2\frac{1}{2}$  miles away. In these instances, at least, foxes were not eliminated over large areas by single 1080 stations, although it is possible that the continued activity was by nomads from the outside.

Accumulating information indicates that coyotes tend to move downward out of the higher mountains in the winter. Some apparently move only far enough to es-

cape the soft, deep snows and return in late winter when the snow crusts and settles. Tagging studies in Yellowstone National Park (15) clarify these seasonal migrations. There the downward trek begins as early as October, and by February many coyotes have returned. Much of this drift precedes and is not dependent upon the movements of big game. The recovery records of animals marked and released high in the mountains suggest that practically all coyotes living there in the summer move downward, at least for short periods, in the winter.

Because the habits of the coyote and the red fox are similar, there is no practicable method of controlling coyotes in the midst of foxes on the high mountain sheep ranges in the summer or winter without also killing some of these smaller canines. Traps and coyote-getters, as well as lethal stations, take their toll of foxes. Some of these animals can be released from traps, but probably few survive that have been captured very long. Marshall (5) tagged 22 foxes so released, but even with a reward for the return of tags only one emaciated animal was ever reported.

The apparent solution, in the interest of killing fewer foxes, is to reduce as much as possible coyote control work at the higher altitudes in the summer, and concentrate efforts during the winter at the lower altitudes when probably more coyotes than foxes move downward. Since some of the coyotes move only short distances, and perhaps for only limited periods, much of this winter control work may have to be done within National Forest boundaries. In many localities the only method that could be successfully employed at this time is the lethal station, and poisoning in the lower mountains should be less destructive to foxes than the use of traps or coyote-getters at the higher altitudes in the summer. Although conditions vary from one locality to another, observations in Colorado and Yellowstone Park suggest that the main red fox winter range coin-

cides roughly with that of martens. In Colorado this may be defined as the spruce-fir type, extending from 9,000-9,500 feet upward.

#### Bears

Lethal stations employed in the lower mountains, below the main concentrations of red foxes, may well be within bear ranges and occasionally may be fed upon by these animals, particularly in the spring. Bears generally go into hibernation before the stations are exposed in the fall, but may emerge before the lethal baits can be destroyed in the spring.

Bioassays with 7 bears, furnished by the Branch of Predator and Rodent Control and the Montana Fish and Game Department, disclosed that these game animals are killed with small amounts of 1080. On a weight basis, the tolerance of bears for the chemical is about five times that of coyotes. They are about as susceptible as bobcats, and are less resistant than martens, badgers, or raccoons. Because of their low tolerance for 1080, it is indicated that many of the bears that feed on stations will be killed. The data suggest that adult bears may be fatally poisoned by eating as little as three pounds of the average station meat.

In exposing 1080 stations for coyote control in the mountains, care must be taken either to choose locations where bears do not range or to remove the stations before the animals emerge from hibernation. A few mountainous regions may be entirely uninhabited by bears, but in bear country the animals are apt to occur anywhere; hence, in the latter localities the only effective safeguard is removal of stations as early as possible in the spring before the animals emerge from hibernation.

#### Birds

As in lower areas, there is considerable feeding by birds upon lethal stations in the mountains. Identification of the feeders through the sign only is uncertain, but with the employment of clean meat it was possible to observe the birds in action. A partial count of

those observed includes 71 Canada jays, 44 mountain chickadees, 10 magpies, 2 golden eagles, 1 long-crested jay, and 1 Clark's nutcracker. On occasion, arctic 3-toed woodpeckers and downy woodpeckers were observed grubbing in nearby trees, but they showed no interest in the meat. The birds mostly were sighted feeding on unpoisoned dummy stations in timber, and it was noted that the activity was much less in open areas.

There are bioassay data only for eagles and magpies. Eagles are fairly resistant to 1080, and few should be killed by feeding on stations, particularly when these are frozen. Magpies are readily poisoned, but observations in other localities where 1080 stations have been employed have disclosed no general reduction in magpie numbers. It would seem that 1080 stations, because of their widely spaced locations, should have no greater effect upon the total population of jays, chickadees and nutcrackers than upon magpies.

#### Summary

It is indicated that, with proper precautions, 1080 stations can be employed without seriously damaging populations of martens, weasels and minks. For the safety of martens, stations must be well removed from cover, either timber or brush. In field trials, these fur animals refused to go to meat placed 50 to 75 yards from timber, but these distances should be considered too short for maximum safety. At all times lethal stations should be placed as far as possible from the preferred marten habitats. In fact, because of the hazard to the many red foxes also living in the higher mountains, it appears advisable to limit station placements to the lower altitudes.

Weasels maintain such limited ranges that relatively few of their total population could ever come in contact with stations widely spaced for coyotes. Limiting placements to open areas and avoiding brushy habitats will further minimize the dangers to these fur bearers.

Pending more complete data, it is indicated that not many minks

would be endangered by stations placed one-fourth mile from streams. For the maximum protection, however, placements probably should be at much greater distances.

Compound 1080 stations placed in the mountainous and forested regions probably would be more hazardous to bears and foxes than to the mustelids. Bears are likely to feed if they find the lethal baits, and bioassay data strongly suggest that such feeders will be killed. In bear country, stations, if used, should be exposed only during the periods when the animals are in hibernation.

Because the habits of the coyote and the red fox are so similar, there is no practicable method of controlling coyotes in the midst of foxes without also killing some of these smaller canines. Traps and coyote-getters used on the high ranges in the summer kill foxes, and it is possible that, because of the more limited ranges of these smaller predators, stations widely spaced for coyotes may be no more destructive to the total fox population than the more densely-set traps and coyote-getters. Accumulating data suggest that coyotes move down in the winter more than foxes, and effective control during that season in the lower mountains may reduce coyote numbers with a minimum loss of foxes.

In employing 1080 for the control of coyotes in the plains, deserts, and non-forested foothills, there are many locations where stations may be exposed with minimum danger to other wildlife. In contrast, the forested and mountainous regions may offer relatively few suitable sites. In such environments, each prospective station should be carefully examined to determine its potential hazard to beneficial carnivores.

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