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U. S. Department of Agriculture

CONTROL OF
PREDATORY ANIMALS

LETTER FROM
THE SECRETARY OF AGRICULTURE

TRANSMITTING

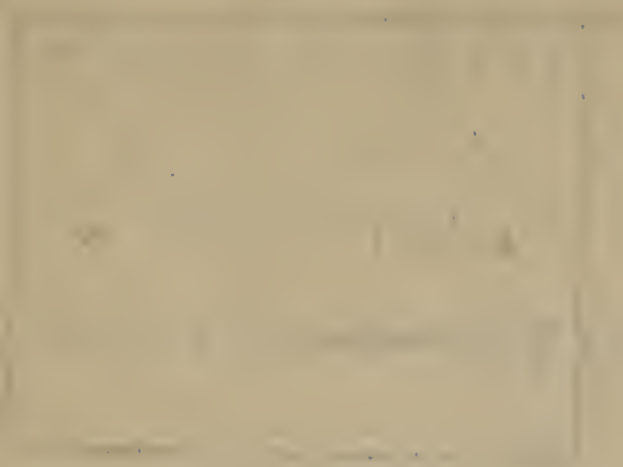
REPORT ON INVESTIGATIONS MADE BY THE DEPARTMENT
OF AGRICULTURE AS TO THE FEASIBILITY OF A TEN-
YEAR COOPERATIVE PROGRAM FOR THE
CONTROL OF PREDATORY ANIMALS
WITHIN THE UNITED STATES



JANUARY 3, 1929.—Referred to the Committee on Agriculture
and ordered to be printed

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON

1929



LETTER OF TRANSMITTAL

DEPARTMENT OF AGRICULTURE,
Washington, D. C., December 26, 1928.

SIR: Pursuant to a proviso of the act making appropriations for the Department of Agriculture for the fiscal year ending June 30, 1929, and for other purposes (Public Act No. 392, 70th Cong., on p. 23, under the heading Bureau of Biological Survey), I transmit herewith a report on investigations made by the Department of Agriculture as to the feasibility of a 10-year cooperative program for the control of predatory animals within the United States, with the estimated cost.

After careful consideration of the matter, the conclusion of the department is that a 10-year program for the effective control of these pests, such as that outlined in the attached report, would be entirely feasible from the standpoint of the biological problems involved; that it would be in effect a most tangible form of agricultural relief; and that it would involve additional Federal expenditures as follows:

	Allotments from appro- priations for 1929	Annual ap- propriations required under 10-year program	Increase over funds now available
Control of stock-killing wild animals.....	\$346, 867	\$782, 500	\$435, 633
Control of smaller predators (rodents).....	219, 767	596, 200	376, 433
Total.....	566, 634	1, 378, 700	812, 066

It is recommended that provision be made for the adoption of this 10-year control plan whenever the financial policy of the Govern-ment will permit.

Respectfully,

W. M. JARDINE, *Secretary.*

To the SPEAKER OF THE HOUSE OF REPRESENTATIVES.

MAY 23 1929

REPORT ON INVESTIGATIONS BY THE DEPARTMENT OF AGRICULTURE ON THE FEASIBILITY OF A 10-YEAR COOPERATIVE PROGRAM FOR THE CONTROL OF PREDATORY ANIMALS WITHIN THE UNITED STATES, TO- GETHER WITH THE ESTIMATED COST

INTRODUCTION

The predatory animals of the United States, on the control of which the Department of Agriculture, through the Bureau of Biological Survey, has been working for more than 12 years in the interests of agriculture, horticulture, forestry, animal husbandry, and wild game, are of two general groups: (1) The large carnivorous animals that destroy livestock and game; and (2) the herbivorous and other small predators that destroy growing and stored crops, forest and other nursery stock, and the range grasses that support the country's farming and livestock industries.

The first part of this report deals with investigations for the control of such livestock destroyers as wolves, coyotes, mountain lions, bobcats, and bears, generally termed "predatory animals"; the second part, with investigations for the control of such smaller predators as prairie dogs, ground squirrels, pocket gophers, jack rabbits, woodchucks, procupines, mice, rats, and moles, most of which are termed "rodents."

The estimates for carrying forward a 10-year program of control of these predators, the details of which are presented in the following pages, would involve annual appropriations of \$782,500 for the stock-killing animals and \$596,200 for the smaller predators, or an annual appropriation of \$1,378,700 for all lines of predatory-animal control over a 10-year period. The funds available for control of predators from the current appropriations (1929) amount to \$346,867 for stock-killing animals and \$219,767 for the rodents and other small predators, or a total of \$566,634.

The estimated savings effected even from the inadequate work thus far made possible by Federal appropriations have been demonstrated to be more than \$10 for every dollar spent. It is believed that the funds estimated to be necessary for a 10-year intensive program of control, through preventing constant reinfestation of cleared areas, will make this saving permanent, and enable the department to meet the demands in States where operations are now being undertaken and to extend its work on the public domain and into new areas from which requests are constantly being received, and thus prevent enormous losses to agriculture, horticulture, forestry, and stock-raising. It is essential to the effective prosecution of work already undertaken that injurious wild animals on both Federal and private lands be brought under control if reinfestation of adjacent lands that have been cleared of the pests is to be prevented. It is the definite obligation of the Federal Government to take care of its own lands.

Based on 12 years' experience in conducting operations for the control of predatory animals, the department can state definitely that the program set forth in this report is altogether feasible. Complete eradication of predators is not practicable and in some areas is not advisable. Under the proposed plan, however, it is believed that the animals could be brought under control to such an extent that their damage would be negligible and in many cases ended completely. If the program were adopted, smaller annual expenditures would thereafter be required to maintain control. Cooperation plays such an important part in control operations that in devising the program the department consulted State officials and other cooperators and received assurances from them that they would support the program and continue the present ratio of cooperative expenditure if the increased Federal expenditure were authorized.

PART 1

STOCK-KILLING ANIMALS

Predatory animals, such as coyotes, wolves, mountain lions, bobcats and some stock-killing bears, make serious inroads on the stocks of sheep and lambs, cattle, pigs, and poultry, as well as on the stocks of wild game mammals and ground-nesting and insectivorous birds of the country. The annual toll taken by these stock-killing animals in the United States is estimated to run between \$20,000,000 and \$30,000,000, by far the greater part of which is by the coyote. This animal is also the cause of much concern in that it is a carrier of rabies, or hydrophobia, a disease that was prevalent in the States of Nevada, Colorado, Utah, Idaho, and eastern Oregon in 1916 and 1917, and later in Washington and in southern Colorado. The coyote is also found to be susceptible to tularemia, a disease of the wild rabbit that is at times fatal also to human beings, and one that the coyote can in all probability transmit. Control operations have demonstrated that the coyote is by far the most persistent predatory animal in the western range country.

The Federal resources to meet the problems of predatory-animal control as they exist in the various States have been utilized on those areas of greatest infestation, particularly in the West. Several additional States in other sections of the country and the Territory of Alaska also have requested that cooperative campaigns against predatory animals be instituted within their borders, notably North Dakota, Wisconsin, Missouri, Louisiana, Kentucky, and New York. Within the past two years New York has become infested with coyotes in a county bordering on Lake Ontario, and there these predators during the spring of 1927 killed \$10,000 worth of sheep.

Thorough control of stock-killing wild animals can be brought about only by coordinated action of Federal, State, county, and private agencies. The Department of Agriculture is looked to for leadership and supervision in this work, because of the fact that the organized procedure it has developed through the Biological Survey has stood the test of time, and its expert personnel is constantly in demand for extending operations over additional areas. Investigations have shown that to meet the problems that confront the stock grower and the game conservationist a more equalized expenditure on the part of the Federal Government is required with relation to

the cooperative funds made available. This is especially needed in view of the fact that predatory animals still exist in large numbers on the Federal domain, and these public lands serve as a breeding ground from which State and private lands become infested.

DEVISING A PROGRAM FOR MORE EFFECTIVE CONTROL OF PREDATORS

During the summer of 1928 predatory-animal control leaders in the various districts were visited by supervisory officials of the department, and with them field surveys were made to determine what kind of a program would be most feasible for bringing the predators under more effective control. From each individual leader estimates were obtained after careful study of the situation in his district as to Federal funds that would be needed to carry out such a program. These figures were compiled on a 10-year basis, as consultations throughout the country developed that this would be the minimum period over which effective control work could be planned with any hope of carrying out the program. The estimates were based on the assumption that the present ratio existing between cooperative funds and the allotments from Federal appropriations would continue to be nearly two to one. The amount provided thus far by cooperators during the current fiscal year (1929) totals \$578,565, compared with \$346,867 in Federal funds. It is probable that this ratio will be maintained, and in a large part of the western range States the proportion of cooperative funds may even be materially increased, for if the financial program should permit making additional Federal funds available, control operations could be undertaken over many stock-growing ranges of States where needed work has not heretofore been possible. Possibly by the end of a 5-year period there may be evidence of attainment of the control being sought in several of the western States. If so, the department would recommend such reductions in the appropriations as the evidences warrant.

From the above-mentioned investigations, it is now estimated that an annual expenditure of \$782,500 for the entire United States should be made for control operations whenever funds are available for such purpose. In the following table a comparison is made of the present predatory-animal allotments in the various States with the funds which would be available for apportionment for operations in corre-

[Handwritten notes and signatures at the bottom of the page, including "J. C. ...", "C. S. ...", and various initials and dates.]

sponding districts in a program, such as that presented, extending over a 10-year period:

TABLE 1.—Comparison of allotments from present (1929) appropriations with estimates of funds needed for annual allotments in a program of predatory-animal control extending over a 10-year period

Districts	Allotments from present appropriations	Estimates of funds needed for annual allotments on the 10-year basis
Alaska.....	\$2,000	\$12,500
Arizona.....	21,070	40,000
California.....	24,530	49,680
Colorado-Kansas.....	18,810	52,650
Idaho.....	19,230	39,380
Kentucky.....		10,000
Louisiana.....		10,000
Missouri.....		10,000
Montana.....	21,495	36,000
Nevada.....	28,825	60,000
New Mexico.....	15,220	37,700
New York.....		10,000
North Dakota.....		10,000
Oregon.....	24,490	41,100
Oklahoma-Arkansas.....	19,550	50,500
South Dakota.....	13,250	34,250
Texas.....	26,455	76,400
Utah.....	27,770	40,000
Washington.....	20,650	46,200
Wisconsin.....		10,000
Wyoming.....	21,865	64,140
Supervision.....	10,865	11,000
Poison supplies, etc.....	9,530	11,000
Eradication methods research.....	16,502	20,000
Total ¹	342,107	782,500

The totals from current appropriations are exclusive of \$4,760 set aside for the Secretary's reserve for the purpose of meeting emergencies. The amount authorized, therefore, was \$346,867.

In making the foregoing estimates the department has taken into consideration all the ramifications that enter into the rather complex predatory-animal control problem in the various States. The estimates are based upon conditions actually existing at this time. While much has been accomplished during the past 12 years, absolute control of the predatory-animal situation has not been attained, and reinfestation is therefore constantly occurring. The department has had in effect since the inception of the work a well-defined plan, but it has fallen short of the control objective.

The program of the organized cooperative campaigns has been one of suppression and control from the start, rather than one of complete eradication of species. This statement is injected to make it clear that the control operations are undertaken in the interests of man and his economic welfare whenever and wherever possible, and not thoroughly to eradicate from the country any species of animal life that adds interest to the wild, when far removed from industrial operations. In areas specifically set aside for the perpetuation of primitive conditions, such as the national parks, and in mountain fastnesses far remote from settlement and economic activities, operations for bringing predatory animals under control are not at present called for, and when needed they will be for the most part localized.

Much detailed information was submitted by the individual leaders of predatory-animal control to substantiate the estimates made for

their respective districts. A typical example is herewith presented (Table 2) in the case of the California predatory-animal district.

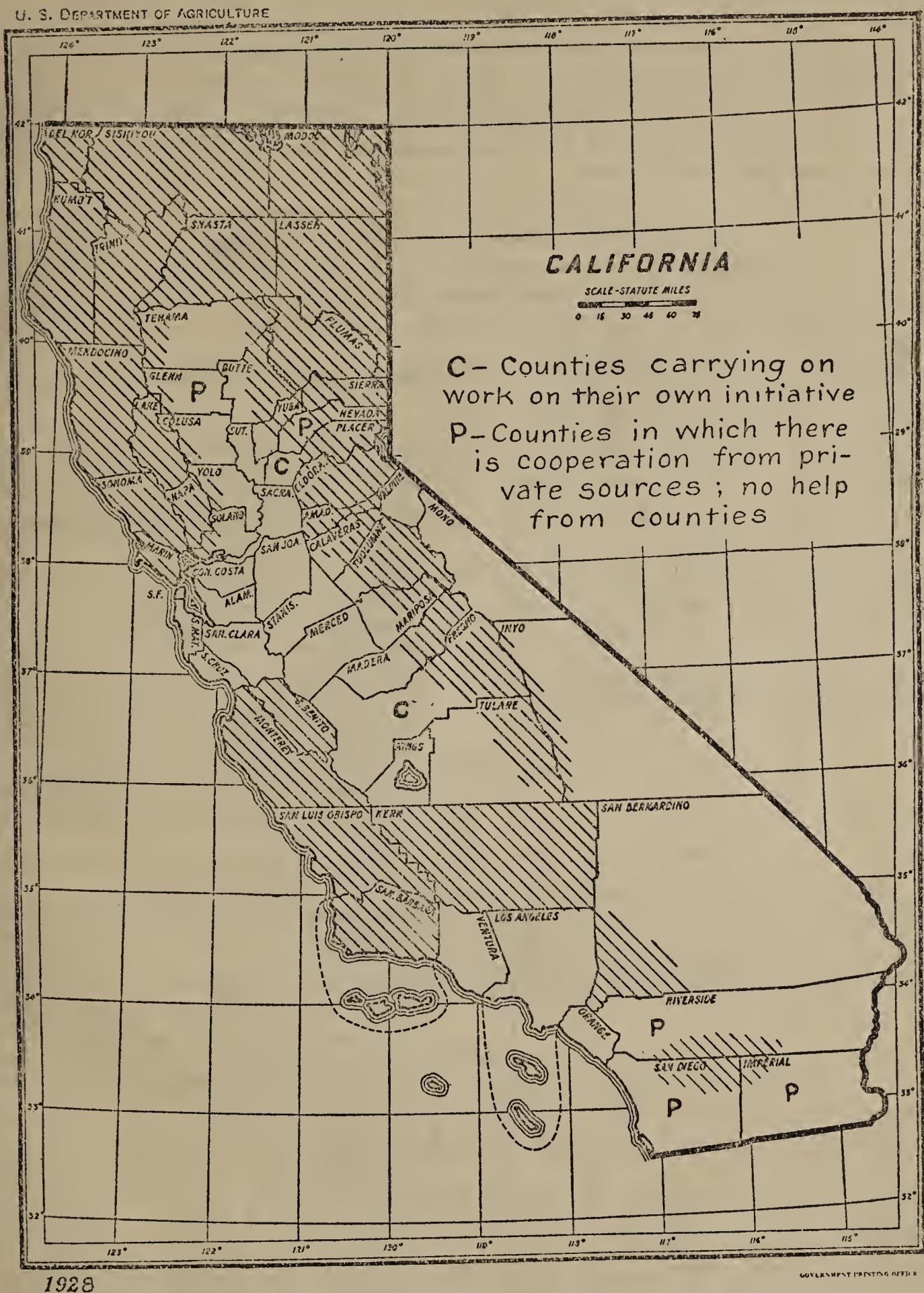


FIG. 1.—Areas in California (shown by shading) that are being and will continue to be extensively worked by departmental hunters in cooperation with county and State authorities, to obtain predatory-animal control, including both the Sierra-Cascade and the coast ranges. Similar details were worked out for other States in preparing estimates of funds needed for a program of predatory-animal control extending over a 10-year period.

The details and statistical matter as worked out for that district are very similar to the results of investigations in other western States. It is from such careful studies as the one presented for California

(see fig. 1) that the totals were reached that make the aggregate additional sum stipulated in the foregoing as needed for carrying out a 10-year program.

TABLE 2.—*Typical example furnished by the State of California of details on which estimates were based for a proposed 10-year program in predatory-animal control, showing the number of hunters that should be employed, their aggregate salaries, and the county, State, and Federal funds that should be contributed for their support, with detailed statements by county indicating the nature of the country over which the hunters must operate*

County	Number	Aggregate salaries	Division of salaries			Remarks
			County	State	Federal	
Alameda.....	2	\$3, 240	\$2, 500	\$740	-----	Border county; protects interior; high and foothill type of Sierra Nevada.
Amador.....	2	2, 000	1, 000	500	\$500	
Butte.....	3	4, 620	2, 560	1, 060	1, 000	Do.
Calaveras.....	3	3, 540	1, 500	1, 020	1, 020	Do.
Colusa.....	2	1, 500	-----	750	750	Coast Range type; work here is essential.
Contra Costa.....	1	1, 620	1, 620	-----	-----	County pays all expenses of hunter's salary.
Eldorado.....	2	3, 240	1, 500	870	870	Border county; protects interior; high and foothill type of Sierra Nevada.
Glenn.....	2	2, 120	1, 000	1, 120	-----	Coast Range type; rough and natural breeding ground for coyotes; private individuals cooperating in lieu of county.
Humboldt.....	5	6, 990	5, 000	995	995	Coast Range type; rough and natural breeding ground for all predatory species.
Imperial.....	2	985	-----	985	-----	Desert type of natural breeding ground; great feeding industry in evidence for sheep; private interests cooperating as far as possible; county does not.
Kern.....	3	3, 080	2, 580	500	-----	Only intermittent supervision given this county.
Lake.....	3	4, 740	2, 000	2, 740	-----	Natural Coast Range breeding ground; exceedingly rough and a focus of infection for coyotes and bobcats; county can not do more than at present; essential job.
Lassen.....	3	3, 800	1, 500	500	1, 800	Border county; probably has more drift of coyotes from Nevada than any other; needs protection all year; a source of supply to interior.
Madera.....	2	3, 120	1, 200	960	960	Border county; protects interior territory; Sierra type.
Mariposa.....	1	1, 620	-----	810	810	Possibility of county or private cooperation; Yosemite Park drift of coyotes.
Mendocino.....	6	9, 780	8, 000	890	890	Natural Coast Range breeding ground; rough and rugged; one of the worst counties in the State to keep controlled, and the largest cooperator.
Merced.....	2	2, 370	1, 500	870	-----	Cascade Range conditions with continual drift from Oregon and Nevada; rabies endemic unless control kept; game protection necessary; antelope and mule deer important.
Modoc.....	6	4, 325	1, 800	1, 260	1, 265	
Monterey.....	2	3, 300	1, 500	-----	1, 800	Coast Range conditions of worst order; rabies and game protection; national forest natural breeding grounds for all predatory animals.
Napa.....	3	3, 240	2, 500	740	-----	Coast Range conditions; natural breeding ground and distributing area.
Nevada.....	2	3, 240	810	1, 215	1, 215	Cooperation from small sheep men; Sierra conditions that are at their worst; important that it be continually worked; protects interior.
Plumas.....	2	1, 500	-----	750	750	High Sierra county; control practical only in summer; a focus of infection.
Sacramento.....	1	810	810	-----	-----	Interior county; county bearing total expense of hunter's salary.
San Benito.....	1	1, 620	-----	810	810	Typical breeding country furnishing coyotes to other counties; little, if any, county cooperation can be expected, but area must be worked to carry out plan.
San Bernar- dino.....	1	1, 320	-----	1, 320	-----	Old county without cooperation.
San Diego.....	1	810	-----	405	405	No county cooperation can reasonably be expected but work should be done, as this part is entitled to help and stops drift to other localities.
San Joaquin.....	1	1, 620	1, 620	-----	-----	Interior county; bears all expense of hunter's salary.
San Luis Obis- po.....	2	2, 000	1, 000	1, 000	-----	Prospective cooperator.

TABLE 2.—*Typical example furnished by the State of California of details on which estimates were based for a proposed 10-year program in predatory-animal control, showing the number of hunters that should be employed, their aggregate salaries, and the county, State, and Federal funds that should be contributed for their support, with detailed statements by county indicating the nature of the country over which the hunters must operate* —Continued

County	Num-ber	Aggre-gate sala-ries	Division of salaries			Remarks
			County	State	Federal	
San Mateo.....	1	1, 500	1, 500	-----	-----	County bears all expenses of hunter's salary.
Santa Barbara..	2	3, 240	1, 620	1, 620	-----	Prospective cooperator.
Santa Clara.....	2	2, 250	1, 125	1, 125	-----	
Santa Cruz.....	1	125	-----	125	-----	Similar to Siskiyou, with rabies an important factor; breeding ground of coyotes and bobcats, which spread to other counties that are being worked; no county cooperation.
Sierra.....	2	2, 160	-----	1, 080	1, 080	
Siskiyou.....	3	4, 920	-----	1, 140	3, 780	This county is one of the most important from a breeding, game protection, and rabies standpoint; much Government land; no county cooperation; antelope very important.
Solano.....	1	1, 620	1, 620	-----	-----	County bears total expense of hunter's salary.
Sonoma.....	2	2, 070	2, 070	-----	-----	Do.
Stanislaus.....	2	2, 310	1, 500	810	-----	After first year county to bear all hunter expense.
Tehama.....	7	5, 310	3, 000	2, 310	-----	Typical Coast Range; breeding ground and supply for surrounding territory with many sheep; a focus of infection or infestation.
Trinity.....	2	3, 000	-----	1, 500	1, 500	Probably the worst breeding ground of the Coast Range territory; 74 per cent Government and State land; county unable to cooperate; much game; must be intensely worked.
Tulare.....	1	1, 500	750	750	-----	Sierra foothill type; breeding ground.
Tuolumne.....	2	3, 000	1, 500	1, 500	-----	Sierra foothill and mountain type; breeding and distributing class.
Yolo.....	2	3, 240	3, 240	-----	-----	County bears all expense of hunters' salaries.
Yuba.....	1	1, 620	1, 000	620	-----	Sierra foothill and high country; breeding and distribution.
Field supervi-sory officials and miscella-neous ex-penses.	-----	33, 700	-----	6, 220	27, 480	
Total.....	-----	153, 715	62, 425	41, 610	49, 680	

NOTE.—It should be possible to decrease Federal and State amounts by 20 per cent after the second year, after which practically all cooperating counties should bear the greater part of the burden. There are, however, counties that will because of their physical and social peculiarities have to be handled by the State and Federal Government for all time. A reasonable control can be attained but a 100 per cent clean-up can never be made. This will necessitate a continuation of control work for an indefinite period. The figures herewith given are more or less approximate, but are reasonably close to the amounts that will be necessary for efficient work.

SERIOUSNESS OF THE PREDATORY-ANIMAL PROBLEM

By persistent, systematized cooperative effort since the year 1915, when the department began to build up its field organization for lessening the stockmen's losses from predatory animals, the gray wolf has been brought under control in all States west of the one hundredth meridian. The small red wolf of eastern Texas, however, is still responsible for severe depredations on livestock, to the great financial loss of stockmen. Bobcats, mountain lions, and the occasional stock-killing bear also take annual toll of livestock and wild game. The combined killings of all these predators, however, do not approach the exasperating losses suffered by the livestock interests through the depredations of the coyote.

The losses coming to the attention of the department are frequently caused by individual predatory animals, the capture of which taxes the ingenuity of the expert personnel of the Biological Survey engaged

in control operations. For instance, the capture of the notorious "Custer wolf" in South Dakota was finally accomplished after seven months' persistent effort on the part of one Federal wolf hunter. This wolf had taken a toll of more than \$25,000 in cattle and had escaped the combined efforts of numerous bounty hunters. In one Texas county another official hunter killed a female wolf that within a year's time had destroyed \$5,000 worth of registered sheep and goats. In southern Colorado one male wolf in six weeks' time killed outright nine head of long yearling cattle and so badly mutilated another yearling that it died near a waterhole, where it had gone to quench its thirst. In Wyoming two male wolves were killed that during one month had destroyed 150 sheep and 7 colts. Where wolves are not under control, in such States as Arkansas and Oklahoma, the present loss in livestock is of very great consequence.

The individual work of wolves can scarcely be compared with the persistent attacks of roving bands of coyotes. In Morgan County, Utah, three coyotes attacked and killed \$500 worth of sheep in an hour. Near Antonito, Colo., 67 ewes became separated from the rest of the herd and two days later were found killed by coyotes. In Oregon four coyotes in two nights killed 15 purebred sheep and rams. In California, near Middletown, on one ranch running 2,000 sheep, coyotes killed 200 in one year, although the sheep were close herded. In a flock of 36,000 sheep owned by 10 men near Marysville, Calif., the loss caused by coyotes was 1,950 in one year; and out of 1,175 turkeys owned by three men the loss in one night was 187. Near Wilbur, Wash., a woolgrower reports the loss of 33 sheep by coyotes, 17 being killed in one week; and near Olympia a poultry producer reports the loss of 80 chickens in one month's time from the same source. In Montana, in one night's raid coyotes killed 26 lambs owned by two neighboring woolgrowers, and near Sula 200 lambs were killed by coyotes between June and September 1.

Nor do ravages on livestock form the only real menace from coyotes, for it has been found that in California these predators have done considerable damage to melon and grape crops. Coyotes have frequently been known to take practically every bunch of grapes in small vineyards. Wild game also suffers from the work of coyotes, as may be instanced by statistics compiled in the New Mexico field office at Albuquerque, where it was found that the stomachs of 48 coyotes taken during August, 1927, contained deer flesh; also in April of that year considerable depredations by coyotes on young calves were noted in New Mexico—much of this being done in feed pastures, particularly on newly born calves.

In Arizona, during the fiscal year 1920, 445 stockmen and farmers reported livestock losses from predatory species of \$378,151 in one year; a number of others reported a loss of 2 to 10 per cent of their calf, colt, and lamb crop each year from wolves crossing into that State from Mexico, and from other predators such as mountain lions, bears, coyotes, bobcats, and foxes. Since the bringing of the gray wolf under control in 12 of the western range States, to hold control it has been necessary constantly to maintain expert wolf hunters in known wolf crossings on the international boundary along the Arizona-New Mexico border, to destroy the wolves coming sporadically from the Province of Sonora, Mexico.

A very acute situation has arisen on national forests in the State of Arkansas because of the increasing number of wolves there. As

a result of successful fire-control measures on those forest areas, the sprouts of hardwood trees have become numerous and afford thickets dense enough to harbor predatory animals, chiefly wolves. The local residents are quick to note the real cause of this increase of the predators. Forest officers, while usually able to convince them that forest fires deplete the grazing resources and at the same time fail to kill the boll weevil or to improve hunting and fishing, and while fairly successful in overcoming the sentiment favorable to woods burning, find in the wolf situation a real problem, threatening to cause loss of the ground gained in operations and educational efforts in fire prevention. On the Ouachita Forest citizens are suffering such serious losses of livestock from wolves that there is talk of woods burning to drive out the predators. In such places as this the need for extermination should be quickly and effectively met. In one district of the Ozark National Forest in 1927 wolves killed 200 hogs three months old, 1,400 young pigs, 10 sheep, and 50 lambs, valued at \$4,600. Action tending toward control of this situation became effective July 1 of the present year, whereby a cooperative agreement for predatory-animal control operations was entered into between the department and the Arkansas State Game and Fish Commission.

PROGRESS IN CONTROL OPERATIONS

Careful field studies of the abundance, habits, and relationship of predatory animals to the livestock industry have been made by the Biological Survey for many years. Men with keen insight into the ways and habits of wild creatures and versed in animal psychology have sought out improved methods of luring them to destruction when their presence has been found detrimental to the livestock business.

The first demonstrations and experiments by the department for the control of wolves and coyotes were conducted during the year 1914-15 in Colorado, Nevada, Texas, Idaho, Oregon, and other western States. In eastern Oregon and northern Nevada, where rabies prevailed among coyotes at that time, a considerable number of hunters were employed to assist in destroying these animals in the hope of eradicating this disease.

Depredations upon livestock continued to be so serious and the means of protection then employed afforded so little real relief to the stock-raising industry that in 1915 stockmen took up the matter with their representatives in Congress, with the view of obtaining the aid of the Federal Government. On July 1, 1915, the first appropriation—\$125,000—resulted, specifically providing Federal funds to assist in organizing campaigns against predatory animals on national forests and other public lands and to correlate and direct the many agencies at work on the problem along the most effective and economical lines. This had as its object making distinct and permanent headway in relieving the stockmen from the serious drain upon the productive capacity of the great western ranges caused by predatory animals.

The Biological Survey during the fiscal year 1916 began to build up the necessary field organization. The principal western livestock-producing States where the need appeared most urgent were organized in eight predatory-animal districts, each in charge of an experienced leader. The hunters employed devoted their entire time to the

work, and were not permitted to receive bounties from any source. The skins of all animals having fur value taken by the hunters became the property of the Government and were sent in to the department and sold at public auction, the receipts being turned into the United States Treasury. To date these total \$430,243.84.

Four methods of destroying predatory animals are followed—shooting, trapping, poisoning, and den hunting. The total kill of livestock predators since the fiscal year 1916 is shown in the following table:

TABLE 3.—*Predatory animals destroyed by the Bureau of Biological Survey and cooperators from the initiation of the work on July 1, 1915, to the end of the fiscal year 1928*

States	Bears	Bobcats and Canada lynxes	Coy- otes ¹	Wolves	Moun- tain lions	Total
Arizona.....	143	2, 025	12, 304	358	910	15, 740
Arkansas.....		76		287		363
California.....	129	5, 941	25, 191	3	133	31, 397
Colorado.....	114	1, 401	19, 065	174	90	20, 844
Idaho.....	136	1, 865	25, 789	133	11	27, 934
Illinois.....			10	18		28
Kansas.....			62			62
Michigan.....	34	193	1, 337	276		1, 840
Missouri.....		52	133	187		372
Montana.....	201	1, 694	36, 621	596	150	39, 262
Nebraska.....		1	16			17
Nevada.....	4	9, 940	60, 762	6	41	70, 753
New Mexico.....	188	2, 582	16, 644	604	460	20, 478
North Dakota.....		10	655	1		666
Oklahoma.....		18	479	183		680
Oregon.....	264	4, 654	36, 476	31	89	41, 514
South Dakota.....	1	338	9, 495	53		9, 887
Texas.....	1	3, 896	23, 252	3, 153	21	30, 323
Utah.....	59	4, 301	33, 125	188	131	37, 804
Washington.....	173	1, 236	28, 143	2	42	29, 596
Wyoming.....	156	1, 582	37, 422	707	18	39, 885
Total.....	1, 603	41, 805	1 366, 981	6, 900	2, 096	419, 445

¹ Above totals represent coyotes the bodies of which were actually recovered and the skins or scalps secured. The total number of coyotes, however, does not take into consideration those killed by poison and not found. It is estimated that an additional number of coyotes totaling more than 800,000 were taken during the period covered.

SUPPRESSION OF RABIES IN PREDATORS

During 1916 demonstrations and experiments were carried on in localities other than on national forests and public lands, where predatory animals were causing heavy losses of livestock. Added impetus and intensity of purpose were given this work by the appearance, spread, and destructiveness of rabies, which that year gained a foothold, particularly among coyotes and wildcats, in southwestern Idaho.

Special work for the suppression of rabies, made possible through an emergency congressional appropriation of \$75,000, which became available March 4, 1916, was conducted under the same supervision, organization, and methods that were followed in the regular predatory-animal control operations. The alarming increase of rabies among wild animals, particularly coyotes, was attended with danger to livestock and also to human beings. The seriousness of the outbreak is indicated by the fact that during the year 1916 the State authorities of Nevada treated more than 60 persons who were bitten by rabid animals, either wild or domestic. So great was the dread inspired by

the presence of these maddened wild animals, and of domestic animals bitten by them, that children were accompanied to school by armed guards. Driven by their rabid blindness, coyotes entered the yards of dwellings, attacking any object they might encounter—dogs, cats, or human occupants; they entered feed lots and snapped and infected cattle, sheep, and other domestic animals; and also, contrary to their regular habit, on the public highways attacked pedestrians, horsemen, and automobiles. The destruction of livestock was enormous. In a feed lot at Winnemucca, Nev., a single rabid coyote caused the loss of 27 steers. The State of Nevada during the fiscal year 1916 appropriated \$30,000 to cooperate with the department in waging a campaign against the pests in that State. The work was prosecuted vigorously, through trapping and extended poisoning operations, during 1916, 1917, and 1918, when the spread of the disease was materially checked and plans were further developed for its limitation and ultimate suppression.

The movements of livestock between their summer and winter pasture ranges, with accompanying movements of dogs and predatory animals, made possible a spread of rabies into the contiguous territory of eastern Oregon, southern Idaho, northern California, the western half of Utah, and even into eastern Washington. Cattle and sheep were destroyed in large numbers through this extension of the disease, and at least 1,500 persons were bitten by rabid animals. A few cases of rabies were reported in Montana and Wyoming, but prompt action resulted in stamping it out before it could gain a foothold. The measures employed by the Biological Survey in Nevada were applied in the other States, and with the cooperation of local authorities further spread of the disease was effectually stopped. The measures for prompt control and eradication of this dread disease are now so well understood that the occasional sporadic outbreaks are met without delay and stamped out by detailing specially trained men to each infested locality.

EFFECTIVENESS OF THE WORK THUS FAR UNDERTAKEN

During the fiscal year 1928 the average force of skilled hunters employed under the direction of the Biological Survey numbered 500. These men are working under the direction of trained leaders and are organized in 14 districts, exclusive of Alaska, as follows:

- | | |
|-----------------------|---------------------------|
| 1. Arkansas-Oklahoma. | 8. New Mexico. |
| 2. Arizona. | 9. South Dakota-Nebraska. |
| 3. California. | 10. Oregon. |
| 4. Colorado-Kansas. | 11. Texas. |
| 5. Idaho. | 12. Utah. |
| 6. Montana. | 13. Washington. |
| 7. Nevada. | 14. Wyoming. |

The hunters of the various districts are paid in part from the Federal Treasury and in part from cooperative funds supplied by State and county appropriations and from contributions from livestock organizations and individuals. There has been a steady consistent increase in the funds provided for cooperation with the department in this work, as the direct benefits derived from the systematically organized operations become evident. Present advices indicate that the cooperative funds for the year 1930 will be materially increased.

Since the inception of this work, study and experimentation both in the laboratory and in the field in conjunction with control operations have brought great improvements in the methods and practices employed in campaigns against predatory animals. The poisoning campaigns have increased in number and have been more effectively organized and conducted each succeeding year. The success has been watched and approved by stock growers, with the result that these men are continually urging further extension of the work. The campaigns have been followed by a marked decrease in the number of coyotes in the sections covered, with a corresponding decrease in the losses of sheep, cattle, pigs, colts, and poultry. Reports from stockmen indicate that on many ranges and lambing grounds, especially where funds have permitted concentration of the control work on areas of heaviest infestation, the former heavy annual losses have become negligible or have been entirely eliminated.

The success thus far attained with limited resources is strong indication of the efficient control that could be expected if the experienced force of hunters, working in cooperation with the States in well-organized districts and under trained leadership, were equipped to carry out a control program extending over a 10-year period.

PART 2

THE SMALLER PREDATORS, OR RODENTS

The smaller predators, including the rodents, cause losses in farm crops and range forage in the United States that run into hundreds of millions of dollars annually. Their control is one of the most tangible means of increasing production and profits in agriculture, horticulture, stock raising, and forestry. The magnitude of the task of control is measured by the length and breadth of the entire United States, and its execution requires not only action by Federal and State officials, but the voluntary cooperation of hundreds of thousands of farmers and others whose active interest in the campaigns must be enlisted. The control operations as carried on through the Bureau of Biological Survey are closely interlocked with the activities in progress in the control of stock-killing animals.

A DOUBLE PROGRAM FOR MORE EFFECTIVE RODENT CONTROL

The smaller predatory species involved in the control work include the ground squirrels, prairie dogs, jack rabbits, pocket gophers, woodchucks, porcupines, house and field mice, wood rats, kangaroo rats, brown rats, and moles. So numerous and so widely distributed are these pests that uncontrolled their damage to farm crops and forage would be appalling. A comprehensive program of control, more drastic than that conducted at the present time, is needed. Much has been accomplished, and much remains to be done.

TABLE 4.—Allotments from present (1929) appropriations and estimates of funds needed for annual allotments in a program of rodent control extending over a 10-year period

Districts	Allotments from present appropriations	Estimates of funds needed for annual allotments on the 10-year basis
For cooperative work on State, private, and Federal land other than national forests:		
Arizona.....	\$8, 460	\$33, 000
California.....	9, 110	36, 800
Colorado.....	6, 220	27, 750
Idaho.....	6, 534	17, 560
Kansas.....	6, 780	10, 000
Montana.....	8, 222	29, 330
Nevada.....	5, 425	10, 000
New Mexico.....	13, 860	39, 760
Oregon.....	11, 540	36, 000
South Dakota.....	6, 275	31, 900
Texas.....	15, 208	49, 400
Utah.....	10, 301	26, 000
Washington.....	11, 220	17, 500
Wyoming.....	10, 480	20, 000
Eastern United States.....	19, 097	88, 200
Infested forest lands (see Table 5) ¹	35, 050	80, 000
Supervision.....	8, 530	9, 000
Poison supplies, etc.....	7, 955	9, 000
Eradication methods research.....	16, 500	20, 000
Total ²	216, 767	596, 200

¹ Allotments from present appropriations for work on national forests aggregating \$35,050, are as follows:

Arizona.....	\$12, 000	Montana.....	\$100	South Dakota.....	\$1, 200
California.....	2, 700	Nevada.....	1, 000	Utah.....	1, 000
Colorado.....	5, 100	New Mexico.....	4, 000	Washington.....	500
Idaho.....	3, 700	Oregon.....	3, 500	Wyoming.....	250

² The totals from current appropriations are exclusive of \$3,000 set aside for the Secretary's reserve for the purpose of meeting emergencies. The amount authorized, therefore, was \$219,767.

TABLE 5.—Acreage, as compiled by the Forest Service, of rodent-infested lands on national forests, on which an annual expenditure of \$80,000 is needed for control operations covering a 10-year period

Forest district	States in which forest lands are infested	Area infested (acres)
No. 1.....	Montana, northeastern Washington, northern Idaho, northwestern South Dakota.	1, 444, 470
No. 2.....	Western Colorado, Wyoming, South Dakota.....	265, 637
No. 3.....	Arizona, New Mexico.....	1, 153, 887
No. 4.....	Utah, southern Idaho, western Wyoming, Nevada, northwestern Arizona.	2, 418, 386
No. 5.....	California.....	675, 500
No. 6.....	Oregon, Washington.....	1, 749, 269
Total.....		7, 712, 149

Two estimates were made of the needs for covering the two well-defined though interlocking programs in rodent control that have been instituted by the department. The first estimate has to do with rodent-control work on national forests. The department's leaders estimate that prairie dogs and ground squirrels can be controlled on the 8,000,000 acres of infested national forest lands in a systematic campaign extending over a term of 10 years at an average cost of 10 cents an acre. This would involve an annual expenditure of \$80,000.

There can be little financial assistance to the department in this undertaking, though it is anticipated that considerable cooperation can be expected in the way of voluntary labor. In this work the Forest Service will cooperate to the extent of its ability.

The second estimate is concerned with extending rodent control to adjacent infested acreage on other public domain, including Indian reservations, and with more adequately assisting in operations on State and private agricultural lands. The estimate for this, based on a 10-year program and on an expected continuance of cooperative funds in the present ratio, calls for an annual Government expenditure of \$516,200. The cooperative funds now forthcoming from States, counties, associations, and private individuals, compared with available Federal funds, hold the ratio of about 4 to 1. For the present fiscal year these funds thus far aggregate \$801,604, compared with \$219,767 available from Federal appropriations. The total estimated need for the two programs is \$596,200. Table 4 shows the present rodent-control allotments for cooperative use on the public domain and on State and private lands, in States in which intensified operations have been conducted for more than 12 years, and the funds tentatively proposed for apportionment for operations in corresponding States over a 10-year period.

EXAMPLES OF DESTRUCTIVENESS OF RODENTS

Some idea of the seriousness of the losses suffered annually from rodents can be obtained from the following examples: In Idaho, according to 4,037 signed statements made by farmers, there would have been a total annual loss from ground squirrels of \$2,087,742 in farm crops on 638,971 acres if nothing had been done toward control, or an average annual loss of \$3.26 an acre. Experiments conducted in Arizona show that prairie dogs destroy from 25 to 80 per cent of the annual production of forage in infested areas. Midland County, Tex., alone records a loss of \$95,000 this year from reduced cotton yield because of depredations by rabbits. A break in an irrigation canal near Gila Bend, Ariz., caused by pocket gophers resulted in a \$35,000 crop loss and required nearly \$5,000 for repairs. A heavy infestation of mice this year in Jones and Lyman Counties, S. Dak., was responsible for the destruction of more than 40,000 acres of corn, to the great financial loss of the owners. One farmer in Texas reports a loss of \$500 in sweet potatoes and turnips on 20 acres, caused by depredations of rats; and another in the same State a loss of \$60 in ripe figs and \$1,500 in trees from the same source. Other rodents also take great toll of growing and stored agricultural products, the extent of their depredations varying with their abundance from year to year.

For many years farmers and stockmen in the West, in numerous instances driven to the verge of desperation by constantly recurring losses, endeavored to clear their holdings of rodent pests, only to find their methods ineffective or their lands constantly reinfested by animals from adjacent public domain or from lands of their less thrifty and energetic neighbors. The Department of Agriculture received many urgent appeals for help from Western States, the cry being that if the rodents could not be controlled the people would have to abandon their ranches. In many instances it was apparent that the portion of the crop eaten by the rodents represented the

difference between a comfortable profit and a distinct loss on the year's enterprise. In some localities human health also has been endangered by the presence of rodents, as where ground squirrels become carriers of such diseases as spotted fever or bubonic plague, as in parts of Montana and California, or where infected wild rabbits, the main source of tularemia, which is now found in nearly every part of the country, operate to communicate this disease to man.

Rats constitute a greater economic menace, both in spreading disease and destroying property, than any other single animal pest, although warning is continually sounded and control operations undertaken. A conservative estimate of the annual loss because of rat depredations in the United States would be in excess of \$200,000,000. Rat control in cities as well as on farms has been given attention through publicity and demonstrations in connection with the organization of antirat campaigns, and by investigations of places that encourage rat infestation, followed by recommendations to city officials and others concerning necessary corrective action.

Because of their great abundance and remarkable fecundity, such injurious predators as prairie dogs, ground squirrels, pocket gophers, jack rabbits, rats, and mice have been able to resist the sporadic individual efforts of farmers and stockmen. Very often farming practices tend to provide ideal conditions for the abnormal multiplication of those rodents that readily turn from supplies of native vegetation to feed upon growing crops or stored agricultural products. Hence, the numbers of these animals have increased, as have the infested areas, in spite of all individual and other attempts thus far undertaken toward control. Under these conditions areas cleared of the pests by progressive landowners soon become reinfested by invasion from public lands and from adjacent private holdings where their control has been neglected.

ORGANIZED CONTROL OPERATIONS

Up to and including the year 1916 the department, through the Biological Survey, had worked largely on field investigations of damage to crops and range grasses caused by prairie dogs, ground squirrels, pocket gophers, jack rabbits, field mice, and rats. Studies and experiments also were conducted to determine effective methods for the control or complete eradication of the pests in localities where they were proving seriously destructive. Some demonstrations also were made to show farmers how to protect their crops and hay from destruction by rodents. The demands made by farmers and stockmen for systematic operations to eliminate the losses caused by rodents justified the assignment to the department of the task of organizing the work of controlling these pests under a definite and cooperative program. This was begun in cooperation with State and private organizations in 1917.

The organized rodent-control work of the Biological Survey is now being carried on in 15 States in the West under the direct supervision of 14 district leaders, and in the East under the direction of one district leader with necessary assistants. Each leader organizes and correlates the activities of the various agencies interested in rodent control in his district. The extent of operations at the present time is indicated by the fact that in cooperative undertakings during the past year more than 3,306,000 pounds of poisoned grain and vegetable

baits were used in controlling rodent pests on 14,545,591 acres of land. This involved the use of approximately 7,000 pounds of strychnine, besides 141,580 pounds of calcium cyanide and 626,463 pounds of carbon disulphide.

Entering into the cooperation are such agencies as agricultural colleges, State departments of agriculture, agricultural agents and other county officials, other governmental agencies, farmers' and stockmen's associations, and individuals. The cooperation rendered by these agencies, including work, materials, and money, denotes the general satisfaction with the methods of the Biological Survey, the cooperative funds made available during the past 12 years being approximately four times the amount expended from Federal appropriations.

The importance of the results of rodent-control operations may be judged from replies to a questionnaire mailed to 4,018 cooperators in Arizona. These estimated that as a result of the year's work in that State alone there was a saving in crops, range grasses, and fruit trees of \$474,235. The total cash expenditure for rodent control in that State by all cooperating agencies amounted to \$41,367.

During the past year an alarming infestation of rats occurred in Texas, and to combat it the department was asked to assume the leadership through its field assistant in charge of rodent control in that State. This resulted in organized antirat campaigns in 34 counties, and rats were taken totaling by actual count 3,690,528, probably representing not more than a third of the total kill.

During the fiscal year 1927 an effective poison, believed to be specific for rats and mice, was developed by the department. The use of this practically eliminates danger to human beings and domestic animals. Also gratifying progress was made in methods of applying fumigants for the control and eradication of rats under varying local conditions.

The department has demonstrated that permanent headway in rat control can be accomplished by furnishing trained leadership to stimulate public interest, to demonstrate and instruct in the most practical control methods, and to direct organized campaigns against rats. All States east of the Mississippi River are urgently in need of such service, and this is true of most of the Western States, also. It is not possible to furnish this service to the degree now required, and funds are needed to extend this important work, as specified in the above estimates for a 10-year program.

THE CONTROL PROBLEM ON NATIONAL FORESTS

Gratifying as has been the progress in eradicating rodents from range and farming lands, there remains a serious infestation that requires attention on the public domain, particularly on national forests. The carrying capacity of grazing areas on rodent-infested national-forest land, estimated at 8,000,000 acres, is reduced from 25 to 80 per cent by such rodents as prairie dogs and ground squirrels. The denudation of land through close cropping of the natural cover of native grasses by rodents is one of the primary causes of destructive erosion. In this process soil is not only carried from areas where needed but is deposited as silt in irrigation reservoirs and elsewhere, entailing much trouble and expense in further removal.

The national forests and other Federal lands, including Indian reservations, are often the source of infestation of private agricultural lands and other areas. Typical of such conditions is the invasion of the upper Arkansas Valley in Colorado by the Wyoming ground squirrel, mainly from adjacent national forests. Another striking example is furnished in Montana, where vast areas of Federal lands, mainly mountainous, forested, or broken in character, frequently border on private holdings.

Of late years the seriousness of porcupine devastations in forests, including young plantings, has been shown in southwestern Colorado, where on one national forest some 200,000 acres are so badly infested that porcupines are alleged to be more destructive to the trees than any other single agency, not excepting fire. Similar conditions have been reported from Idaho, Oregon, Washington, Utah, Arizona, New Mexico, and California. In the past two years a simple but effective method of controlling porcupines by poisoning has been worked out by the rodent-control experts of the Biological Survey. Extensive porcupine-control operations are needed over many of our national-forest lands.

It is important that the department control the rodent infestations on these public lands. The available Federal funds have been in a large measure used in cooperative-control operations on private lands, with additional systematic work on national forests and other public domain in Arizona, New Mexico, Montana, Colorado, Idaho, California, Oregon, and Utah. A definite systematized program, however, for the eradication of ground squirrels, pocket gophers, and prairie dogs is called for over the public domain, including every national forest west of the Continental Divide. It is the definite obligation of the Federal Government to adopt such a program.

ENCOURAGING RESULTS OF THE CONTROL CAMPAIGNS

The fact has been recognized for many years that cooperation and systematic effort on all infested areas are essential to the effective control of rodents that feed upon agricultural crops and migrate from place to place in search of food and shelter. Since the department was given the responsibility of rodent control, plans have been conceived and a technique evolved and put into operation that have effected the required cooperation of many thousands of farmers and other landowners, and the practical elimination of certain rodent pests over millions of acres of valuable agricultural lands. This has been attended by an enormous direct saving and has been followed by increased production of important crops. The eagerness with which more than 80,000 farmers during the past year availed themselves of the opportunity to obtain relief from these pests through joining in cooperative action under trained leadership and applying the methods of control developed by the department, is most significant and gratifying. They are coming more and more to realize that losses due to depredations of rodent pests need not be tolerated.

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