ENVIRONMENTAL MANIPULATION IN ROOF RAT CONTROL PROGRAMS

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ABSTRACT: The control of roof rat Rattus rattus involves not just chemical and physical suppression, exclusion, and sanitation in an integrated environmental manipulation approach, but in order for the environmental manipulative technique to work, the environmental-behavioral habits of the individuals living in these roof rat infested areas must be modified. Once a target area of known rodent infestation has been initially impacted and environmentally improved upon, the task by the homeowner to continue to practice environmental manipulation must be ongoing. Continued maintenance of the environmentally improved area by staff knowledgeable in environmental manipulation and behavioral modification is the only way to insure that the area will continue to have such reduced carrying capacity so as not to allow roof rat reinfestation. Without continued maintenance, roof rat populations will return to an environmentally improved (manipulated) area in four years' time.

INTRODUCTION

Environmental manipulation in the control of roof rats, Rattus rattus, follows three traditional major factors, and two alternate and more important supportive factors. The first is sanitation, with sanitation being nothing more than good basic hygienic practices. The second is exclusion, or building the rodents out. And the third is suppression, both physical and chemical, nothing more than the direct killing of the rodents themselves. But there are two alternate thrusts that have to be interplayed with the three factors that may be considered to be traditional environmental manipulation, and that is behavioral modification and continuing maintenance. Therefore, environmental manipulation is not just changing the environment for the better, but it's modifying the behavior patterns of the people who live in that environment, and the ultimate product is rat control, a direct result of the manipulative process.

Since 1964, the City of Ontario, California, has asked the California State Department of Health, Vector Biology and Control Section, and the San Bernardino County Environmental Health Services Department to evaluate the roof rat populations that are infesting the sanitary sewers and the citizens' homes in and around their community. During 1966, a survey was made in response to the above request, and the State Department of Health reported to the city that roof rats were indeed present in the sewers. (Rohe 1966) This was unusual, since the roof rats were using the sewers as a freeway system to gain access to other parts of town. The other locations in California where roof rats have been found in sewers are San Diego, Bakersfield, Santa Barbara, Pasadena, and La Habra. (Brooks 1963)

By 1971, they had migrated from the underground freeway to an aboveground freeway by using the telephone wires and the power lines to walk from area to area or block to block. We found that the rat populations were actually on the increase and they were moving towards the neighboring communities.

Finally, in 1974, rodent populations became so great in one portion of the city that the citizens responded by filing petitions with the City Council and asking for direct help in the removal of these rodents from their community. In September of 1974, the City Council requested the Department of Environmental Health Services to undertake control measures in this high roof rat complaint area. At this time, a presentation was made before the City Council to explain those factors that the Insect and Rodent Vector Control Section of the Department felt were necessary to control and eradicate the rodent infestation within the defined target area. This four-square block area, City Council was informed, was going to be rid of rats, not just by the placing of large amounts of rodenticides as requested by the City Council, but rather through an integrated approach utilizing environmental manipulation.

METHODS

Environmental Manipulation

It was then explained to the City Council that the individual citizen was going to have to alter the environment around his household that was conducive to rats.

The City Council was informed that with only utilizing rodenticides, studies have shown that the rats would be back at certain percentage levels within a year to two years, and we want something that's more long lasting; we want to try the environmental manipulation technique, and what we would use is an integrated control approach, environmental manipulation, with about four staff members who could accomplish this in less than two months.

However, we would need the City Council's cooperation so that the citizens wouldn't call back to their Council and say, "these health people are harassing me, they're making me do these things." The Council would have to back us up. Then we contacted the local County Supervisor and we had to have his backing as well, so that if they didn't get action from their local City Councilman they wouldn't go to their County Supervisor and ask for help. And finally, we stressed to the City Council that the Department was going to use education, uppermost, with enforcement only as a last alternative.

Education, basically, involves a one-on-one approach, utilizing the Premises Correction Notice (Fig. 1). The term Premises Correction Notice was used rather than Notice of Violation, because it was felt that using this approach was more in the spirit of cooperation so that the people felt they were just being told what rodent causal factor(s) the vector biologist found on their property that was conducive to the rodents.

Environmental Improvement Agency
DEPARTMENT OF ENVIRONMENTAL HEALTH SERVICES
1111 East Mill Street, Building 1
San Bernardino, CA 92415

RODENT CONTROL
PREMISES CORRECTION NOTICE

Date_____

Name_____ Regarding Premises Located At:_____

Address_____

An inspection of the above premises discloses conditions which must be corrected in order to assure that the house, the yard, and the neighborhood will be kept free of rodents. These measures are necessary to control and eliminate these animals and the ectoparasites which are a nuisance and can carry diseases.

THE ITEMS CHECKED [X] . MUST BE CORRECTED:

I. Building(s) in need of ratproofing to prevent the entrance of rats through openings in foundations, siding, vents, etc.

- a. ☐ Crawl holes, foundation vents, attic vents not effectively screened. (Use ¼" mesh wire, such as hardware cloth.)
- b. ☐ Rats can enter at roof intersections, or under eaves.
- c. ☐ Rats can enter through holes in foundation, loose or broken siding, or around holes for pipe or conduits.
- d. ☐ Overhanging vegetation needs to be pruned away from building(s) and/or wires.

II. Rat harborages, where rats may hide and/or nest in protected places, which this Department found to exist on the premises.

- a. ☐ Wood piles, loose lumber, metal, and miscellaneous items, must be stored 18 inches off the ground, with a clear area below, and 12 inches away from walls, buildings, or fences, or be removed from premises.
- b. ☐ Rubbish piles, weeds, or brush to be removed from premises.
- c. ☐ Heavy ground cover, ivy, elephant grasses, heavy vertical vines, etc., need to be pruned, thinned, or removed.
- d. ☐ Palms or other trees to be pruned and/or thinned.

III. Potential food sources found to exist on premises.

- a. ☐ Garbage improperly stored or not stored in fly and rodent-tight garbage containers.
- b. ☐ Fruits and nuts not harvested and lying about on the ground.
- c. ☐ Pet and bird foods left outside.
- d. ☐ Improperly stored foodstuffs such as fruits, vegetables, nuts, pet foods, grains, etc.

IV. Other_____

Your cooperation in correcting the checked items, within_____ days and by _____, 19____, will be greatly appreciated. Failure to comply with this notice within the specified time may subject you to penalties as provided by State and County Ordinances. If additional information is needed, please call_____ (Vector Control Section).

RICHARD L. ROBERTS, R.S., MPH, Director
Department of Environmental Health Services

By_____
Vector Control Consultant

12-14665-631

Fig. 1

Sanitation

During the educational visit, it was explained to the homeowner what good sanitation practices they could follow to help remove the roof rat from in and around their premises. These are listed as Item III on the Rodent Control Premises Correction Notice. They were shown how garbage cans needed tight-fitting lids; how fruits and nuts that were not harvested could be a food source, whether in the trees or lying on the ground; how pet and bird foods left outside could also be a food source; and improperly stored foodstuffs could also be an alternate food source.

It was also pointed out to premise owners that snails were an excellent rodent food source, and if snail control were practiced, it could severely impact the carrying capacity of the infestation area.

Exclusion

In the exclusion phase, rat-proofing methods and rodent entrances were pointed out to the homeowner so that they could see where rodents were gaining access into their homes or properties. These are pointed out in Item I of the Premises Correction Notice. Item II points out rodent harborage. During the one-on-one educational visit, the places where rodents hide or nest which could be found to exist on the premises were also shown to the property owner. Palms needed to be pruned, thinned, or banded with metal to prevent rodent access. Vertical ivy was removed and ground cover thicker than one foot in height was also asked to be removed. Wood piles and loose lumber and other refuse had to be stored at least eighteen inches off the ground with twelve inches away from walls, buildings, or fences.

It should be pointed out that during the Sanitation and Exclusion phase, we took advantage of the Annual City-wide "put anything on the curb" Clean Up Week. Fliers and news media were utilized to tell people they could put on their curbs any debris or refuse they might have that wouldn't normally fit in their refuse containers. Mattresses, old refrigerators, stoves, and other large refuse was placed out at curbside by the citizens and picked up at no extra cost.

Suppression

The suppression phase is a metered phase and was designed to only be brought into play during the exclusion and sanitation techniques. In other words, while they were ongoing. We as vector biologists wanted to offer the roof rat an alternative food source, while his usual sources were being removed or cut off. These physical and chemical suppression techniques were in the form of a diphacinone bait block, purchased through the County Department of Agriculture, or through the use of a Victor snap trap. These suppressive techniques, however, were only offered to the citizensonce they had begun their exclusion and sanitation practices, and not until then.

The Target Area

The target area encompassed four contiguous blocks. To begin with, the target area and its initial attack phase was comprehensively surveyed to: (1) determine what the actual Rattus rattus populations were; (2) determine where the roof rat populations/infestations existed; (3) determine which premises had the highest rodent causal conditions. After the results of the comprehensive survey, the target area was then entered into the attack phase. During this phase, the homes within the target area were attacked in a circular motion, working from the outside going towards the center of the target area, in essence, producing an adverse outside-perimeter environment effect. It was felt that by manipulating the premises on the periphery and then working towards the center, those rodents which were harbored in the premises in the center of the target area would have no harborage to go to if they attempted to escape towards the periphery. During the attack phase, the vector biologists were brought into play. The biologists interact one-on-one, as previously discussed, going door-to-door. Since the entire area is being attacked at once, it was the intention that each of the premises come into compliance on or about the same dates. During this compliance period, while good sanitation practices were being observed and exclusion was taking place, then the physical or chemical means of suppression were utilized.

RESULTS

The comprehensive survey showed that the small target area had 130 premises. Within the 130 premises, 252 violations or deficiencies were noticed after the comprehensive survey (Table 1.).

During the attack phase, each homeowner was issued the Premises Correction Notice and given ten-to-fourteen days for compliance. After this period, the vector biologists returned to see if the environmental manipulative techniques had taken place. If not, the homeowner was mailed a second Premises Correction Notice; however, typed at the top of the form in red letters were the words, "Second Notice." On analyzing the original data, the specialists found that it was necessary to send the second notice to 40% of the premises. Those homes where causative conditions and actual rat signs were found were supplied with the rodenticide and placed by the Insect and Rodent Vector Control staff. The initial comprehensive survey showed a 51.5% infestation rate. Bait consumption was monitored every two days to assess acceptance and to replenish bait if need be. In order to monitor the bait for acceptance, a postage card system was utilized. (See Fig. 2). This postage card required no postage stamp. A card was left with the homeowner, plus an additional card was attached to the bait, should the homeowner lose the original card. All the homeowner had to do was check off one of the boxes printed on the

Table 1. Results of comprehensive survey of the target area (Stotelmyre 1978).

Violations Relating to Buildings	Number of Violations Sept 1974	Nov 1974	Dec 1977
crawl hole not effectively screened	4	0	4
crawl hole screen loose or open	3	0	5
foundation vents not effectively screened	11	0	5
attic vents not effectively screened	5	0	0
openings in sidings and foundations	0	0	1
openings under eaves	0	0	0
openings around pipes and conduits	1	0	9
limbs and vegetation overhanging roof	67	1	46
Violations Relating to Rat Harborages			
woodpile not stored 12-18 inches off ground and away from walls	51	0	23
loose lumber, metal, and miscellaneous items not stored as above	21	0	18
rubbish, piles, weeds, and brush accumulated on property	6	0	16
heavy ground cover, ivy, etc., need pruning or thinning	52	1	21
palm trees need pruning or thinning	7	0	8
Violations Relating to Food Sources			
garbage improperly stored	3	0	5
fruits and nuts lying on ground	7	0	20
pet and bird food left outside	9	0	6
miscellaneous violations	5	0	3
TOTAL VIOLATIONS:	252	2	190

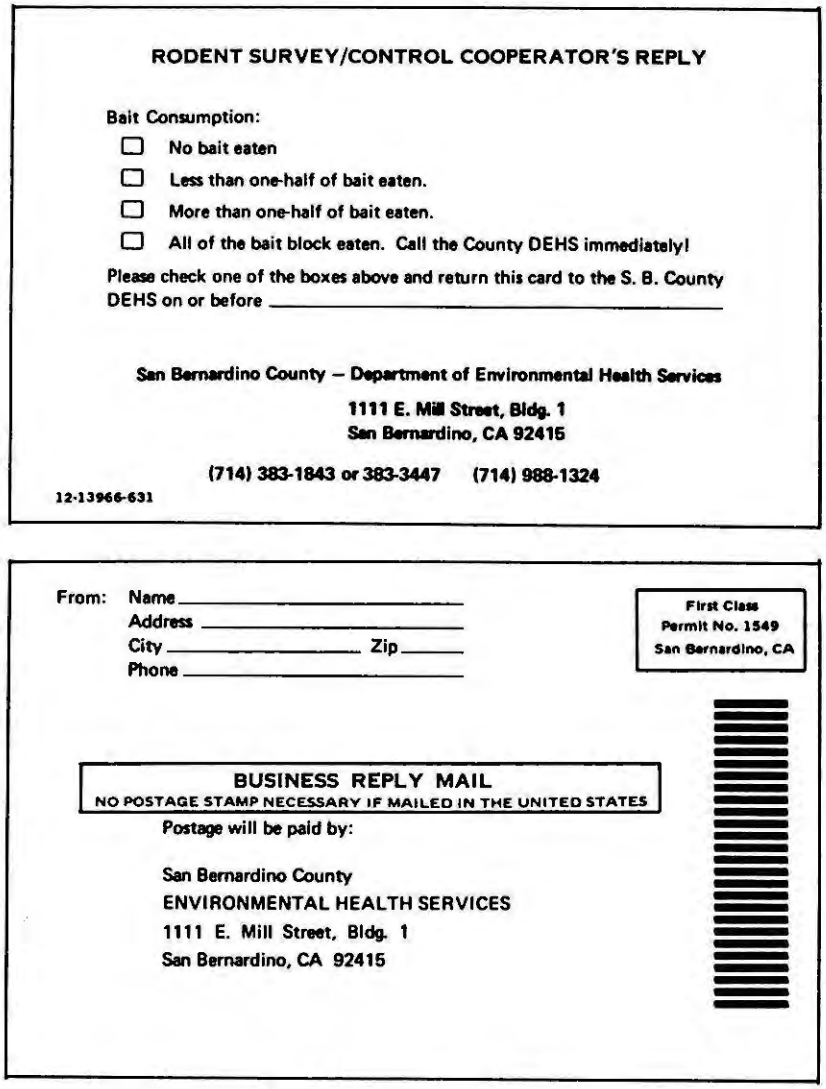
back of the card: No bait eaten -- Less than half the bait eaten -- More than half the bait eaten -- All the bait eaten, Call the County Department of Environmental Health Services immediately. If the homeowner did not contact the department, bait was removed on the fourteenth day after placement.

Two weeks after the attack phase, all premises within the target area had been environmentally manipulated or were in the process of completing their manipulative phases. The response by the citizens was overwhelming. Removal of vertical ivy growths; wood piles placed on racks 12-18 inches off the ground; trimming trees touching telephone lines; garbage and refuse clean-up; and general sanitation have all been accomplished by the citizens. The follow-up, or second comprehensive survey, showed that no active rat signs were found to exist in the 130 premises two months after the attack phase (Table 1). In the years following this initial environmental manipulative study, the target area was purposely left without benefit of a continued maintenance program in order that it could be observed to determine how long it would take for the roof rat Rattus rattus to return and reinfest the area.

DISCUSSION

I will discuss here the conclusions drawn from this small target area study. It was determined that in order to further gain compliance within a city for roof rat control and to environmentally manipulate a large area, a very large staff would have to be hired and trained in environmental manipulative techniques, but this would involve tremendous expenditures that were not available at this time. Based on what the department calculated was a monumental success, considering the favorable response from the citizens/homeowners, the department in 1975 began corresponding with the federal government and asked them to consider the possible funding of a roof rat control project. At this time, the federal government stated they were only funding projects for Norway rats, and they also stated that roof rats weren't normally found contributing to blighted areas.

In February 1977, the State of California lobbied in Atlanta, Georgia, on behalf of many of the cities and counties within the state that were having problems with Rattus rattus. At that time, the findings of the small demonstration project which I have referred to here were reported to the federal authorities. In March 1977, word from Atlanta, Georgia, was that a state demonstration project for roof rat control was going to be funded. San Bernardino County submitted a grant application utilizing the success and the data from the first environmental manipulative experiment in the Ontario area and



RODENT SURVEY/CONTROL COOPERATOR'S REPLY

Bait Consumption:

- ☐ No bait eaten
- ☐ Less than one-half of bait eaten.
- ☐ More than one-half of bait eaten.
- ☐ All of the bait block eaten. Call the County DEHS immediately!

Please check one of the boxes above and return this card to the S. B. County DEHS on or before _____

San Bernardino County – Department of Environmental Health Services
1111 E. Mill Street, Bldg. 1
San Bernardino, CA 92415

(714) 383-1843 or 383-3447 (714) 988-1324

12-13966-631

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Fig. 2.

designed a new 191-contiguous-block target area in the City of Ontario, following the environmental manipulation program for roof rat control. In January of 1978, San Bernardino County was awarded the first roof rat control demonstration project in the United States. Based on the principles of an integrated environmental manipulative approach, as well as the basic principles for Norway rat program goals, the purpose of this grant was to show how roof rats can be controlled, or to set guidelines for future roof rat control grants in the United States. It is hoped that by the end of the demonstration project, December 1980, it can be shown which rodent causal factors had the greatest interaction in roof rat populations in the target area.

Another benefit which we, as well as researchers after us, have substantiated (Stotelmyre 1978) has been that mass media/publicity on environmental manipulation techniques, if properly prepared, can benefit 50% of the target population which you want to attack. In other words, about 50% of the people will do the work necessary to perform a large majority of the environmental manipulative tasks without the one-on-one contact.

Another factor, and probably the most important factor in showing the need for continuing maintenance and behavioral modification, a 1978 resurvey of the target area--just 38 months after the conclusion of the November 1974 environmental manipulative techniques--showed that the roof rat Rattus rattus was beginning to return to its former numbers, and by the 48th month would more than likely return to its previous population levels (Table 1) (Stotelmyre 1978). Therefore, once roof rats are eliminated by the method explained here, a maintenance program is necessary, a program of constant reminding by a trained vector biologist to show the people in the area that we still care about the fact that they have roof rats and that they need to continue to work towards its control.

Lastly, this demonstration project also pointed out to us that, along with our ongoing Ontario demonstration grant, roof rats are predominant in higher socio-economic areas; and until the federal government can realize the fact that middle class people can have high roof rat infestations, then there will be few ways to fund the combat of roof rat with environmental manipulation because staff is needed to work one-on-one to behaviorally modify the populace and show a continuing maintenance program.

LITERATURE CITED

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