PEST MANAGEMENT IN RELATION TO HUMAN HEALTH

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ABSTRACT: Vector-borne disease prevention and control strategies, aside from those associated with domestic rodents, have rarely involved management of vertebrate populations, even though in many cases such management would appear to represent the most effective and economical long-term approach. Prevention of a long list of arthropod transmitted diseases is often at best a stop-gap procedure undertaken only after substantial disease hazard is detected in reservoir populations. More often, control actions await the detection of human cases, at which time short-term emergency control measures may be conducted, usually involving the use of toxicants against arthropod vectors and occasionally vertebrate reservoirs. In some cases, action is not taken because techniques are not available, but more often the decisive factors in action versus inaction are economic, jurisdictional, and/or organizational. Often, public health problems proceding from unmanaged vertebrate populations are (justifiably) given low priority on the basis of costs versus benefits. If the same populations constitute a problem for health, economic, wildlife, or recreational interests, it may behoove us to pool our priorities, skills, and resources in collaborative management program designed for the greatest overall benefit rather than to procede only on those programs that can be justified on the basis of one special interest.

At every meeting I've been to lately where people interested in control have gathered, the seats have been provided with crying towels and tears have been shed for lost prerogatives, prohibited techniques, and the sheer inhumanity of our being required to justify what we do in terms of its effect on the environment.

Public health vector control is concerned with plague, tularemia, Rocky Mountain spotted fever, Colorado tick fever, a host of mosquito-borne virus diseases, among them eastern, western, Saint Louis, and Venezuelan encephalitides, and many other recognized and as yet unrecognized protozoal, bacterial, and viral diseases associated with vertebrate populations. The threat of these diseases is not unsubstantial. Last year, over 600 human cases of Rocky Mountain spotted fever were reported in the United States. In Colorado alone there were 244 known cases of Colorado tick fever, a non-reportable tick-borne disease associated with rodents. Bubonic plague epizootics among native rodents were reported from six states, and, although there were only two human cases from wild rodent sources in 1973, this disease remains a perpetual threat to man, particularly if urban or rural rat populations are allowed to develop, bringing the classical epidemic elements of rat-flea-pathogen into close contact with man. Venezuelan equine encephalitis, which moved from South America through Central America and Mexico to invade Texas in 1971 continues to be a threat. Surveys for V.E.E. virus during 1972 and 1973 revealed far higher than expected rates of infection by western equine, eastern and Saint Louis viruses in animal populations. These few examples serve barely to outline the magnitude of public health problems associated with vertebrate populations.

Management of reservoir and vector populations and epidemic control always has relied heavily on the use of toxicants, particularly in the years since World War II. Restrictions and regulations that inhibit or prevent actions for the solution of immediate public health problems tend to confound public health workers as much as do similar restrictions on programs to conserve crops, livestock, and forest resources. Some regulatory decisions have been nothing less than ridiculous.

Nevertheless, I feel that the inconveniences brought about by environmental regulations and the groping of regulatory agencies might better be looked upon as the first feeble efforts to regroup for the coming battle for the survival of mankind. The issues are clear. On the one hand, we are faced with a fantastically burgeoning world population, accompanied by world-wide shortages of food and energy necessary for survival; on the other by unlimited, unregulated exploitation of resources and consequent destruction of the earth's fragile ecology. These are aspects of the same problem and consideration of one without the other is unthinkable. If we are to survive, our task calls for a level of management never before attempted. Impact statements and current environmental regulations represent only a first fumbling step toward development of appropriate management approaches. Eventually, it will be necessary to justify every action we take on social and economic as well as on environmental grounds. In order to accomplish these management objectives, it will be

necessary to develop systems that will integrate every social, economic, health, and environmental element involved with the problem. Proposed pest management actions will then be justified on the basis of their effect on the total system. Unilateral or single interest actions will no longer be possible.

What I propose to illustrate and discuss here is the need for another kind of preliminary step in the direction current regulations appear to be leading us -- integrating agency and interest-oriented action toward the definition and solution of interrelated or common problems. This, I believe, is an area in which those of us working at every level can find productive action while working with the trend rather than against it.

The following examples represent situations in which such cooperation or collaboration could have, or should have, been undertaken with profit to all concerned.

The Norway rat population in rice-growing areas of Sacramento Valley investigated by Mr. Joe E. Brooks and I in 1964, offers an outstanding example of a problem shared by several interests and jurisdiction, but not of sufficient importance to any one of them, on the basis of costs/benefits ratio, to merit research or attention at the time.

Norway rats constitute important reservoirs and sources of infectious disease to man. Among these are bubonic plague, murine typhus, and leptospirosis. Although bubonic plague and murine typhus are endemic in California, the former among wild rodents in many parts of the state, the latter among rats and possibly opossums in southern California, neither was observed in rice field rats. The classical flea vector for both, Xenopsylla cheopis, was not present on rice field rats and, although the flea, Nosopsyllus fasciatus, was present and is weakly capable of transmitting plague, rats did not appear to be in contact with wild rodent sources of plague infection. While our studies did show evidence of Leptospira infection in rats, the fact that rice culture in California is almost entirely mechanical eliminates opportunity for human infection from water or direct contact. Therefore, rice field rats, although a potential public health hazard, are a minor one and control measures against them cannot be justified on a public health costs versus benefits basis.

Rice field rats also represent a hazard to fish and wildlife interests, principally to nesting waterfowl and pheasants by eating their eggs. At the time of our investigation, the extent of damage done by rats to game bird reproduction was not known and was not at that time being investigated.

Rice growers themselves absorb the greatest economic impact. Although the extent of rat damage to rice crops had not been measured in 1964, estimates ranged from two to five sacks per acre. This, growers were content to live with, depending on the high productivity of the land and sophisticated cultural techniques for profit. Interestingly, an additional two percent to five percent of each crop is lost in harvest during normal years and it is this waste which allows rat populations to overwinter successfully.

Thus, rice field rats do not appear to represent a severe enough problem to any of the three interests to warrant investigation and management. Summing all three, however, it might appear that a management program would be of value. Efforts in recent years on the part of growers to reduce the number of check levees in order to create more growing space for rice per unit area may well be the answer to this problem, since such levees represent summer and fall harborage sites and spring dispersal pathways for rats.

A second example has to do with both predator and prairie dog control, principally in southwestern Colorado.

Until 1970, Cynomys gunnisoni was under intensive surveillance and control on southwestern Colorado ranch and range lands. In addition to the prairie dog program, an effective coyote control program had been conducted for years. The use of 1080 grain bait on prairie dogs resulted in non-specific killing of carnivores other than coyotes, particularly badgers.

In 1970, both programs were halted by regulatory action. By 1972 a vast increase had occurred in Cynomys gunnisoni populations formerly under control, particularly in La Plata, Montezuma, and San Juan Counties. By 1973, prairie dogs had become so abundant that they were excavating every vacant lot in Cortez and Ignacio and their burrows occasionally emerged through paved streets. It is not known whether or not carnivore populations released from control pressures might eventually have a stabilizing effect on Cynomys

populations or whether or not that effect, should it occur, would hold Cynomys within economic and public health limits. Although it appears doubtful to me that predators would drastically reduce Cynomys levels, the issue deserves study. No such effect could be observed in 1972-1973.

Plague epizootics were detected in 1972 in the Pine River Valley and before the summer was over the plague organism had been isolated from prairie dogs and their fleas collected in the local churchyard and at the edge of a school playground as well as in many other sites in the Valley. These epizootics, despite emergency control measures at selected, populated points, continued in 1973, moving toward Cortez.

By 1973, epizootic plague was detected within a few miles of Cortez where for the protection of the public health it was considered necessary to enter into a flea control program, using insecticides, followed by prairie dog control within the city and other populated areas. This was carried out by a special district, organized for the purpose and supported by the State of Colorado. The special district is continuing, but has funds enough only for palliative measures.

A final example concerns Curecanti National Recreation Area which lies along Blue Mesa Lake, an impoundment of the Gunnison River in Gunnison County, Colorado. The area supervised by the National Park Service is some 20 miles in length and several miles wide, containing both long-term and short-term camping facilities, boat launching ramps, boating concessions, a store and restaurant concession, and a visitors' center constructed at a cost of approximately $6.5 million in 1968-1969. During the peak season from mid-June through August, the facility receives approximately 5,000 visitors per day.

The National Recreation Area lies in the river-bottom carved by the Gunnison River running between high plateaus. The river bottom area is rolling sagebrush slopes and stretches of short grass, with steep escarpments rising on either side. The surrounding mesas are sheep, cattle, and prairie dog country.

A colony of Gunnison's prairie dogs parallels Blue Mesa Lake from near its upper end and extends for more than ten miles down the lake past Elk Creek where the Visitors' Center, the main boat launching ramps, concessions, and permanent campgrounds are located. The location was aptly chosen on an architectural and engineering basis; here the river-bottom widens and there is plenty of flat land for camp sites, boat-trailer parking, and easy access for heavy campers and boats. It also represents the largest area of choice prairie dog habitat along the lake.

In July 1970, a visit to Curecanti revealed an exceedingly high population of prairie dogs at Elk Creek. Active burrow systems were estimated in excess of 30 per acre. Prairie dogs moved freely through the camp areas and the Visitors' Center.

In early June 1971, a C.S.U. graduate student working with the Plague Section reported an apparent epizootic among prairie dogs at Willow Creek, approximately six miles upstream from Elk Creek. Of 15 prairie dog carcasses he sent to the laboratory, 13 were positive for plague by fluorescent antibody staining. The epizootic moved rapidly through the prairie dog population and by July had reached Elk Creek where prairie dogs were dieing by hundreds. The rate of movement through the colony could be observed on a day-to-day basis.

The Recreation Area was closed and an attempt was made to abort the epizootic by use of an insecticide against the flea vector. Although the insecticidal measures were successful in reducing fleas by 98 percent, the epizootic continued at a much slower pace through the summer, transmission probably occurring by ingestion of infected dead by healthy animals. The Recreation Area remained closed all summer while prairie dogs were eradicated by means of the old-fashioned Carbon bisulphide method by pump injection and covering of burrows. The epizootic, as often happens, abated with onset of winter weather. Assistance to the National Park Service from other agencies in site selection and planning could have reduced or eliminated this problem. As it is, continued management of prairie dogs involving the use of toxicants will continue to be necessary at Curecanti during the forseeable future.

Obviously, the actions of agencies and private interests involved in management of rodent and predator populations can have a decided impact in areas of interest other than their own. Nevertheless, recent reviews of research, such as that printed in Coyote Newsletter, indicate to me that despite large quantities of money being spent, there is

very little integration (a situation Coyote Newsletter was designed to alleviate) and the majority of studies are directed toward solutions of special interest problems. What we need are large-scale integrated analyses of the total problem, not piecemeal studies which often are biased, at least to the extent that elements not perceived as pertinent to the special interest concerned are overlooked or disregarded. Until the need for integrated studies are recognized, I think we owe it to ourselves and the future to communicate and cooperate at every level so that each of us may at least recognize and acknowledge other aspects of the total picture.

Potential areas of collaboration among agencies and interests involved in the management of vertebrate populations are many. Of particular value to public health has been the involvement of the Division of Wildlife Service, U.S. Department of Interior, in operations directed toward the detection and control of such wildlife diseases as rabies and bubonic plague. In the case of plague, the assistance of D.W.S. in the collection and submission of blood samples on filter strips for the detection of plague antibody in carnivorous animals has enabled us to maintain a level of surveillance never before achieved. As this program develops, working through both state and federal agencies, we will learn more about the geographic distribution and ecology of plague than previously thought possible. Conversely, associated studies on the effects of diseases on rodent populations may be of inestimable value to economic interests involved in their management. This example represents a short step in the direction of integrated activities, for which there was no need to pass legislation or to frame cumbersome interagency agreements, only a desire on the part of investigators and managers to merge efforts in the solution of common problems with benefits to all concerned.