

## "TEMPORARY CONTROL METHODS VS. MOSQUITO SOURCE REDUCTION"

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### AN INTRODUCTION TO A PANEL DISCUSSION "CURRENT TRENDS IN MOSQUITO ABATEMENT"

Among this world's most unpleasant and thoroughly disliked persons is the man who says "I told you so." The fact that he has been right only makes him the more irritating to those who have not believed his prognostications and have been proved by him to be wrong. Therefore the Chairman of this discussion has placed me in the position of possibly losing whatever popularity I may have had in this group, by asking me to present an introduction to this discussion on "Current Trends in Mosquito Abatement." During the past forty-two years (and Billy Herms before me) we have been "telling" you that the most logical, effective and economical methods by which mosquito prevalence can be reduced to the lowest practicable minimum in California are (1) to eliminate, or reduce the extent of, water in which mosquitoes develop; (2) where this is not practicable, use methods which make irreducible waters relatively unattractive to mosquitoes; (3) use biological methods, such as predatory fish (*Gambusia*, etc.) where they are applicable; and (4) use appropriate larvicides where necessary to "mop up" such larvae as cannot be controlled by these methods. We certainly never suggested the community-wide use of adulticides prior to the advent of DDT, and in 1949 (Presidential Address, American Mosquito Control Association) I labelled the use of adulticides as an "advertisement of failure" to abate the mosquitoes.

Also in that 1949 Presidential Address (Proceedings, page 38) I stated "Over the past forty or more years, both experience and logic have indicated that the basic function of mosquito control is to eliminate or minimize the production of mosquitoes. All successful practice in this field, in temperate climates and civilized areas, has been based on this concept. The introduction of new insecticides of greater toxicity as larvicides or adulticides has not changed this basic postulate of mosquito control."

Well, what happened? Nothing! No one paid any attention. You were all bemused in the phantasmagoria of DDT—wonderful stuff! Just spray it all over the landscape and the skeeters disappear like magic! But, along toward the end of 1949 doubts began to appear in some quarters—DDT didn't always work 100%. The ugly specter of resistance began to raise its head. By good fortune the Program Chairman of the 1950 meeting gave me another opportunity to talk and I fired the other barrel, so to speak, in my "Which Way Now?" talk. This time most of you listened and began to believe that perhaps there was something valid in the old-fashioned ideas. And some of you have begun to do something about it, not only by talking about it here in our meetings, but practically out in the field where the problems are. You perhaps have been asking yourselves the question "Why produce them wholesale and then try to kill them retail?" Silly idea when you look at it, isn't it?

There are certain concepts of mosquito operations for the benefit of the public which we ought to examine as a preliminary to this panel discussion. These are the ideas

respectively of control, abatement and eradication. I shall not attempt to go into a semantic dissertation as to the exact dictionary connotation of each term, for no one that I know uses these terms consistently as mutually exclusive categories of ideas. In New Jersey the term "extermination" is used, but that is wishful thinking, not an accomplished fact. Here in California we term ourselves mosquito "abatement" districts, and in other areas "control" projects are spoken of. We also use the term "control" somewhat interchangeably with "abatement." It will probably be very difficult or impossible to pin everyone down to a precise and circumscribed use of these various terms, and certainly I shall not attempt the impossible, but we can set up the several concepts of our operations so that they can be delineated with reasonable clarity.

Let us then begin with the idea of "control." This may be most clearly understood, perhaps, in the field of malaria control, where we have known for many years that there is a fairly definite, though variable, number of female *Anopheles* vectors per capita of humans necessary to maintain a continuous, or endemic, malaria in a region. If the relative numbers of *Anopheles* vectors per capita of humans in that area is kept well below that critical number, malaria will tend to die out in that area, and we say that we have "controlled" the *Anopheles* and eliminated (eventually) the malaria.

A somewhat similar situation occurs with relation to urban yellow fever. It is a matter of observation that if we can keep the numbers of *Aedes aegypti* below a point at which larvae are found on less than five per cent of the premises in a region, yellow fever cases are unlikely to appear, and will not become epidemic.

But with infectious virus encephalitis we have no such population-vector relationship or index, and we do not know how few *Culex tarsalis* females per capita of population we must have to prevent the epidemic spread, or even the sporadic transmission, of the encephalidites.

At any rate, experience has shown us that we can control some mosquito-transmitted diseases by methods which will leave appreciable numbers of mosquitoes in an area, and these numbers may even be high enough to be somewhat of a nuisance.

With "pest" mosquitoes the situation is somewhat different. Here we usually speak of "abatement" rather than "control," and if the abatement is not fairly close to 100%, the customers usually complain loudly and are not inclined to accept excuses. If a farmer, or an industrialist or business man, or housewife, is paying taxes to get rid of mosquitoes, he or she expects to have no mosquitoes, period! This is partly our fault, because at times in certain areas we have achieved practically 100% control, and the taxpayers expect that as standard performance.

Then there is a third idea, that of eradication. As a rule this concept has been applied only in relatively limited areas and in relation to a single species of mosquitoes. You are all familiar with the practical extirpation of *Anopheles gambiae* in northern Brazil and in the Nile valley, and with the extirpation of *Aedes aegypti* in many South American and Central American cities. We have evidence that *Aedes squamiger* has been extirpated from considerable areas of salt marsh in the San Francisco Bay area, and it would be entirely possible to exterminate this species in this region by well-executed measures within a few more years.

But in temperate climates we seldom hear any one suggest the idea of extirpation of a single species of mosquito,

and certainly no one has suggested that extirpation of all species of mosquitoes in a region is economically practicable. But fantastic as the idea may appear at present, I believe that some of you may be able some day to come close to this idea, even in the central valley of California.

I won't be here then, but when that time comes I hope you will remember that I suggested it as a mark to shoot at.

I shall not say much about that which we term "naturalistic control," not because I do not consider the idea valuable, but simply because we have not been able to get you to give it the serious consideration it deserves. The idea is very simple—merely change the ecology of a mosquito source in some relatively minor way so as to make it unsuitable to the production of a particular species of mosquito. On salt marshes, by alternate flooding, draining and drying, we have been able to free large areas from *Aedes* production. I have hopes that some day you will find out how to change the ecology of rice fields, by some simple procedure so that *Anopheles freeborni* and *Culex tarsalis* will not develop there in significant numbers, if at all. Even irrigated pastures may be subject to some ecological change which will materially reduce or even eliminate *Aedes nigromaculis*, but you will have to change the basic concepts of your thinking in order to find out how to do this.

Experience in the past few years has shown us that the mosquito problem in California is enormous, and increasing in extent and intensity. Years ago when Billy Herms started, conditions were much simpler and good control was achieved relatively easily, by the application of a little "brain sweat" and a lot of muscle, and with little equipment. Today you have lots of equipment as a substitute for muscle. How about some more "brain sweat"?

Most of you are again becoming convinced that source reduction is the only possible answer to the present problem in California. But source reduction does not necessarily imply drainage, or reduction in use of irrigation water, or the use of larvicides. These methods will be useful in various degrees, but why not see what can be done to make ecological changes, either in addition to drainage, restriction of water use, and larviciding, or as an effective substitute in some situations?

Finally, let us not be too impatient for rapid, spectacular results. Long experience has shown me that the steady, continuous application of even modest effort in the right direction, will in the long run produce good results in mosquito reduction. But what do we mean by "in the right direction"? Are we going to put most of our efforts into mosquito source reduction, or are we going to continue with major effort on temporary measures of larviciding and adulticiding? Which, in the long run, is best for the taxpayers who pay for mosquito abatement? I hope that the panel discussion which follows will shed some bright light on this important question.

*Mr. Smith:* Thank you Harold. You will notice on the program that we intend to discuss current trends relating to source reduction under four main headings:

1. The Scope of Education
2. Inter-Agency Cooperation
3. Financial Aid
4. The Place of Law Enforcement.

We will take up educational measures first, and I will ask George Umberger to lead off.

*Mr. Umberger:* One of the most important phases of our work is the education of the public. The small mosquito sources around the home or industrial plant, contribute mosquitoes that we don't find even with the normal degree of control, and these little spots have been putting off a few mosquitoes that make our work, in some cases, look ineffective. In our public relations and education, we are trying to point out the desirability of the people themselves eliminating these many mosquito sources around their home. The education of the people at home automatically carries us on up to the small business man and to the larger operator. We must approach them for a correction . . . if we have worked on individuals we have a basis of understanding to carry our discussions along and to reach a quicker solution. So that to me is one of the most important and basic reasons for education of the public in source reduction.

*Mr. Smith:* Do any of the other members of the panel agree that that is one of our principal functions as a mosquito abatement district, to educate the public to help themselves to take care of the problem? What about the rest of the panel members? Anyone want to contribute?

*Mr. Gray:* We take the position that the Division Foreman and Operators continuously must do educational work as well as corrective work. We make use of pamphlets, yes. But the direct contact of the individual employee of the district with the people he meets is always the opportunity for an explanation of how each individual can take care of his own problem.

*Mr. Smith:* We will get into the means of education in just a minute. Let's stay on the more general subject. I didn't hear any one disagree. I take it then that we are fairly well agreed that education of the public to help them to take care of their problem is a principle aim. I'll throw this question then, first at Ted Raley. "What would you say out of your total budget is spent on education?"

*Mr. Raley:* In the past I would say about 2%. But probably under our new pattern about 7% or 8% of our total budget will go into public education.

*Mr. Smith:* Jack, what would you say on yours?

*Mr. Kimball:* We have no evaluation. Our approach to education is on a long term basis.

*Mr. Smith:* Gordon, could you give any estimate?

*Mr. Gordon Smith:* I think that is a debatable question. Are you going to estimate just on the basis of what you budget for education, or are you going to do that on the time of the individual operators?

*Mr. Smith:* No, just on what is budgeted. We will get into that other in just a moment. Suppose we get into what the different means of education are and look at it from that point.

*Mr. Gray:* In our district each year in the annual report we put in an actual accounting of how much we spend on educational work. I don't remember what it was for 1952 but it is very close to 5%. This does not account for the individual time spent in the field.

*Mr. Umberger:* I have here our annual report for this year. I was just checking to see what was expended last year; it is \$1300. I believe that under education one of the very desirable things a mosquito abatement district can do is to make an annual report which can be given to the public. It is one thing to have canned news that you give the newspaper, but an annual report, even minimal, with a financial statement and a total of the work that was done, plus a narrative of interesting events, and what work is done during the winter months, is valuable. Ev-

erybody says to a mosquito man "What do you do in the winter when there are no mosquitoes?" This report tells that story. It cost over a thousand dollars, but we have such demand for it (even requests from Europe, South America and as far away as Australia) that our Board thought it was a good investment for our people and it might in some degree help mosquito control in all California.

*Mr. Smith:* Let's go on to the types of education that are being used and can be used in mosquito work. Gordon, would you discuss the principle methods that you feel are of most value?

*Mr. Gordon Smith:* I think that all methods are valuable, but I believe we are tending to emphasize more and more individual contacts. People will read a newspaper but maybe it won't sink in. Sometimes they will get a special report; it depends on how interested they are in the subject matter just how much that sinks in. A business man will go to a service club and some of them will listen to a talk and some of them will be thinking about the conference they have that afternoon involving \$15,000 or something. But when you find the problem and take the person who is causing it and point it out to him and explain why, then you have showed somebody exactly what is going on. If they are really interested, they will pass it along to their friends, and I think that type of direct information is extremely important in our work. How well it is done depends on how well your men are trained in explaining and contacting the people.

*Mr. Smith:* Jack, would you discuss further some of the methods that you are using?

*Mr. Kimball:* We have lined them in five different approaches that I have listed here. The first one is what we consider the most important. Like Gordon, we consider the individual approach worthy of most of our time. The individual we refer to is that individual who is creating the most mosquito breeding problems in our area. The ones who we wish to make corrections are the ones we want to spend our time on and explain to them the reasons for making the improvements we recommend. The second most important is education of the various other local agencies in the county involved in some way or other in work that effects our program. We have a so-called agricultural round table in the county at which various agencies who are concerned with agriculture get together once a month. These agencies are Flood Control, the Road Department, the Farm Advisor's office, the Health Department, the dairymen, etc. By meeting with them once a month on a round table discussion of what our program is, they are becoming acquainted with our program and seeing where parts of their program can be of assistance to us and visa versa. The third and fourth are important on a long term basis. The third is education through the schools, especially the grammar schools about the fourth and fifth grade level where they are just getting their introduction into science and metamorphosis of the various insects. Our mosquito picture and a life cycle of a mosquito is an excellent demonstration to them in their classes, and their teachers welcome it. We don't push that; we take it on a request basis. The schools also go up into the high school level with the agricultural program, where they are studying to be farmers, and they have worked up a program of once a year exposing those students to the problems of mosquito abatement, in their agricultural drainage and irrigation practices. The fourth group is

the service clubs. These are taken on request, and a certain number in each club are always surprised to hear of the program that is going on. This gives another outlet to explain the program to our people. The fifth, and in our opinion the least important approach, is through the newspapers and radio talks. We believe in saving these outlets for seasonal changes in conditions, rather than for day to day progress reports; for occasions when you would want to get a particular message across. They you will get the attention you would not have if the work was continuously before the people in these media. These are our five approaches to education in one county.

*Mr. Raley:* I should explain why our public education budget has increased so greatly. My Board of Trustees has given me permission to hire four men to carry on public education along the individual approach pattern. I believe our District is the first one to develop the idea and practice of the "trouble shooter." Frankly, that's a poor designation to use, especially in signing letters, and if you have a better term I would certainly like to hear it.

We are budgetting the salaries and field expenses of these men as a part of our public education program. Their operations are directed mainly at source reduction through educational methods on an individual basis. Even in the short time we have had this program we have good evidence that over a period of years these men are going to definitely pay their way in source reduction.

*Mr. R. H. Peters:* I strongly support the idea of the idea of the individual approach. Every one of us is or should be a salesman of mosquito control, and the thing that we should sell the most is the idea of source reduction as the basic principle of mosquito control. We ought to keep our personnel trained in and appreciative of this method of approach. I will admit that some persons can do a better job of individual contact than others can, but by training we can obtain a sound, positive impression to be left on the individual rather than a negative impression left by an incompletely informed employee.

*Mr. Gray:* One of the important facts which we appear to overlook is that our population is not static, and there is a tremendous influx of new people each year in California. These people know nothing about mosquito problems; they don't even know you have a mosquito abatement district. Perhaps the old timers do, but not the newcomers. I am almost ashamed to admit the number of times in a year our office is called by people who say they have been bothered by mosquitoes for several days or even weeks, and when we ask them why they didn't call us sooner they will reply that until then they did not know there was an abatement district in the county.

Another group that I think you should bear in mind in your public education program for source reduction is your public officials of all kinds, including your county grand juries. We pay particular attention to them as they can help or hinder us in many ways. I think Ed Smith has done a very fine job in getting many groups together in his county, even though he doesn't have full support from his rather difficult Board of Supervisors.

*Mr. Umberger:* I understand we are to have a television broadcast station in Fresno very soon. I am quite interested in the possibilities of that station. Has anyone here used television yet?

*Mr. Smith:* As far as I know the only one who has been on television is Ted Aarons of Alameda County, on the "Science in Action" show. My information is that the Fresno station will be in operation in about two months, and a station at Sacramento shortly thereafter.

*Mr. Kimball:* About a year ago Los Angeles had a television program on mosquito control, in which mosquito fish were the principal actors.

*Mr. Gray:* At the American Mosquito Control Association meeting at Salt Lake City last year the local station put on a television show on mosquito control with Dr. Fred Bishopp and Dr. Don Rees.

*Mr. Smith:* We had better sum up the subject of education before we go on. We are all agreed that the first line of attack in the educational program is that each individual employee out in the field meeting the public constantly has the best opportunity to present the facts about mosquito life to the public and so enlist their help to reduce mosquito sources. But at the same time all these other methods which are open to us should be utilized. In our own case every year, in discussing our budget, we have said "Education in the long range is our best bet and the thing that is really going to do us the most good," but we gave it lip service, because when it came down to preparing the final budget, that was one of the first things knocked out. I think that it deserves more importance, and that is one reason I started the discussion on that line. The percentage that we mentioned is really a fraction of what we spend on education, because there is so much other that is education that is taken care of in our normal operations. Let us go on to the next section, on District and Inter-Agency Cooperation for source reduction. George, would you start on that?

*Mr. Umberger:* I feel that this is tremendously important and it is going to be more important, because in the meetings we are having we are asking the participation of these other agencies, the Central Valley Project, for example, and I believe that we are going to have to be careful in our approach and in our relationship with them. In my own experience, after the job is done it is important to go back to them to see if they believe what was done was the right thing and the job is taken care of. What is the other person's viewpoint? It is somewhat like selling an automobile, isn't it? It's not the first sale but a continued relationship.

*Mr. Smith:* We can't expect cooperation without giving cooperation. The panel right after this one is going to be specifically on inter-agency cooperation, so I would like to spend our time right now on the matter of cooperation on the part of the District with the farmers who have the problems. How can the mosquito abatement districts help solve some of these water problems that the farmers have? I will call first on Bob Peters to explain just what he has been doing in that direction in Lodi.

*Mr. R. H. Peters:* Our program in the Northern San Joaquin County District has been one where we have actually done the job. We feel that it has been extremely successful because the results have justified the end, the participation has been very satisfactory, and best of all when the job is done it is reasonably to our satisfaction. Our District owns two large tractors which we have used to advantage in various ways. Our initial program was begun for the purpose of clearing river bottom lands and it was done on a cooperative basis whereby the taxpayers were not charged, but it was paid for by the party who owned the land and who was going to put the land to some useful purpose. The project has extended into minimization or source reduction of water in industrial situations such as wineries and canneries, and it has definitely given us a very satisfactory position in cutting down the

actual cost of control within our district. We are heartily in favor of this cooperative method of source reduction.

*Mr. Smith:* There are several ways in which a mosquito district can help solve the problem of standing water, either as Bob has suggested, offering to do the job at cost (and that also is the way our own district is handling it) or by being in a position to advise as to how that can be done, or in some cases by partial contribution of the cost of the job. Now I think that we can throw all those suggestions out for general discussion.

*Mr. Aarons:* On this inter-agency discussion I wanted to interject one comment. We have a habit, in our county, of visiting with our Supervisors. I would like to impress upon the group the worthwhile results that will come from that practice. We have talked about these other groups that we are interested in having cooperation with, but you will benefit tremendously if you will get in the habit of talking with your Supervisors.

*Mr. Gray:* I might modify that, Ted. I never bother the Board of Supervisors as a Board of Supervisors, but I sure see them as individuals, at lunch or at lodge or something of that kind.

*Mr. Smith:* Are there any further comments on this? Let's get into this matter of financial aid by putting up a portion of the cost of the project or renting the equipment at cost.

*A Member:* In our District we do some source reduction work on a share the cost basis for two or more reasons. One of them is where it is a hardship case; the farmer doesn't have too much money and he says he can't afford to hire a dragline. We can do it at cost to the farmer less expensively than he can hire it done, and he can usually pay at least a part of the cost. Frequently he can pay it all. Secondly, when we do it ourselves the job is designed for mosquito control as well as to help the farmer. If we do it, the drain is cut with square sides and properly designed to get the maximum benefit for mosquito control purposes. All of our work is done on a cost basis; we charge the farmer by the hour for the equipment. When we get the job lined up and the farmer agrees to it, he is given an estimate. We guarantee not to go over the estimate; occasionally it does cost us a little bit, but it is designed to be done on a cost basis for the farmer.

*Mr. Smith:* I would like to discuss our own operation in that respect just briefly. Before we purchased the dragline we were participating financially by putting up a percentage of the cost of a drainage project when it could be shown by our district records that it would reduce a mosquito problem. That was a very successful program. We accomplished a number of drainage programs which would not otherwise have been done. We had cooperation on a number of these jobs, with other organizations such as the Soil Conservation District, the Irrigation District, or the Road Department. Since we purchased the dragline, we do not engage in that type of subsidy. We do rent the dragline out at cost to solve a problem involving mosquito reduction. In a good many cases we have met with up to as many as twenty or twenty-five farmers to discuss the best method of solving a drainage problem. We have our attorney present at the meetings, and we provide them with legal services necessary in obtaining rights-of-way and granting each other the rights-of-way. We have provided an engineering service, either doing it ourselves, or providing somebody to do it for them. We have given them the use of the equipment at cost. When we first purchased our dragline, there was some question as to

whether we could keep it busy. We have had it over a year now and there hasn't been a single working day when the weather was not too bad, when that dragline was not working, and for the last year we have had about six months work lined up for the dragline, so there doesn't seem any doubt as to the demand for its service in drainage jobs which are helping us to reduce mosquito problems.

Now jumping back for just a moment to inter-agency cooperation, I'd like to relate one incident where we certainly have gotten excellent cooperation to solve a problem. Our Board of Supervisors for some time has been pursuing the policy of discouraging the flooding of county roads by farmers. In one particular case not far from the City of Merced, there were about five farmers who had a drain which didn't go any place except up against the county road. The Road Commissioner and the District Attorney notified them that that must cease. They invited them to a meeting at the Court House with the District Attorney and laid down the law to them about what would happen if they didn't solve their own drainage problem, and we were present to propose to them the method of doing so at the least cost to them. They didn't hesitate for a minute; they agreed to do the job right then, and it was accomplished, and the road hasn't been flooded since. That was certainly a matter of excellent coordination and cooperation between agencies. Do we have further comments now on this matters of financial aid and use of equipment? Harold, do you have anything to say about your operations?

*Mr. Gray:* Our program on the surface is entirely illogical and opportunistic. In practice it works out, and we have usually received back from the land owners more in the way of cooperation and projects for mosquito abatement than we have put in ourselves. We go on the idea that we will do at least part of the work ourselves, and that usually stimulates the land owner into something that is even more expensive than if he had done it for his own purposes. We cooperate with our Flood Control District and County Surveyor's office which runs the roads, and I think invariably we get more back from these other agencies and individuals than we have put in.

*Mr. Raley:* We have taken the position that the one creating the source should be responsible for its correction. We tested our wings in the beginning of our District on household problems, and have been able to carry that along in good order. Over the years we finally established our position with industry, and now have that in good order. Dut to the 1952 epidemic, we feel that we are in a good position in relation to agriculture, and although our program is rather new it shows very good promise and we have every reason to feel that it will work just as successfully as the other phases of our activities. We do have one problem, and that is the fixing of responsibility, and I can visualize that it is going to take us perhaps two years to actually work that out to where we can determine the relative responsibility for the elimination or reduction of known mosquito sources. In the Valley it is rather hard to separate natural and man-made waters, but I am thoroughly convinced that as we establish our position we will be in a more favorable working relation than with the idea of contributions. I've never had anything cut my throat so wide open as contributing financial help to a particular project because I had the unfortunate experience of having every other project in the District wait until we were able to get around to furnish financial help to that problem. I had that experience in Marysville and

I think Dick Sperbeck suffered from it to a certain degree. Since then I've tried not to become involved in mutual contribution projects. Our point of view has worked in household drains, it worked in industry, and we have every reason to feel that it will work in agriculture. It is amazing how agriculture will respond as people begin to understand your problem and how it will benefit them in the process.

*Mr. Smith:* George, there are two things I'd like you to comment on. One is the use of rehabilitation prison labor in drainage, and the other is your work with drainage districts.

*Mr. Umberger:* Our main corrective or source reduction work in Sacramento County is done with road camp prisoners. Last year when our encephalitis picture began to get out of hand, we went before the Board of Supervisors, explained our problem and advised them that we just had to have help. We have two large road camps in Sacramento County; one of them has about three hundred men in it and the other has about two hundred and fifty. Every man in those two road camps was put out digging ditches. We had a hundred and twenty five of them assigned to our District directly. One of the costs of our permanent control as far as it shows on our report, is buying tools and boots for those men. We pay them no salary; they are each given a five cent pack of Bull Durham a day; that is their contribution from us. Working in the field they get a third meal, which the County pays for. The balance of the road camp prisoners were assigned to the County Engineer. Those men took the vegetation out of drainage ditches along the roads, and in the special drainage district which has been set up in the County. Between four and five hundred men working every day during the months of late June, July, August and September, right on through the winter has been a contributing factor in the success of our larviciding program. It is an illustration of the development of our inter-agency cooperation, and exploring all possible sources of help. When we started out with the thought of using road camp prisoners we didn't dream that the program would develop and tie in so favorably, because in many people's eyes and the County government it wasn't the mosquitoes they were interested in as much as the drainage. We have a terrific drainage—summer drainage. In one area right across the river, we checked last year and there were thirty-two new swimming pools being constructed in back yards. These gals all have to be like the Joneses; if they have two Cadillacs, it is two next door, and if they dig a swimming pool why there has to be a swimming pool dug next door, and you can just imagine the swimming pools that exist in that rural community with thirty-five or forty being constructed each year. When that water is released, we just haven't the channels to take care of it. The water was going all over the country, and it was one of the jobs of these men to develop channels so that water could move on down to its final discharge into the Sacramento or the American River.

*Mr. R. H. Peters:* I might say, Ed, that to a certain extent maybe my faith in human nature was reduced somewhat by having come from the sanitation field. I often wondered how many cesspools or septic tank drains I could have abated had I been able to carry a shovel on my shoulder instead of a little card or notice book. Based on that, I think that a more rapid and perhaps a more satisfactory result can be obtained by District participation in some of these measures.

*Mr. Gray:* Don't you think that we are getting out of our province, inasmuch as there is another agency set up by law which has the responsibility? Don't you think that the matter of open septic drains should be referred to the Health Department, rather than to make policemen out of our employees?

*Mr. Peters:* Well, I was merely generalizing.

*Mr. Gray:* Here is a point worth consideration. I don't believe that mosquito control men should be doing police work, because we lose our effectiveness. The Health Departments have the responsibility of sewage disposal, and we should obtain their cooperation to get these open septic drains taken care of.

*Mr. Peters:* I think there is no question about that. They are better prepared to do the job, but I merely made the point that by doing the job yourself sometimes you can accomplish considerably more.

*Mr. Smith:* We will be getting into enforcement in just a moment, but let me comment briefly. I agree with Bob that we can sometimes do a lot more if we are willing to do it ourselves, but I'm not sure whether we should be willing. I recall last summer we hired a few women inspectors during operation *Culex tarsalis*; they were highly successful. The principal reason for the excellent cooperation we got on that inspection program was the publicity that *Culex tarsalis* was getting. Every previous year when we have run a concentrated survey of the disposal units in the County, we averaged about 50% cooperation—that is, about 50% of them were willing to go along with us on what we asked. But last summer it was 90%, and I think that the public relations and education program put on last summer on *Culex tarsalis* was responsible. However, there was one case in which it didn't work. One of our women inspectors found a particularly bad situation and in discussing it with the man of the house suggested that it was in pretty terrible shape: in fact, a child could fall through the rotting very easily. He said "Well, you look like a big girl. If you want it done why don't you do it yourself?"

In summing this up, I think that it is obvious from the discussion that we are taking some advantage of inter-agency cooperation. Perhaps some of the comments have shown avenues of approach to some of the rest of you that you haven't already taken advantage of. I think there is a lot more to be done—a lot of things that can help us all. As to how we are going to solve these individual water problems in the field, whether we are going to do the work ourselves, whether we are going to serve strictly in an advisory capacity, whether we are going to put up part of the money, or whether we are going to rent equipment at cost, of course that all depends to a great extent on the local situation, but all those avenues are open, and I think that we will all be exploring one or more of them in the near future.

The last subject we have for discussion on this panel is "The Place of Law Enforcement in an Abatement Program." That I think can be very interesting, and I think the place to start that is with Harold Gray, as he has drawn up a detailed procedure under the various methods available by law.

*Mr. Gray:* The problem of law enforcement as contrasted with a service function is one that we have kicked about in these meetings for a number of years. What happens ultimately is that although we start out with the idea that we are going to serve the public, we eventually come

to the place where patience wears a little thin, and then we decide to turn the problem over to the District Attorney. What we should turn over to the District Attorney is a matter of policy. Policy should be determined by the Board of Trustees rather than by the employees of the District. As far as I am concerned personally, I would like to proceed first with the method of persuasion and education, then secondly you might say somewhat on the basis of demonstration, in which we do the problem work ourselves, and as a last resort for those people who are stubborn and recalcitrant, we will just have to apply the law. I will give you one little demonstration of what I mean. Last year we had a very bad outbreak of *Culex pipiens* right in the very center almost of Oakland in an abandoned quarry. This abandoned quarry is now being filled in. It had a big pond at the bottom of the old quarry pit, and we had it stocked with fish and it gave us no trouble. When they started to fill it, they filled in with rubbish, garbage and God knows what in addition to earth. The fish were killed and then our troubles began. They threw in a lot of brush and floating wood, and we had a situation in which the production of *Culex pipiens* was going on underneath the floating debris on top, which the insecticides could not penetrate. Even when they filled it in later on we still had problems, because there was water under the fill, and the fill cracked. We couldn't get any results at all. So we simply went to the District Attorney, and now the burden is on the person who is handling that fill, and he is practically under indictment, with understanding that either he controls the mosquitoes there or it is a matter between him and the Judge. I don't think the Judge is going to be very lenient under the circumstances. With some people you have to have the big stick in the background. I personally would rather not have to use the stick. I think you get better general public relations, and I think you get better compliance in the long run without it, but there are some people you have to use it on. We, frankly, are getting down to the point in our District where we are a little more inclined to use the legal process, because after twenty three years we feel that we've about reached the end of what we can do by persuasion.

*Mr. Smith:* How many times have you used legal means?

*Mr. Gray:* Oh, so far only about three or four times, and then only as far as a citation by the District Attorney.

*Mr. Smith:* Four times in twenty-three years. Have any of the Managers sitting here resorted to the legal method of abating a mosquito nuisance?

*Mr. Raley:* In condemnation of a right of way we have taken several to the District Attorney. Ours can hardly yet be called using the law for source reduction. We have used the law for right of entry, and in one case we did have a real reason for condemnation, but as yet we haven't had the experience of going to court on a source reduction problem. It won't be long, though.

*Mr. Smith:* Gordon, would you relate your instances?

*Gordon Smith:* We have never actually had to go to court yet, but we have had occasions when we have gone in and spoken to the District Attorney or had the County Counsel attend a meeting of the Board of Trustees when a recalcitrant individual was brought in. We have found that a letter from the District Attorney or a citation from the District Attorney's office, or in one instance a telephone call from the Justice of the Peace, was quite sufficient to get the job done. We have never taken anyone to

court yet. Law enforcement is a good place to use inter-agency cooperation where you can get it. We have a working agreement with the Kern County Sanitation Department on cesspools, where they have on occasion taken the people in to court because they refused to correct the cesspool problem. We find the cesspools through our urban operators walking the yards, and we then turn that work over to the Sanitation Department for correction.

*Mr. Peters:* I think that to a certain extent the proper use of the law in our work can actually be educational. I had one farmer who said he would throw anybody off his place that had the idea he had mosquitoes on his property. Under the circumstances I had a Deputy Sheriff go out with me. The use of the law educated this man that what I was saying to him was not just so much wind coming across his field. We have had no difficulty with him since that time. There are other ways that the law can be utilized to educate; certainly a properly arranged and educational session in the District Attorney's office is the only way you can open some men's minds to reason.

*Mr. Gray:* It is more effective to have the District Attorney cite him to appear, and thus put him to the trouble of coming in.

*Mr. Kimball:* In five years of operation we haven't reached the point yet where we even had to request an informal talk with the District Attorney, or even with our own Board.

*Mr. Umberger:* We have never had a court case. The only person that has ever been threatened was the State of California.

*Mr. Smith:* I think that there is a proper place for law enforcement, but as has been brought out in this panel it is a matter of last resort. As we started out here with the subject of education I certainly feel that in many cases a man with a mosquito problem is going to correct it by himself, once he is aware that he has it, and knows what he can do about it. Of course that isn't true in all cases. Next we discussed the matter of cooperation. I think that it is certainly far better for us to go to a farmer that has a serious drainage problem and offer to help him solve it, rather than to merely point out that he has a problem and he should do something about it. Then finally we get down to the matter of offering some concrete help, whether financial (some are opposed to that), or whether it is a matter of using equipment. I think that will in some cases persuade some people that would not otherwise be persuaded. Then we get down to the individual who is not cooperative, who does not understand and does not want to understand what the program is, and has no intention of doing anything about it. There is the proper place for law enforcement, and as Harold brought out it is a matter of Board policy. In our own District the Board of Trustees adopted a set of policies several years ago; we must put first emphasis on the progressive elimination and reduction of mosquito sources, they said; second, emphasis should be on the matter of cooperation with the farmers and other agencies in the reduction of mosquito sources; a supplemental method should be larviciding or adulticiding; and then finally, as a last resort, taking the difficult cases to court when that appeared to be in the public interest. I think that from the discussion of the panel we have put each of these various things in their proper perspective.

*Mr. Umberger:* There is something which I might touch upon. In our discussion here we have mentioned the

little fellow, the individual farmer. Different Districts have different problems and areas, but in the thinking of our problems we should look at the big problems. The construction of an eight mile channel by the U.S. Engineers and the State Reclamation Board created a mosquito problem for us that was about three hundred feet wide and eight miles long. We went through the various State agencies, talked it over with those engineers, and everybody whistled. So we were going to bring suit against the State of California and the U. S. Engineers. It all terminated in the Attorney General's office, and the problem was solved, after talking about it and being told by a number of people that funds were just not available. In our work, I think some of our unsolvable problems may be the big problems, not the little fellow.

*Mr. Smith:* But that certainly is getting back to the inter-agency cooperation. Are there questions from the floor that anyone wishes to address to the panel as a whole or to any member?

*Dr. Tinkham:* I would like to address this question to the panel. In this particular case let us assume that a man is running the waste water from cotton fields to the ditches along the side of the road, creating quite a mosquito problem, and you have talked your head off in trying to educate him for a long time. You have four or five possibilities. You can continue to talk, or you can go in there and divert the water for the farmer and get a bad name for the District. Or you can take him to the District Attorney, but in previous years the County Road Department has taken similar cases to the District Attorney and he would throw them out of court. So what should you do in a case like that?

*Mr. Raley:* We went to the Board of Supervisors and talked with them and asked them to support the laws as they now exist in relation to dumping of agricultural water on road rights-of-way. I would suggest that you start first with your Supervisors and get that support before you try to go much beyond that.

*Mr. Gray:* Law is really majority public opinion. As long as the majority of public opinion is behind a law, it will be fairly well observed, and you can without great trepidation make use of it. To give you an example of what I mean, we have laws against robbery, with penalties; I think that is pretty well supported by the majority of public opinion. No district attorney, unless he is bribed or corrupt, has any hesitancy about prosecuting a man for theft or burglary. In mosquito abatement, if you start law enforcement in an area where public opinion is not very strongly behind you, you will find considerable difficulty in law enforcement because the District Attorney will sense that public opinion is not behind him and he will let you down in various ways, even if he doesn't deliberately refuse to issue citations or prosecute. We have known situations where that occurred. So ultimately law enforcement is going to come right back to the proposition of public education. If you have your public education to the point where the majority of people want mosquito abatement, you need not worry about law enforcement when it is necessary to resort to the law.

*Mr. Smith:* We have time for just one more question. Dick Spërbeck?

*Mr. Spërbeck:* I would like to ask the ones that own their own equipment and are doing this outside work, what criticism or opposition you run into from your private operators and private contractors? Do you have any trouble along that line?

*Mr. Smith:* In our case the biggest private operator in the County is the one who sent the dragline salesman over to us, telling him "The mosquito district certainly needs one and you had better sell one to them." He worked very closely with us. We referred jobs to him and he refers jobs to us, so we have no difficulty there whatsoever.

*Mr. Greenfield:* When we bought a dragline, and word got around town that we were doing drainage work, all of the commercial companies came over to see how far we are going to extend operations, and they were quite concerned about our doing that type of work.

*Mr. Smith:* Let me put it this way—we prepared well in advance by pointing out that we are not using our equipment for anything except the solving of mosquito problems. Our District records have to back up the fact that there was a mosquito problem present. With that we will close this panel. Thank you very much, gentlemen.

*President Peters:* The next topic to be considered is "Water Conservation Program in Merced County Effecting Mosquito Source Reduction." Would you like to take over at this point, Ed, and introduce the participants in this discussion?

PANEL 3:10 P.M., THURSDAY

*Mr. Smith:* I think that it was obvious the last panel was informal: this one also will be informal.

(Editor's Note: We regret that an adequate recording of this panel discussion was not available).

#### FIFTH SESSION

FRIDAY, FEBRUARY 13, 1953, 9:00 A.M.  
ODD FELLOWS HALL, SACRAMENTO

*President Peters:* The program calls for the presentation of a paper by Dr. Longshore, of the State Department of Public Health, on the epidemiology of encephalitis. Dr. Longshore is late in getting here, and therefore we will ask Dr. Reeves to give his paper on "The Knowns and the Unknowns in the Natural History of Encephalitis," and have Dr. Longshore give his paper after Dr. Reeves.

#### THE KNOWNS AND THE UNKNOWN IN THE NATURAL HISTORY OF ENCEPHALITIS<sup>1</sup>

W. C. REEVES, PH.D.

*The George Williams Hooper Foundation for Medical Research, San Francisco, and the School of Public Health, University of California, Berkeley*

The subject of encephalitis has not been discussed at these conferences since 1948. Before that time, it was a most conspicuous part of the program at every conference from 1940 through 1948. I am sure that this four-year interval of rest and respite was most refreshing to many of you who were beginning to be bored and doubtful of the value of repetition and prodding. However, events of the past summer are sufficient reason, I trust, for my having been asked to discuss the subject which your program committee selected.

<sup>1</sup> This investigation was supported in part by a research grant (E31 C5S) from the National Microbiological Institute of the National Institutes of Health, Public Health Service, and is a contribution from a cooperative project with the Communicable Disease Center, Public Health Service, Federal Security Agency, Atlanta.

In preparing for this discussion, I reread the extensive series of papers which appeared in the proceedings of the Conferences from 1940 through 1949, and they are well worth perusing. As a matter of fact, I soon reached the conclusion that the representatives of mosquito control agencies should be the best-informed group of public officials on this subject in the United States. The development of knowledge is clearly seen by following these papers, but perhaps the easiest and least painful method is for me to summarize pertinent knowledge and unsolved problems which we face today, solely with reference to California.

In a paper on encephalitis presented at the 1940 conference, Dr. Tommy Aitken summarized the unknown in the following way:

"What we want to know is:

1. If the disease is mosquito-borne?
2. Can we associate an outbreak of encephalitis with an increase in the mosquito population of the particular area concerned?
3. Can we catch the offender red-handed in the field?"

Today I believe we can answer all these questions with an unequivocal "yes."

At the 1945 conference, Frank Stead posed the following questions:

- "1. How is the disease transmitted to man?
2. What are the principal vectors?
3. Where are the endemic areas?
4. How is the disease kept alive in endemic areas?"

Today I believe we can answer all these questions except the last one, and it at least in part.

However, enough of looking over our shoulders—let us attempt to summarize what is known and what remains to be learned. Let us clarify and restate the consensus, where possibly the picture has been confused.

As Dr. Longshore will clearly present the case, encephalitis—particularly of the Western equine and St. Louis types—is a public health problem, actual and potential, in the state of California. What you may not realize is that there is no other area of the United States where such accurate and complete records are available as guides to program planning and action. The areas where the various viruses are present and their level of occurrence are adequately delineated.

#### SOURCE OF HUMAN INFECTION

The occurrence of human cases leads us into our first contact with the natural history of these viruses—namely, where, when and how does man contract his infection? Present evidence leads to the belief that it is through a mosquito vector, and in California principally through one species, *Culex tarsalis*.

Let us examine the evidence in this State upon which this conclusion was based:

1. Proven cases of W. E. and St. L. infection have been limited to a seasonal (summer) period. Authentic exceptions to this have not been found. This is generally accepted as one supporting fact that an arthropod vector is the probable source of infection.
2. The observed number and activity of mosquito populations have been compatible with the hypothesis that they might serve as vectors.
3. The seasonal population curve and feeding habits of *C. tarsalis* have been compatible with its serving as a vector.