PROCEEDINGS AND PAPERS

OF THE

Twenty-fifth Annual Conference of the

California Mosquito Control Association, Inc.

AT

HOTEL DE ANZA

SAN JOSE, CALIFORNIA

JANUARY 21, 22 AND 23, 1957

Edited by

C. DONALD GRANT

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It is with deep regret that the members of this Association have met the loss of their former colleagues, now deceased, during this past year. The many years of close association, friendships, and recognition of the worthy services they have rendered to mosquito control work and the public which they served is herewith attested with fullest appreciation and grateful remembrances of the companionship which we shared with them.

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California Mosquito Control Association

MONDAY MORNING SESSION

January 21, 1957

The opening sessions of the Twenty-Fifth Annual Conference of the California Mosquito Control Association, Inc., convened at the De Anza Hotel, San Jose, California, and was called to order at 9:30 o'clock a.m., President W. Donald Murray, Visalia, California, presiding.

CALL TO ORDER

President Murray: Welcome to the Twenty-Fifth Annual Conference of the CMCA. We never quite start on time, but we are not too far behind schedule.

We have a few announcements.

It is requested that everyone who is going to present a paper have that paper in writing; but if he should not, his remarks will be reported by a Stenotypist. Mr. Jesse James is the reporter.

We hope to make this as informal as we possibly can. The strictly formal presentation of papers can lead to some drudgery, so the more spontaneous you can be, the better our Conference will be.

I trust everyone has registered. If not, please do so at one of the intermissions.

There are dinner and dance tickets available. If you plan to attend the dinner and dance, please get your tickets as soon as possible so that the hotel management may prepare accordingly.

There have been arrangements made for the ladies. If you have your wives in town and do not know what to do with them, arrangements are being made for a tour for them tomorrow afternoon. The tour will be completely free, and it should be very interesting for them.

I would like to call your attention to one of the provisions of our society relative to nominations for officers. The CMCA By-Laws provide for a committee which selects the slate of officers. In this way the committee has time to study the qualifications and the desirability of different persons and to come up with what should be the best available. However, this is a democratic type of organization, and we want to keep it that way. Therefore, there are certain provisions for other nominations. No nominations may be made directly from the floor; however, if you would like to select someone else and if you have seen that person and know that he will accept, then you may follow the By-Laws by posting, with the Secretary . . . I will read from the By-Laws:

> "The meeting will also receive before the second session of the Annual Meeting"—this is the first session. The second session begins at 1:30 this afternoon—"Before the beginning, nominations may be made in writing and signed by not less than three representatives of corporate members for any of the elective offices of the Association. Nominations may not be made in any other manner."

At this time I should like to begin with the formal program. Dr. Carl Duncan, Chairman of the Department of Natural Sciences of San Jose State College, was to present a welcoming address; but, as Dr. Duncan doesnt' seem to be present this morning, we will move to the next speaker.

Dr. Malcolm Merrill, Director of the State Department of Public Health will present a welcome.

Dr. Merrill: It is a pleasure to me indeed to have been invited to come and meet with you at your session here this morning. I thought I had everything planned so that I could spend the day here with you, and hoped very much it would be possible to do so. Unfortunately I have another iron in another fire today in the form of a poliomyelitis bill that is being considered in the Legislature, and I am going to have to leave immediately, that is, as soon as I can, in order to get up to Sacramento for hearings that will be held later in the day.

WELCOME FOR THE STATE DEPARTMENT OF PUBLIC HEALTH

MALCOLM H. MERRILL, M.D., MPH
Director, California State Department of Public Health

It pleases me to appear before your Association to extend a welcome in behalf of our Department and to present remarks on the occasion of your Association's Twenty-fifth Anniversary. Chronologically speaking, you have reached a milestone in your organized efforts (to quote from your slogan) in "service of the public health and comfort through advancing effective mosquito control." It is also a pleasure to me to recognize as an active participant in this Conference, Harold Farnsworth Gray, who has contributed so much throughout his span of years to mosquito control, to founding and furthering the objectives of your Association, and toward helping to shape the environmental sanitation program of the State.

Although our Department has maintained a relationship with mosquito control since its inception in the state approximately 50 years ago, our closest association has existed during the past decade. Since the advent of the subvention program in 1946, we have journeyed

an eventful course together and I am personally delighted to recognize the significant advances which have been made within your group in this short span of time. The enlarging professional outlook which characterizes todays mosquito abatement program in California is truly worthy of acknowledgment and recognition. I venture the opinion that Harold Gray must possess a warm sense of pride that his many years of pioneering in this field is proving to have been so well dedicated. This salutation is by no means intended to suggest that any relaxation or resting upon present accomplishments is possible; rather, it is an expression of commendation to the sincerity and conscientious application, which you mosquito abatement workers have demonstrated in meeting these difficult past 10 years which have been characterized by a drastically expanding problem.

The task before the mosquito abatement forces in the state is a great one. In view of the prospect for at least a doubling of the present eight million irrigated acres, and the increasing liquid waste problems which characterize expanding industry and growing communities, the potential of the mosquito problem might also be regarded as formidable. It is our optimistic outlook, however, that through your effectively organized and operated programs this significant public health problem can and will be resolved.

This should certainly serve to indicate that we regard mosquito abatement agencies as part of the team of public health. We have come to consider the function of mosquito abatement as an integral part of environmental sanitation. The broad public health program which we know today has gradually acquired the responsibilities which pertain to human disease and conditions of physical ill-being. It has also been characteristic of public health development that due to financial limitations certain priorities have had to be recognized. This has always meant doing first things first. Accordingly in the field of mosquito control throughout the world, those vectors of malaria, yellow fever, dengue fever, filariasis, and encephalitis have and still are understandably receiving primary attention from public health agencies. Today we are fortunate in being able to say that, with the significant exception of encephalitis, these diseases are not objects of public concern in California, although this is not true throughout many other parts of the world.

We must also be responsive to the constant changes taking place in our physical and social environment, which require revised, if not new, definitions of public health. Today we find ourselves as public health workers justifiably obliged to direct significant effort toward the prevention of conditions and practices which lead to malnutrition, substandard housing, home accidents, alcoholism, air pollution, and excessive levels of noxious pests—including mosquitoes. All of these conditions, if permitted to continue, ultimately lead to significant impairment of physical or mental well-being. This broadened outlook in public health is not peculiar to the State of California or even to the nation.

The constitution of the World Health Organization, for example, reads: "Public health is a state of complete physical, mental, and social well-being and not merely the absence of disease and infirmity." The U.S. Public Health Service some years ago went on record as recognizing pest mosquitoes to clearly be in the realm of public health whenever they occur in such a degree of prevalence as to impair normal living, including use of the out-of-doors in the vicinity of the home, as well as the occupation, and in recreational areas. Certainly we in California have had to recognize that a substantial part of our State is characterized by a mosquito problem which clearly impairs normal living. We have also had to recognize that the public looks to and expects local mosquito abatement agencies to protect it against this adverse influence on their health and comfort. In no way does such a recognition imply attention to pest mosquitoes to the exclusion of vector mosquitoes. In California the separation of these two entities as programs is exceedingly difficult from an administrative standpoint. The wide choice of habitat of *Culex tarsalis*, primary vector of encephalitis in California, and its general distribution throughout the state wherever pest mosquitoes occur, makes abatement of all mosquito species which adversely affect the public well-being the most realistic approach to the problem.

In contrast with the past, we are now facing a situation in which mosquito problems arise largely from water which is artificially obtained, that is through man made impoundments and diversions, and which is used for agricultural, industrial, or community purposes. As is the case with mosquito abatement, the field of public health has a broad interest in water far beyond that of assuring its potability for drinking purposes. You as mosquito control agencies and we in public health work with numerous other agencies on diverse and related aspects of water management. For example, water pollution control legislation identifies prolific mosquito production as "contamination" or "pollution" depending upon whether vector or pest species occur as a result of disposal of liquid wastes (including excess irrigation water). Responsibility for abating contaminations on an emergency basis rests with public health agencies. Water pollution control boards have the duty to control "pollutions." Mosquito abatement districts, of course, are empowered within their own statute, to engage in corrective, preventive and emergency action against mosquitoes. The inevitable preventive planning which must characterize the present and future mosquito abatement program characterizes all workers in environmental sanitation. Cooperative and integrated working relationships between official agencies are essential to achieve mosquito abatement and sanitation objectives.

Along the line of environmental measures, I am pleased to note the increasing emphasis upon mosquito source reduction by most mosquito abatement agencies in the State. Those agencies participating in the subvention program have had as a guide, since 1949, the "Standards and Recommendations for Local Mosquito Control Agencies," adopted that year by the State Board of Health. It is gratifying to recall that the "Basic Principles" contained in these Standards, which I quote in part, "A primary program shall be continuously carried on based on the incorporation of measures aimed at progressive reduction of known mosquito breeding sources," were in effect even before mosquito resistance to the "miracle" insecticides became a general reality. This mention is made to illustrate that the emphasis on mosquito source reduction has not been one resulting from desperation, but rather that it underlies all soundly operated mosquito abatement programs of the

past, the present, and undoubtedly, the future. This is truly preventive action.

A brief reference to the statute under which mosquito abatement districts operate also seems appropriate. The powers granted to a Board of Trustees provide them with almost endless flexibility for exercising discretion in selecting the most effective means to deal with the wide variety of problems confronting every district under the changing conditions being experienced. The optional exercise of educational, cooperative, interagency, legal and direct abatement methods by the district enables virtually every existing problem to be ultimately resolved. The Panel Discussion on Various Approaches in Securing Source Reduction, scheduled later in the Conference, will probably evaluate these alternatives at length, so I will not elaborate or attempt to propose a philosophy on methodology.

Perhaps of equal if not even greater importance than abating existing sources, however, is a program of preventive planning aimed at heading off the potential problem of the present and the future from water resources, industrial and community developments. This can best be achieved by your participating in water use planning within your local jurisdiction.

We well recognize the importance of our Department's role in preventive planning at a State and Federal level. In this regard, a recent survey of our Bureau of Vector Control by the State Department of Finance resulted in inclusion in the Department budget for the coming year of a Water Projects Consultant, effective July 1, 1957. If approved by the legislature he will be assigned the responsibilty of negotiating with State and Federal Agencies to assure that mosquito preventive measures are incorporated into water development plans throughout the state. This specialist will also attempt to bridge the gap between the water development agencies and local mosquito abatement programs by making available to you pertinent information regarding planning which is under way in various sections of the state. We still feel the need for increased consultation and service to local programs on mosquito source reduction planning and demonstrations. Although we have thus far not obtained additional personnel for this purpose, we will do our best to expand this activity within the existing resources of the Bureau of Vector Control.

Another need recognized and included in our budget for the coming year is a position for a Supervisory Scientist. This position, also hopefully to be effective July 1, 1957, will be expected to perform a coordinating and technical guidance function for the mosquito control investigations. This should result in maximum utilization of the Department's resources as well as those of the local mosquito abatement agencies and other cooperating institutions and agencies. The administrative survey by Department of Finance, as well as a technical review conducted simultaneously by the Communicable Disease Center of the Public Health Service, supplied endorsement of the mosquito research projects currently under way. We must recognize that this research program has been operating under conditions of extreme hardship and uncertainty in the past. This is the unfortunate lot of many new programs in the early phase of development. It is our firm belief, however, that this modest investigational effort will prove to be a sound investment of funds and time. The sustained support which your Association has patiently given to this vital activity has been gratifying to observe. It is my conviction that the scientific research staff in this program is laboring industriously on work which is basic to the ultimate solutions of our mosquito control problems. It is virtually impossible to establish a time-table for production in any research undertaking. Nevertheless, it is a fact that it is only through the diligent attention of competent research scientists to these tasks that the needed technological advances are made. I urge your continued support of this program, and your continued cooperation with the scientists who are dedicated to aiding in finding solutions to your many problems.

Another matter of interest to you all, I am sure, pertains to the conditions of eligibility of local agencies for subvention. A careful restudy of this whole matter has been made during the past year in which your representatives have participated. We believe concurrence exists that only those agencies with a critical need for subvention should be regarded eligible in the future for operational support. This does not pertain to eligibility to receive a basic allocation. Accordingly it is our plan to confine operational support during the next fiscal year to those agencies operating at a tax rate of 15¢ per $100 assessed valuation or higher. The balance of the factors of the present formula will continue to apply. This new policy on subvention is based on a number of considerations, that I believe are familiar to you.

I should like to shift to the matter of Civil Defense. It is my understanding that thus far local mosquito abatement districts throughout the state have not been integrated into the medical and health activities of the Civil Defense program. It need hardly be mentioned that the personnel and equipment resources which exist within the agencies comprising your Association are of incalculable importance to the people of our state in the event of either extreme enemy induced or natural disaster. Briefly stated, the state disaster plan imposes a tremendous responsibility upon our Department. During normal times, the Medical and Health Division of the California Disaster office is a Division in the Department of Public Health. This Division is responsible for developing the plan for utilizing needed personnel, equipment and material resources which are depended upon whenever a disaster arises. That portion of the planned program which most directly concerns mosquito control agencies is associated with the areas of vector control and decontamination. Our Bureau of Vector Control is charged with directing and carrying out such activities within the regional and local Disaster Offices. The California Pest Control Operators Association has already volunteered its services to assist the Bureau of Vector Control Staff in emergency vector control and decontamination activities in the event of disaster. In addition, it is hoped that the California Mosquito Control Association, through its member agencies, will likewise volunteer its services to these important functions. This can be accomplished by contacting your respective local or county Civil Defense Office and requesting assignment in Medical and Health Services. Provision will thereupon be made to assure use of your personnel in vector control and decontamination functions. As part of your local Civil Defense organization, your resources would first of all be used to protect your immediate locality if disaster oc-

curred there. Should the need exist for service elsewhere in the State in the absence of local disaster, your services in vector control and decontamination would be assured elsewhere.

Enrollment in an official Civil Defense and Disaster Organization now, before an "extreme emergency" exists, in addition to serving the people of our State, also provides the following advantages for Mosquito Abatement Districts and their personnel:

1. All enrolled employees automatically become eligible for State Workmen's Compensation should they be injured while serving as disaster service workers or while engaging in disaster training activities.
2. Through the medium of pre-disaster planning you become eligible for rapid reimbursement for goods and services expended, as provided for in Bulletin No. 106 and Supplement, California Disaster Office.
3. Mosquito Abatement Districts may acquire Federal surplus property by submitting requests through the accredited local or county Civil Defense and Disaster Organization in which they are enrolled. This program was initiated in November 1956 and is covered in detail in Bulletin #39 of the California Disaster Office.
4. Possession of Civil Defense Identification Cards, issued in advance of disaster, permits immediate movement of holder during Civil Defense emergencies. These passes usually authorize holders to pass traffic control points to perform their duties.

It is my understanding that further discussion of this subject will occur later during your Conference. May I urge your Association to take the steps necessary to become identified in the California Civil Defense program.

What is in store for mosquito control agencies in 1957? Although it sometimes seems to avail little in California, it is always well to look in retrospect at what has recently happened. A glimpse at 1956 shows that California was consistent with respect to having unusual weather. We experienced one of our most rugged winters in history in which floods left destruction in several areas throughout the State. An above-normal snow pack was experienced in the mountains of northern and central California. If a normal rainfall had continued, threat of a serious Spring flood prevailed in the Central Valley. However, a subnormal rainfall followed to dissipate this danger. A moderate summer with only a limited period of high temperatures ultimately gave way to Autumn and the subsidence of a moderate mosquito season. Thus far this Winter, we have been faced with perhaps the weirdest drought in the past 100 years.

During 1956 only 19 cases of mosquito-borne encephalitis were confirmed in our Laboratory. Thirteen of these were Western Equine and the remaining six, St. Louis encephalitis. Of 1,047 mosquito pools tested in Sutter, San Joaquin, Fresno, and Kern Counties, not one isolation of St. Louis virus was made. One-hundred forty-three pools yielded Western Equine virus and 16 pools showed the recently discovered "X" encephalitis virus. In addition, only six confirmed cases of encephalitis in horses were reported in 1956. An additional 14 suspected cases in horses have also been reported. With respect to malaria, only two cases have been confirmed as indigenous, although three additional cases are still being followed in order to determine the likely place of origin. Thus, California experienced one of the lightest years of mosquito-borne disease occurrence in its history, with 1956 being the second consecutive year of a relatively low incidence. To just what combination of circumstances this may be attributed, remains speculative. Accordingly, what will develop this year defies prediction.

These remarks have attempted to encompass a considerable range of our common interests. The substance of what I have tried to convey suggests our need to stand back now and then and take an objective look at ourselves, our programs, and our progress. We certainly find this to be necessary in the sharply defined public health programs for which our Department shares responsibility. It would be a satisfaction and justifiable plagiarism if we could say: ". . . In public health . . . and in mosquito control . . . progress is our most important product."

President Murray: Thank you, Dr. Merrill for these encompassing statements relative to policy in the relationship of the Health Department and the Mosquito Association.

I have one interesting comment relative to what was mentioned about other agencies and their developments and planning in advance. Just last week the U.S. Army Engineers, in developing a new reservoir in Tulare County—outside of any mosquito district at the present time—nevertheless contacted two neighboring districts, and when they presented the advance planning it was almost amazing to see the thought which had gone into it and what they knew about mosquitoes. If that is typical of our future, we have the best coordination imaginable. We certainly do appreciate whoever helps on these coordinated programs.

Thank you, Dr. Merrill.

The next talk will be by Mr. Carl B. Meyer, Principal Hydraulic Engineer, State Department of Water Resources.

WATER CONSERVATION AND DRAINAGE OF IRRIGATED LANDS UNDER THE CALIFORNIA WATER PLAN

CARL B. MEYER

Principal Hydraulic Engineer
State Department of Water Resources

In 1947 the State Legislature made an appropriation to the State Water Resources Board for a state-wide water resources investigation for the purpose of determining the fullest practicable conservation of the State's water resources for all beneficial purposes. Subsequently the Legislature made additional appropriations to this board for continuation of these investigations. The State Division of Water Resources provided the engineering services required for these investigations for the State Water Resources Board, resulting in the publication of Bulletin No. 1, "Water Resources of California," and Bulletin No. 2, "Water Requirements of California." Concurrently with the presentation of these

bulletins, work as conducted on The California Water Plan, which was designed to conserve sufficient of the waters of California to supply the needs of the State for all beneficial purposes under conditions of ultimate development.

In 1956 the State Legislature created the State Department of Water Resources, which department took over the functions of the Division of Water Resources, and also many of the duties of the State Water Resources Board. This board was abolished and a new board created under this law, which has advisory powers only. The Department of Water Resources is continuing the investigations leading to The California Water Plan, and has issued a preliminary edition of Bulletin No. 3, which describes the features of the plan.

Bulletin No. 1 revealed that the mean water supply available to the State from the waters of its streams amounted to some seventy million acre-feet. However, the distribution of this supply was by no means uniform, with a greater part of the water supply being available in the northern portion of the State. Seventy-two per cent is obtained from watersheds north of Sacramento, and only sixteen per cent from those draining into the San Joaquin Valley. This bulletin also showed that there are large fluctuations in the available water supply, some seasons furnishing supplies considerably in execess of the mean and others being subnormal. In 1937-38, the estimated runoff was 135 million acre-feet, nearly twice the mean, and in 1923-24, only eighteen million acre-feet or about one-fourth the mean. The studies also revealed that during the ten-year period from 1924 to 1934, water supplies for the State as a whole were only about fifty per cent of the mean.

Studies made in connection with Bulletin No. 2 determined that the water requirements needed for all beneficial purposes under conditions of ultimate development would be about fifty-two million acre-feet per season. The term "ultimate development" is defined as the water needed at some time in the indefinite future when development of the State had progressed to the point that all resources had been completely developed. Of the ultimate water requirements, only about ten million acre-feet will be needed in the area of the State north of Sacramento, or about one-fifth of the total state requirements in contrast to the seventy-two per cent of the water supply available in that area. The great water use in California today is by irrigated agriculture with 90 per cent of the water used for that purpose. Even under conditions of ultimate development, when it is estimated that the population will have grown to 42 million, irrigation will still use 80 per cent of the water.

The studies in connection with The California Water Plan reveal that it would be possible by proper conservation of California's natural water supply, together with its rights in and to waters of the Colorado River, to furnish an adequate supply sufficient for the water requirements under conditions of ultimate development. The California Water Plan may be divided into two portions—the export-import systems, and the local development projects. The export-import system, by means of a series of large reservoirs, pumping plants and canals, will collect the surplus water supply in the northern portion of the State and deliver it to areas of deficiency in the central and southern portions of the State. In order to provide the regulation of the water supply for both local development and for the export-import plan, The California Water Plan contemplates the construction of some 260 reservoirs in the State. There will be large reservoirs in northwestern California, principally on the Eel, Klamath and Trinity Rivers, and on the principal tributaries of the Sacramento River to furnish water supplies for the export-import plan. In addition there will be numerous upstream reservoirs to regulate the water supply for local development. However, even this large number of reservoirs will not be sufficient to regulate the extremely variable water supply and provide sufficient over-year or cyclic storage in order to furnish a full water supply during periods of subnormal runoff. Therefore, it is planned under The California Water Plan to use the ground water basins of the State, by means of conjunctive operation, to provide the necessary cyclic storage to obtain complete regulation of the water supplies.

Conjunctive operation of ground water reservoirs may be defined as a coordinated operation of surface and ground water storage. The surface reservoirs would regulate flows during winter flood periods in such a manner that these flood flows could be diverted to suitable spreading areas for the replenishment of the ground water basins. The surface reservoirs would make available to the lands overlying the ground water basins an irrigation supply varying from a complete supply during wet seasons, to a very small one in extremely dry seasons. This variable supply would then be firmed by pumping from ground water in such a manner that the ground water supply would augment and firm the available surface supply, and the user would receive a firm supply in all seasons, wet or dry. In wet seasons the supply would be all from surface sources, and in dry seasons almost entirely from ground water. This method of operation results in depletion of storage in the ground water basins during periods of subnormal runoff, with consequent lowering of ground water levels. Replenishing the basins during periods of above-normal runoff, by means of spreading the flood flows previously mentioned, will result in rising ground water levels.

As you are probably aware, it is not possible to irrigate crops in such a manner as to apply only such amounts of water as the crops consume. Rather it is necessary to apply water in excess of consumptive use. This excess percolates downward to ground water and causes a rise in the water table. In some cases this causes the water table to rise so close to the surface as to cause drainage problems. Thus a portion of the water supply utilized by irrigation when the surface reservoirs furnish this supply during wet periods, would percolate to ground water and furnish an additional replenishment.

The method of operation just described results in cyclic operation, and with proper regulation of withdrawals and replenishment, should not result in a continuous lowering of water tables, but rather should result in rises during wet periods equal to the lowering in dry. Also, this controlled operation would not result in water levels rising high enough during wet periods to cause a drainage problem.

The importance of ground water reservoirs in furnishing this cyclic supply under The California Water Plan can be seen from the estimated available storage in the Sacramento and San Joaquin Valleys, as deter-

mined by the Ground Water Branch of the United States Geological Survey from cooperative studies made for the former Division of Water Resources. These investigations showed that there are some thirty million acre-feet of available ground water storage capacity in the Sacramento Valley between levels of twenty and two hundred acre-feet below ground surface, and one hundred million acre-feet in the San Joaquin Valley between levels of ten feet and two hundred feet below ground surface. There are also other large important ground water basins in other portions of the State, principally in southern California. In addition, there are many other basins important to the development of local water supplies. The ground water basin here in the Santa Clara Valley is of great importance in conserving and regulating the local water supply.

This conjunctive operation of ground water basins results in another problem in connection with the utilization of these ground water basins. This problem is commonly called "salt balance" Salt balance may be expressed by stating that the total salts added to the water supply of a given area should not exceed those removed from the area by drainage or other means. When precipitation falls upon the ground surface, or water percolates from natural stream channels or from artificial spreading grounds, it increases in salinity as it passes through the groud. This is due to the solution of minerals from the soil into the water supply. If a farmer pumps water from a ground water basin, the water derived from the well has in solution these minerals dissolved from the soil. If he applies an irrigation supply in excess of the consumptive use of the plants, as is usually the case, the excess water will percolate down to the ground water body, and in so doing, will dissolve additional minerals from the soil. It can be seen that if this recycling of the water is carried on for a number of cycles, that each cycle will result in a greater concentration of salts in the water until a condition is reached when the water is no longer usable. The above discussion of salt balance indicates the reason for and necessity for providing for drainage under The California Water Plan.

The quantity of water that is necessary to remove to maintain salt balance is dependent upon the quality of the initial supply received. The poorer the quality, the greater the amount of water which will be necessary to remove to maintain salt balance. It is fortunate for California that in the greater portion of the State the natural water supply draining from its mountains is of very superior quality. This refers particularly to the streams draining the Sierra Nevada and also those streams draining into the Sacramento Valley from the coast ranges in the northern portion of the valley. However, the streams entering the Central Valley from the Coast Range from Cache Creek south contain in many cases considerable dissolved minerals, and the ground water supplied by percolation from these streams reflects the quality of the supply and shows high mineralization. The quality of water draining from the west slope of the Coast Range south of San Francisco and north of Santa Barbara is, in a number of instances, rather highly mineralized and water quality problems exist in these areas also.

The studies in connection with The California Water Plan indicate that a main drainage canal will be required in the San Joaquin Valley to maintain salt balance and remove excess salts. This canal would extend from the southerly end of the San Joaquin Valley in the vicinity of Buena Vista Lake and would extend northerly down the trough of the valley and west of San Joaquin River, and would discharge into some channel in the Delta, whose waters are not usable for irrigation or other beneficial uses. In the Sacramento Valley, it is probable that a similiar drainage canal may become necessary, although due to the better quality of the available native surface water, its use may not be necessary.

If such a canal were to be constructed, it would lie in the trough along the west side of the Sacramento Valley, extending from Redding to tide water near Rio Vista. In southern California, it is believed that the large ground water reservoirs there would probably be protected by pumping water for domestic use and discharging it as sewage to the ocean. This discharge would remove excess salts and remove the possibility of too great an accumulation within the ground water reservoirs. In other portions of California it is probable that under conditions of ultimate development certain drainage facilities may be necessary in order to remove excess salts.

It is believed that the above discussion has demonstrated the necessity of providing adequate drainage under conditions of ultimate development in order that The California Water Plan may function properly, and that there may be no permanent deterioration of the available supply furnished by that plan.

In conclusion, California can provide for its ultimate water needs by conserving on the average about five-sevenths of the water which drains from its own watersheds. To accomplish this, it will be necessary to construct numerous reservoirs to regulate the erratic runoff. In addition, it will be necessary to use the large ground water storage to provide cyclic storage in order to provide a full supply in periods of subnormal runoff, such as occurred between 1924 and 1934. To protect the water quality in these ground water reservoirs, it will be necessary to provide drainage to remove excess salts.

President Murray: Thank you very much, Mr. Meyer. One copy of Mr. Meyer's report is available to each district.

At this time we will take about a twenty-minute break.

(Short recess)

President Murray: I would like to make a few announcements.

I have information from Dr. Duncan. He has been unavoidably detained, and he thinks it would be better if he tried to come tomorrow. His wife is ill, and he felt that he couldn't try to make it here today; but if we can give him some time tomorrow morning—and I am sure we can—we will do so.

There is one further thing to which I would like to call your attention. Many of you have been downstairs and have seen the exhibits. These exhibitors contribute to our Conference financially and they appreciate the attention which you can give them. Be sure to give it to them. There are also exhibits outside, and don't overlook them. Those inside are convenient, but there are some on the north side of the building. There are jeeps, trucks and other exhibits outside.

Perhaps at this time we should have several other announcements relative to other programs. We have the American Mosquito Control Association which is having a very big meeting in Miami, Florida, and Art Lindquist is the President-Elect of the AMCA. Would you like to say a word about that, Art?

Dr. Lindquist (Silver Springs, Maryland): Mr. Chairman, Gentlemen: As you all know, the American Mosquito Control Association's Annual Meeting will meet at Miami, Florida, from April 28 to the 2nd of May.

We have been working on the program for several weeks, and I believe that it will be of interest and use to almost everyone who attends. We were fortunate in obtaining several outstanding men for the first day to give papers; for example, the World Wide Malaria Eradicalook them. Those inside are convenient, but there are tion Program by D. L. L. Williams. Many of you now know him. J. W. Wright of the World Health Organization from Geneva, Switzerland will give us a talk. Dr. Travis has consented to talk on the present status and future possibilities of biological control of mosquitoes.

Then there are several symposia. There is one here on insecticides and mosquito control. The discussion leader is Dr. Smith. We have five papers by people whom we believe know their subjects very well.

Another symposium is entitled: What Can Applied Ecology Contribute to Mosquito Control? Dr. Morrie Provost is the discussion leader. Another symposium is: The Progress in Mosquito Control Through Elimination of Breeding Areas. Bob Vannote is the discussion leader.

Then there will be room for the submitted papers, and anyone having any papers that they would like to give may submit them to me or Fred Stutz, who will, in turn, send them over to me.

I don't believe there is anyone here from Florida. I might say that I have been working with Mr. Mulrennen and Mr. Stutz on this program and they have all their committees set up for the entertainment. They will have tours; I don't have any specific information at this time on what tours will be included and exactly what type of entertainment there will be, but I think you can rest assured that the Floridians are behind this meeting one hundred per cent, and it will be well worth anyone's while to attend.

Remember the dates: April 28 to May 2.

Incidentally, Ted Raley asked this morning about the hotel situation. I think the Florida group will have that information coming out to the membership in the very near future.

I believe that is all I have.

President Murray: Thank you, Art. I understand there is a fair delegation from California planning to go.

Mr. Raley (Selma): There will be no effort to arrange transportation for the group. I do have information on some of the methods of travel. I will bring that up more particularly in the business meeting of the California Association; but between then and now, if any of you are interested in the approximate cost of travel to Miami Beach—and of course we know you will return, so we are talking about round trips—I will be very happy to give you what I have. At the business meeting I will read a letter from one of the air travel bureaus that has figures on the cost by air travel.

President Murray: I believe Jay Graham has an announcement he would like to make.

Jay, would you like to say something about the Utah Meeting?

Mr. Graham (Salt Lake City, Utah): I don't want to say very much about it because I am sure Dr. Rees has something on that topic. But we will have a very fine program. We have Dr. Hess, Logan Field Station; and we will have a lot of other good speakers. The meetings are March 8 and 9. We would like to have as many people there as we can get from California, and from other places, too. I think Dr. Rees will have more on that.

President Murray: Fine. Thanks, Jay.

Now, let us continue with our program. We have several very important basic talks this morning. The first one of these is by Henry Dietz, Assistant State Attorney General, on Water Law Affecting Mosquito Abatement.

WATER LAW AFFECTING MOSQUITO ABATEMENT

HENRY A. DIETZ

Assistant State Attorney General
State of California

Mr. Dietz: Mr. Chairman, Gentlemen of the Association, Guests: I bring you the greetings of Attorney General Brown of the State of California, who asked me to express his hope that you would have a successful and wonderful meeting and that you go on in this work which, so far as he is concerned, and so far as I am concerned, is one of the most necessary things that is today being done in order to keep our civilization on a stable basis.

I was perhaps never more shocked than when Brother Peters, who happens to be sitting over here, not so long ago told me at a meeting that I was attending of the State Board of Public Health, that were it not for mosquito control, the great central valleys of this State would not be inhabitable. It caused me to pause and think; it caused me to have a great deal of concern as to whether or not you gentlemen were doing your work or not, because I enjoy going to the valley, other than in the hot summer time.

I have noted one thing that seemed to impress everyone who has anything to do with thinking about mosquitoes, that is that you people are allergic to water to the extent that I haven't a drink of water here. (Laughter.)

I am reminded a little bit of my son, Paul, who, incidentally, determined at the age of three that he was going to be an entomologist. He is now nine and is still of that determination. But he, too, is allergic to water; not so far as playing in it is concerned, but insofar as, of course, the usual things about keeping clean. Now by that I do not mean you gentlemen are in any way affected in such a manner.

So you see I have a two-fold interest in what you are doing. Number 1, I think you are probably keeping the

State of California so that we can live in it; Number 2, I have a son who, so far I know, definitely is going to be an entomologist.

I have only one trouble with him, and that is that he gets mad at me when I won't believe him when he brings in a specimen, as he calls them—not necessarily a mosquito, but some specimen — which he says is such and such; and I say, "Oh, I don't know. Are you sure? Are you sure?"

Well, yesterday, of all things, he came wandering in with a little green vial which he could look through.

He said, "Dad, down at the YMCA I caught a black widow."

I said, "Oh, you did not."

He said, "I sure did."

So I looked and, of course, the vial was so green that I couldn't determine whether the usual hourglass was there or not. But he insisted it was a black widow.

I said, "They don't grow up here or live up here. They are all down South."

But sure enough it was a back widow. We put it in something I could see it in, and there was the typical old red hourglass. So I got the usual thing: "You don't believe me, do you?" (Laughter)

Well, so far as I am concerned, I probably shouldn't tell a joke because I know you gentlemen are getting ready to listen to some very interesting speakers, and I am going to make this perhaps shorter than one would think.

But I cannot refrain from telling a joke that I heard the other day. This happened to be about a juror who was called for jury duty.

The judge was examining the jury, and this particular juror was on the stand being examined as to why he should or should not be a juror, when all of a sudden he piped up and said, "Your Honor, I would like to be excused."

The court said, "Why?"

He said, "My wife is about to become pregnant."

So the court looked kind of startled, and said, "Would you repeat that, please?"

He said, "My wife is about to become pregnant and I would like to be excused."

Well, the court was about to blow its honorable top when the district attorney piped up and said, "Your Honor, I think the prospective juror is making a mistake. I think what he means is that his wife is about to be confined, but in either event he ought to be home. (Laughter)

Water Law Affecting Mosquito Abatement conjures up many, many problems. Our office is not concerned solely with mosquito abatement nor with water concerning mosquito abatement. It brings into being the problems that the gentleman spoke to you about in the previous speech. It brings into being the case of Arizona versus California, perhaps one of the most important pieces of litigation that is going on in California today, because if Arizona—and I hope no one from Arizona is here, but I understand someone from Utah is so we will let it go at that—if such litigation is lost and Arizona gets the amount of water that they claim from the Colorado River, then there will be insufficient water for southern California to continue to exist or to expand in any way.

It is because of that litigation, because of those problems, that we now have these terrific Central Valley water projects.

It conjures up matters of water control. Then it brings into our thinking the various areas into which the State Department of Public Health is examining. They, of course, as you know, have control over the permits insofar as our domestic water supply is concerned. They have great concern over sewage disposal; they have great concern over contamination of waters.

Then I think of the State Water Pollution Control Board. The State Board and its various regional boards were recently set up by the Legislature, and they have to do with what is defined in the Act as "pollution" and "nuisance." Then I think, of course, of the tremendous number of irrigation districts. I think of all the various other things wherein we, as human beings, are under the aura of water as such.

Upon receipt of this letter I immediately telephoned Brother Peters and said, "My heavens, this is such a broad topic that I am inclined to believe that I might discuss it for a period of seven or eight days, but you indicate that I am to have between twenty or thirty minutes, and I am sure that what I would be able to give on the broad topic would not be sufficient to encompass anything of real value insofar as specifics are concerned."

He agreed with me and we had lunch with a couple of your comrades, and we discussed various things that might be of interest to you.

I am just wondering how many of you have recently picked up your Health and Safety Code and read the Mosquito District Act. I am going to read portions of it and set forth some of the basic things with which you are concerned that have to do with water.

In California this problem is handled by way of districts, and it is my understanding that there are districts in most of the counties, but not in some of them, who are, incidentally, quite concerned with mosquitoes, such as some of the smaller counties up in the Sierra Nevadas.

The ease with which a mosquito abatement district can be formed is almost miraculous. You have the usual things such as notice, taxation, powers and duties, but all that is required is that either a board of supervisors say that this is necessary or a group of petitioners say this is necessary, and the district may be formed. I know of no easier way to form a district.

If you will examine other district laws, you will find in most cases they are couched around petitions, elections and meetings and everything else that you can think of, but a Mosquito Abatement District can be formed rapidly and easily. I have no doubt it was so set up in order to bring about a district which could control mosquitoes in the most rapid fashion because of the fact that it is truly a public health problem.

Now, the sections involved—and I am sure that you know them fairly well, and probably better than I do—have to do with Sections 2200 of the Health and Safety Code and continue on over into Section 2398, with the addition of Sections 2425 and 2426 that have to do with the State's participation in your mosquito district.

But let us return and take a look at what, in fact, are the powers and duties of mosquito districts.

Section 2270:

The District Board may take all necessary or

proper steps for the extermination of mosquitoes, flies, or other insects either in the district or in territory not in the district but so situated with respect to the district that mosquitoes, flies, or other insects from such territory migrate into the district.

There you have the first breakdown of a county line; you have the first breakdown of a district. Ordinarily districts are given no powers—absolutely none beyond the imaginary line or the actual district line in which they operate. In the case of your districts, you have power to investigate and go beyond those districts. Therefore, pools of water, breeding places of mosquitoes, or whatever else you may control, including rats and rodents, if you have such, that duty may go beyond the actual lines of the districts which are set up by the Board of Supervisors.

Part 2 of Section 2270:

Subject to the paramount control of the county or city in which they exist, abate as nuisances all stagnant pools of water and other breeding places for mosquitoes, flies, or other insects either in the district or in territory not in the district but so situated with respect to the district that mosquitoes, flies, or other insects from such territory migrate into the district.

Again you see the scope beyond the line.

The District has the power, of course, to supply the power to build or construct levees, dams and so forth and so on; has the power of condemnation, has the power to make contracts. And here is one of importance: "Enter upon without hindrance any lands." That includes private property. That is more power than they give a policeman. The right to remain secure and free from invasion on one's own land is a right that is jealously guarded by the lawmakers and by the citizens to see that their land is not invaded nor trespassed upon unless they consent.

Here is a broader scope over private property:

Enter upon without hindrance any lands, within or without the district, for the purpose of inspection to ascertain whether breeding places of mosquitoes, flies, or other insects exist upon such lands; or to abate public nuisance in accordance with this article; or to ascertain if notices to abate the breeding of mosquitoes, flies, or other insects upon such lands have been complied with; or to treat with oil or other larvicidal material any breeding places of mosquitoes, flies, or other insects upon such lands.

I have always advised the State Department of Public Health about the extraordinary power the public health officials have been given to enforce and to carry out their particular duties. And I have also referred to the situation involving quarantine. Quarantine is perhaps the greatest single power ever given to any single individual by any legislature in any state, because at that point the legislature has said: You may quarantine for such and such and such.

What does that mean? You may quarantine. That means you may say: You do this and you do it now. You don't have to arrest a person; you don't have to take him to jail; you don't have to offer him bail; you don't have to do any of those things. About the only thing the person quarantined can do is to get in touch with his lawyer and get out a writ of habeas corpus.

So you see the extraordinary power that is given to the public health officers and you begin to visualize from what I am saying the extraordinary power given you also in order to carry out this function of Government, this functiofin of public health which has been considered to be of such extreme importance by the Legislature. You have the authority to tax, you have the authority to sell, you have all the other authorities necessary to carry out your particular work.

Section 2271:

Any breeding place for mosquitoes which exists by reason of any use made of the land on which it is found or of any artificial change in its natural condition, is a public nuisance.

Now, that is pretty broad. The typical statutes which have to do with nuisances and their abatement are two, and you will find those in our Civil Code and in our Code of Civil Procedure, wherein certain things are designed as being a public nuisance, certain as a private nuisance.

A private nuisance, of course, is a situation which John Doe may abate by taking to court a particular thing that Richard Roe, his next door neighbor or his adjoining neighbor or someone in close proximity, may do that causes him to have a nuisance upon his property.

The public nuisance is another thing. A public nuisance must affect an area or a group so that in effect it is public in nature; it is much broader than a private nuisance. But here, insofar as your public nuisance is concerned, has been designated an individual place, an individual person, an individual piece of property, an individual tool. It need not be public in the sense that it spreads, but it is public because of the fact that that particular thing sitting there causes a public nuisance by way of mosquitoes being allowed to breed therein.

What does it say after that? Section 2272 says:

The nuisance may be abated in any action or proceeding, or by any remedy, provided by law.

Then Section 2273 says:

Any remedy provided in this chapter for the abatement of a nuisance is in addition to any other remedy provided by law.

Now, this is what we call a multiple action, whereby a person has a choice or whereby he may use all of the various means that the law provides. So you see yours is not exclusive, but it is piled upon the authority which is given to abate nuisances as a general rule. This, of course, is an unusual statutory provision because it does encompass dual actions, which is another type of action or thought or theory which is generally frowned upon in the law because a man should be charged with one thing and know with what he is charged in order that he may be able to properly defend himself.

Now we get to the prime question: What is a breeding place. That is, what constitutes such a breeding place as may properly be abated by the mosquito abatement districts as a public nuisance.

Then we come up with the further question: Who may be held responsible. I have already gone into this matter of nuisance as such because you have statutory definitions of nuisances. These definitions of nuisance have not changed particularly from time immemorial.

On the other hand, what is a nuisance in a particular case is a question of fact. Does the nuisance fall within the provisions of what is described as a public nuisance here? That is the thing that you must determine. When and under what circumstances a condition on the land producing breeding places for mosquitoes may constitute an abatable nuisance insofar as the law is concerned is a relatively new thing, the reason being that no one knew very much about mosquitoes for a considerable period of time and no one realized what a menace they were until very modern times.

The definition in the act of a nuisance is a dual one. It may be read in the alternative as follows:

1. Any breeding place for mosquitoes which exists by reason of any use made of the land by an owner or one in possession or control thereof is a public nuisance.
2. Any breeding place for mosquitoes which exists "by reason of any artificial change in the natural condition of the land" is a public nuisance.

Thus it seems to be pretty clear that the situation may exist in urban areas where water from household plumbing or excessive irrigation of lawn collects in the streets, gutters and lots on or adjacent to the land of the home owner and results in mosquito breeding places.

Likewise, for example, the definition covers the situation that may exist in rural areas where irrigation water or rain water is allowed to stagnate on the land or leaves the land of the user either by percolation or surface runnage and comes to rest in surface pools on land belonging to another.

I believe that the Legislature has constituted such conditions to be a public nuisance susceptible of abatement by the mosquito abatement districts.

In addition, I believe that the burden of abating these public nuisances is on the owner or possessor of the land on which the nuisance is situated, this being so without regard to whether such person was initially responsible for causing the phenomena to occur. The reason for this is that in protecting the public health, the Legislature has seen fit to fix responsibility on a definite and easily ascertainable person. The Legislature did this in order to relieve the mosquito abatement district of the frequently almost insurmountable problem of tracing the cause of conditions which are most dangerous to the public health and which must be abated with alacrity.

However, this apparent inequality between cause and having a thing occur on your own land does not really constitute an extremely severe hardship on the owner or the possessor who has to abate, or is required to abate, and the reason for this is that he has a remedy at law by bringing an action against the individual who, in fact, caused his area to become polluted, shall I say, or a breeding place for mosquitoes.

In another connection our office has recently ruled that water which has picked up harmful materials from inoperative or abandoning mining operations and drains into surface streams or lakes constitutes a public nuisance. On the other hand, this is a public nuisance under the Water Pollution Control Act, which has its own definition of what is a nuisance, what is a contamination, and what is a pollution of waters.

Since these draining waters containing harmful substances were causing pollution, they were ruled to be a public nuisance subject to regulation of the Regional Water Pollution Control Board. In addition, we held that the offenders here were the persons having legal control of the property from which such harmful drainage arose.

Now that may sound a little bit different than what you are dealing with because of the fact that here we are dealing with the actual source of the water itself. You gentlemen are dealing with the source of the mosquito breeding place as distinguished from the source of the water which causes the place to become a breeding place.

In other words, if the fee of the land under the Water Pollution Control Board Act, where the mine was located, was owned separately from the mineral rights, both the owner of the mineral rights in whose tunnels and shafts were dumped the water which picked up the material tainted and the owner of the fee from whose land the tainted water was produced were responsible for the nuisances thereby created.

The reasoning here was that by failing to take action within their legal power to halt the water drainage or to render it harmless by treatment before it departed from their property, both were responsible for the resulting discharge.

Now, remarkably enough, when I began the research to determine what cases had been decided with respect to breeding places, I found very few. Few cases have gone up into the appellate courts. You can look far and wide for them, this indicates to me that the gentlemen who have been abating mosquito breeding places have done so with a very apt and psychological approach. As Assistant Attorney General, my duty is to stop litigation equally as much as it is to bring litigation. As mosquito abatement enforcement officers, it is your duty to carry on your public relations in the same way. In other words, by education, by persuasion, by your own personal efforts, by showing where and how mosquito abatement is of value to the owner of the place and property where the wrongful water or breeding place exists is something that will be of economical value to the owner.

Litigation is for the purpose of determining and deciding disputes which cannot otherwise be decided. It is frequently lengthy; it would not under any circumstances take care of the problems with which you gentlemen are confronted. So it appears to me that because of the lack of cases—and I know that many cases are tried in the lower courts which are never appealed—those who have this problem have done a terrific educational job and have seen to it that as little litigation as possible has been carried on, and yet the problem is being coped with.

Let us go back to one or two cases that do exist. I found no California cases reported which discussed this question of the abatement of breeding places for mosquitoes. That may come as somewhat of a shock to you; it certainly did to me. There are cases in other jurisdictions, one of which held that a junkman who allowed tin cans to collect water so as to become a breeding place for mosquitoes was guilty of creating a public nuisance and, further, the junkman could be required to construct a roof over his junkyard and piles of junk so as to prevent water from getting into the containers.

Furthermore—and this is an extremely interesting case—it has been held that a public light and power corporation, in constructing its dams, had to choose its site with due regard to the possibility of mosquito breeding, and that where it maintained stagnant ponds or polluted pools of water endangering the health of the surrounding communities, it was guilty of maintaining a nuisance.

On this point the court said—and listen very carefully to this:

> The public health is more important than the public convenience. If the energy of a stream cannot be converted into electric current without damming the water in such a manner as to allow it to become stagnant and polluted so as to make it a menace to life and health, the enterprise is not permissible.

Now, perhaps I am going to be a bit legalistic with you on that score, but this clearly points up the fact of public necessity which controls the question of what is and what is not a public nuisance. It is akin to, for instance, the greater public use that must be determined should you have a situation arise where you have a county that wants to condemn property for a public purpose and it is already dedicated to a public use, such as a public hospital.

Is a public hospital a greater public use than is a public building? The courts have almost universally held that public health is the greatest public use of properties when necessary to maintain the public health.

I have gone on long enough about water and I think perhaps I have gone over my time; but I did want to say one or two more things, if I may, Mr. Chairman, that have to do with a problem that I discussed with Mr. Peters, Mr. Mulhern and Mr. Smith.

The problem has to do with discretion. I vaguely touched upon discretion when I said you have all of this power. You must use that power in order to carry out your duties. But you are clothed with a great amount of discretion also. The mere fact that a statute says that you shall do this or shall do that or shall do the other does not necessarily mean that you immediately just begin litigation, that you immediately must abate, or that you immediately must do any other thing. Discretion of a public official or discretion of a private businessman is something which is guarded with great strength, for without discretion we would end up in perhaps almost an anarchy; we would end up in poor government, and we would end up with so much litigation and so many problems wherein injustices would be done that perhaps we would wish for another type of government.

Discretion is one of those things that can only be described as judgment. There is a great deal of difference in men; there is a great deal of difference in administrators; there is a great deal of difference in lawyers, in doctors, and in all other fields. But the one you invariably pick out, the one who invariably succeeds is the man with discretion who is able to use good judgment, and it is the man with good judgment who ends up with a good administration.

To be ridiculous, obviously it would be—well, I hate to use the word because maybe I would be incorrect—but it would be asinine for you to enter on public property in the city and say to John Doe who has a five inch puddle, "Abate that right now. It is a possible breeding place for mosquitoes."

On the other hand, it would be necessary that you do something if, in fact, mosquitoes were breeding and you knew they were breeding there and the gentleman refused to abate an area where there could be a genuine breeding place. So discretion has to do with when and how and with what means and methods you are going to solve your problem.

Let me take a situation which is a little bit closer to the description of discretion insofar as we lawyers are concerned, insofar as district attorneys are concerned.

Perhaps one of the most difficult cases for a district attorney to determine as to prosecution is a situation involving an alleged molestation of a girl child by a male. The reason behind that is that such cases are frequently used for blackmail, and gentlemen, I say not "infrequently," but "frequently." Therefore, the district attorney must evaluate and judge whether, in fact, this child is telling the truth—this child of four, this child of eight, this child of twelve—or whether this child is imagining things, whether this mother is a distraught individual who thinks that every man who looks at her child is going to attack her child or whether she is a broad-minded, reasonable person. And he must make this determination on the basis of the evidence which is presented to him and whatever further investigation he might make because, likewise, sex crimes are the easiest to charge, the most difficult to prove, and the most difficult to defend.

So what does a district attorney do? He exercises discretion. He says, "This is something that I will not touch because I do not believe this child's story. I do not believe that this thing occurred."

Or he may, like a lot of district attorneys do, say, "Well, this is something beyond me. Take it to the grand jury."

What do you gentlemen do? Who is your grand jury? You are acting in the position of district attorney insofar as bringing prosecutions is concerned. Your grand jury, of course, is to go to your attorney and to your board for determination of situations that may arise which are beyond you. On the other hand, I am sure there are no situations which arise which are beyond any of you gentlemen.

I only wish I had more time to chat with you about other areas that were of interest and concern, but with this I wish to thank you and close.

(Applause)

President Murray: Thank you, Mr. Dietz, for that very important information for us and your very sound advice.

You may have noticed in reading the agenda today that tomorrow we do have some discussion of the legal aspects and the use of discretion in our source reduction program.

Time is moving on, so we should move on to the next speaker. I hope we don't give you the impression that we have cut you down too much, Mr. Dooley. You go ahead and talk as long as you wish.

Mr. Thomas Dooley of the California Legislative Auditor's office will present, as written in the outline, The Interest of the State Legislature in Mosquito Control as viewed by a representative of the State Legislative Auditor's office.

Mr. Dooley.

THE INTEREST OF THE STATE LEGISLATURE IN MOSQUITO CONTROL

By

THOMAS DOOLEY

Administrative Analyst
Office of the Legislative Auditor

Mr. President, Dr. Merrill, members of the Association, and guests, I wish to thank you on behalf of Mr. A. Alan Post, Legislative Auditor, for inviting a representative from our office to come here and speak with you on the subject of The Interest of the State Legislature in Mosquito Control. I would like to mention that the invitation was conveyed to Mr. Post by Senator J. Howard Williams, of Tulare County.

First of all, I would like to describe to you briefly what the function of the Legislative Auditor is and our relationship with the Legislature.

In 1941, both Houses of the Legislature adopted a concurrent resolution establishing a joint Legislative Budget Committee, giving it the authority to appoint a Legislative Auditor and to provide for such other technical and clerical employees as were necessary. The Committee was reaffirmed by each succeeding general session until 1951. In that year, Chapter 1667, Statutes of 1951, was passed by the Legislature and signed by the Governor providing a statutory basis for the joint Legislative Budget Committee and the Legislative Auditor.

The main duties of the Auditor are the following:

1. To ascertain facts and make recommendations concerning the State's budget revenues, expenditures, and organization;

2. To assist the Senate Finance Committee and the Assembly Ways and Means Committee in considering the budget and all bills carrying express or implied appropriations and all legislation affecting State departments and their efficiency, and to appear before and assist any other legislative committee upon instruction by the Joint Legislative Budget Committee.

These are the major responsibilities of the office; one other function that has grown in recent years is that of servicing interim committees on a contractual basis. This consists of providing technical personnel for special studies that might be undertaken by the committees.

It is apparent, then, from what I have said that our function is advisory in relation to the Legislature. We advise on all budgetary matters and the Legislature may or may not take the advice.

Before I discuss the relationship of the State with mosquito control and the mosquito subvention, I would like to comment briefly on the background of state subventions in general.

Although the Federal Government has been giving grants-in-aid to the States and in turn to local jurisdictions for many years, it has been comparatively recent that the State has granted money to local communities for specific purposes. This is particularly true in public health.

There are two types of subventions to local jurisdictions; they are the grants-in-aid to the States and in turn to local jurisdictions for many years, it has been comparatively recent that the State has granted money to local communities for specific purposes. This is particularly true in public health.

There are two types of subventions to local jurisdictions; they are the grant-in-aid subvention and the shared-tax subvention. Grants-in-aid are distributed by appropriation for particular local functions in which there is a state interest. The amount distributed is largely independent of the yield of any particular tax, or of the local jurisdiction in which the revenues are collected. Conversely, the shared tax, including the so-called "in lieu" tax, is state imposed and is shared with local governments according to a fixed percentage of the yield in, or produced by, the local units.

The amount distributed is entirely dependent upon such yield. These revenues are frequently earmarked for specific functions. The auto "in lieu" tax is an example of this. However, shared taxes are sometimes used where there are constitutional limitations which restrict local governments from taxing certain local matters. An example in California is that of liquor where all the tax on liquor is returned to the local jurisdiction although collected by the State.

Some of the reasons for the growth of state aid to local jurisdictions are the following:

1. An attempt on the part of the State to assist local governments in meeting part of their increased costs of operation. It has long been recognized that the State has a responsibility in guaranteeing that certain functions of local governments are carried out adequately in order to meet the needs of the population.

2. The recognition that local revenues are inadequate to carry out all local functions. Since World War II local government revenues have not increased in proportion to needs. A growing share of the national income has been going to Federal and State governments. The local tax base, largely restricted to property values, economic decay in parts of metropolitan areas, and rapid growth of exemptions.

The particular state subvention items that all of you are familiar with is that of the grant-in-aid to local mosquito abatement districts and other public agencies for the control of mosquitoes and gnats.

In 1946, the return to California of many service men from throughout the world, infected with malaria and other potential mosquito borne diseases, posed a health hazard to the people of this State. At that time there was sufficient concern over the problem that the Department of Public Health and many local abatement districts urged the State Legislature to do something in the way of assistance. This assistance was granted in the form of a subvention to the local districts.

The subvention was inaugurated during the 1947 general session when the Legislature added Chapter 5.5 of Division 3 of the Health and Safety Code. This chapter on mosquito control was amended by Chapter 695, Statutes of 1949 to include the control of gnats. The Code provides that the State Department of Public Health may enter into cooperative agreements with any local district or public agency engaged in the control of mosquitoes or gnats or both, under conditions to be prescribed by the State Board of Public Health. Such agreements may provide for financial assistance by the State, but the State total contribution shall not exceed 50 percent of the entire cost of the proposed activity.

The legislation carried with it an appropriation of $400,000 that was to be distributed to the local agencies by means of an administrative formula. I shall not attempt to go into the formula as I am sure that you are all more familiar with it than I am. The $400,000 was started during the 1946-47 fiscal year and has been kept at that level for nine of the ten years that it has existed. During 1953-54 the basic amount was augmented by statute by $300,000 in order to combat the encephalitis epidemic of that year. In the year previous to this, 1952-53, $250,000 was allocated from the State emergency fund through the Bureau of Vector Control to combat an encephalitis epidemic. Approximately one-half, or $125,000, went to the local districts.

If we ask ourselves what is the primary interest of the State in mosquito control, the answer must be that the State's interest is from a public health point of view. It is apparent from the original legislation that was passed in 1947 that the Legislature intended that the State participate with local government in mosquito abatement in areas of the State which have a high proportion of mosquito-borne diseases, including malaria and encephalitis. The Legislature also intended that the State participate in studies with the local jurisdictions concerning disease-bearing mosquitoes.

Another indication of the increased State interest was the establishment of the Bureau of Vector Control in 1947 within the Department of Public Health. The Department was active for many years prior to that in mosquito control work, especially in relation to mosquito transmitted diseases, but with the establishment of the Bureau, the Department accepted the broader responsibilities of maintaining a current analysis of the vector-borne diseases as well as to conduct endemic surveys, operational investigations, control demonstrations, and emergency control programs in conformance with the rapidly expanding knowledge of mosquito and other vector-borne diseases in California.

In conformance with the policy set by the Legislature in previous years, we feel the following responsibilities still hold:

The responsibility for actual operational control of vectors rests with the local community.

1. Maintain surveillance of vector populations.
2. Provide scientific and technical information and assistance to local jurisdictions so that they may efficiently and economically carry out these responsibilities; and
3. Conduct and coordinate emergency operations to meet epidemics and disasters such as were experienced in 1952 and 1953.

These State responsibilities have, of course, been assumed by the Department of Public Health. One question which arises is the extent to which it is proper for the State, through the Bureau, to concern itself with control of non-vector species of mosquitoes. There is no simple solution to this problem. It is complicated by the fact that the public does not distinguish between vector and non-vector species: the non-vectors may cause infections requiring medical treatment; the two types commonly breed in the same source and require similar techniques of control

Now, I would like to mention two proposals that have been made, one that Dr. Merrill this morning alluded to, and I would like to read the actual wordage as it has been subsequently changed in the Budget Act. This is the bill that the Legislature will consider, and it contains all the items that are in the huge budget itself of the Governor. There is one sentence in here that I think would be interesting in relation to this four hundred thousand dollars:

> Be it further provided that not more than seventy-five hundred dollars may be allocated to a single mosquito abatement district unless said district shall first appropriate a sum of money not less than represented by a rate of fifteen cents on each one hundred dollars of assessed valuation of the taxable property in the mosquito abatement district.

This is just a little different than the wording that Dr. Merrill had mentioned, and he took it from the budget where this seventy-five hundred dollar amount wasn't set. It simply says in the budget that no district shall get anything beyond the basic allotment if they are not up to the fifteen cent limit but that can still get up to seventy-five hundred dollars with the Budget Act, and I believe there are only two or three districts that will be restricted on the basis of what they have been receiving in the past from this wordage in the budget bill.

Of course, this hasn't been adopted; it has merely been introduced and has to be acted upon yet.

Another interesting point of discussing that, so far as I know, hasn't come in on bills of legislation yet but which would greatly affect all of you is the fact that some senator has expressed concern as a result of what several of the boards of supervisors in the state have been saying about the fact that the boards have no control over any of the taxes of all the various districts within the county. Now, exactly how they would ever get any type of control is something I know nothing of. But their concern is that all this goes out every year to the tax payer as a total tax that they have to pay, and they get the brunt of it when the taxes keep going up. There has been some concern, and they would like to have more knowledge of what is going on.

Getting back to responsibility again, we feel – and when I say "we" I am again speaking from a staff point of view – when we interpret the laws the Legislature has adopted, that the state is adequately carrying out its responsibility through the subvention item, the present four hundred thousand dollar subvention item, and

the maintenance of the Bureau of Vector Control in the Department of Public Health.

It has been suggested that the subvention funds be restricted to permanent source reduction measures by the local representatives, such as is being done presently in Florida. However, as a practical matter, this approach may not be too sound and we are certainly not suggesting it.

The trend has been in the state recently to go more toward this way, as I understand it. Now, if the trend fails to continue there may be the necessity to restrict the subvention to this type of activity. But, first of all, I am sure it would take a considerable amount of study and research on the part of the Bureau of Vector Control.

In relation to the Bureau, Dr. Merrill mentioned this morning two positions that they are requesting to the Legislature, and our analysis and our recommendations will not be out for two weeks. I had hoped that I would be able to comment upon them, but as I said, our analysis hasn't come out yet and Mr. Post has asked me not to say anything about it, except for the fact that we do believe that particularly the one on the water control has a tremendous amount of merit in it; and that can be seen, I am sure, from the talk on water this morning by the fact that the land under irrigation potentially will increase two fold by the time the complete water plan is adopted.

Now, if there are any questions I would like to try to answer them.

(Applause)

President Murray: Thank you, Mr. Dooley.

I wish we had time to discuss some of these items more thoroughly, but we always seem to run out of time.

Howard Greenfield has an announcement he would like to make.

Mr. Greenfield: I would just like to say to the group that in preparation for our social events this evening it is necessary that your wives be registered as a guest at the registration desk, so if you would pass that information on we would appreciate it very greatly.

President Murray: They don't have to pay for it?

Mr. Greenfield: There is no fee, no. It is merely a courtesy so that they may attend the social functions this evening.

President Murray: Is there a luncheon arranged for noon?

Mr. Greenfield: As I understand, they are setting up for a number of people in here and the overflow is to go down to the main dining room.

President Murray: If there is nothing else to be brought up this morning, we meet once again at 1:30.

(Whereupon, at 12:30 p.m. on Monday, January 21, 1957, a recess was taken until 1:30 p.m., this day.)

MONDAY AFTERNOON SESSION

January 21, 1957

The afternoon session of the Twenty-Fifth Annual Conference of the California Mosquito Control Association, Inc., met at the De Anza Hotel, San Jose, California, and was called to order at 1:30 o'clock p.m., President W. Donald Murray, Visalia, California, presiding.

President Murray: We are not all here, but I believe we shall have to begin.

Our concept of the program was that this morning was to have been, shall we say, general type papers. This afternoon we are going to get somewhat more specific on these papers, and we are also going to review the country. As you know, we have representatives from California, Oregon, Utah, New Jersey, Florida, and other parts. All of those are not represented on the program. But we have Bob Vannote, Secretary of the Morris County Mosquito Extermination Commission in New Jersey. In New Jersey, the term used instead of "Mosquito Abatement District" is "Mosquito Extermination Commission."

We in California, of course, being very conservative in everything we say, could not use "extermination." That term would be inappropriate.

First on this session of Highlights of Mosquito Control Across the Nation, we have The Reappraisal of Mosquito Control Methods for Use in New Jersey by Bob Vannote.

THE RE-EVALUATION OF MOSQUITO CONTROL METHODS IN MORRIS COUNTY, NEW JERSEY

ROBERT L. VANNOTE
Secretary

Morris County Mosquito Extermination Commission
Morris Plains, New Jersey

Every so often it is supposed to be wise to stop, review the past, size up the future, adjust your sights and start going again.

So it might be with our mosquito control program in New Jersey, particularly that small part known as Morris County, from whence I hail.

Although I bring you the best wishes of all New Jersey mosquito control workers for an informative and successful meeting, I do not represent the State Association and speak for no one but myself.

New Jersey mosquito control has come a long way since the turn of the century when Dr. John Smith set forth the biology and life histories of the mosquitoes native to our state. Local control projects got underway soon thereafter; however, it was in 1912 that State Legislation established County Commissions and paved the way for intensive operations.

Unfortunately, no one knew exactly how to proceed. Consequently, a State Association of Commissioners was organized and under the leadership of Dr. Thomas J. Headlee, State Entomologist of the Agricultural Experiment Station, discussions took place and plans were formed to get the program underway on some scientific basis.

Mosquito control in New Jersey has progressed through three periods of development; namely, the 1912-25 period devoted to the development of basic techniques, the 1926-42 period of refinement of control

methods and finally, the post-war period of test and indecision. We now stand at the threshold of a new period of consolidation and mechanic advancement .

Prior to 1942 our control programs were standardized under the Headlee System which embraced tight coordination of effort under a central agency; the accent on permanent control works such as drainage with temporary controls held to the minimum level of public acceptance; plus the usual tools such as public relations, cooperative projects, sampling, etc. A State Association consisting of Commissioner or Trustee membership served as the sounding board or voice of New Jersey mosquito control. The Agricultural Experiment Station and the Association of Superintendents or Managers cleared technical problems and plotted the state course of action on the control level.

Under this system mosquito control proved its worth, weathered the depression of 1930-36, became recognized as an essential public service and has steadily advanced in public merit.

The post-war period introduced several new theories resulting in the stimulation of temporary controls at the expense of the more permanent systems. The use of additives to the basic mosquito larvicides, such as DDT, cut rates of application from 30 - 40 gallons per acre to 3 - 5 revolutionizing the methods of application. The use of fogs and mists made community-wide adult control a possibility and the development of pre-hatch controls offered a possible solution to flood plane mosquito control without extensive drainage programs.

Naturally, alert mosquito control operators were quick to test these new methods and adjust them to their individual problems. Now, after ten years of trial, we pause to gauge our advance and plan for the future.

Without question, the public demand for better and more effective mosquito control is nation-wide. Although it is true that new control agencies, starting operations in areas where the annoyance is severe, succeed with a general reduction of the pest, the older agencies are sometimes hard pressed to establish controls consistent with public demand. As this demand is made known to the appropriating agencies, monies for mosquito control become easier to secure. At no time, since the turn of the century, have mosquito control funds been so available from local sources.

Predicated on these observations and in light of the post-war developments in control methods, how does the New Jersey program of the future shape up?

It is our general conclusion that the Headlee System is still the most effective, long-term basis of mosquito control. The permanent control of major breeding areas must proceed with temporary controls providing the reinforcement necessary to satisfy local public requirements.

The use of pre-hatch controls has become an essential part of the temporary control program for application may be made prior to the intensive breeding season and the long lasting results release essential manpower for permanent operations. Fogs and mists have become emergency tools to be used only in those cases where adverse weather or tidal conditions temporarily upset the balance of the permanent controls. The foreseeable trend of this approach is to sell this service, on a community-wide basis, as a premium operation for which the individual communities pay the costs thus releasing the full control appropriations for the basic work. Within this adult control program the question of the hazard of partly burned petroleum vapors is bound to receive serious attention.

The question of mosquito resistance to chemical additives to mosquito larvicides is not critical in New Jersey. DDT continues to remain effective when used in its proper place. The use of malathion and dieldren has been experimental, only on heavily polluted waters. It is forecast that the New Jersey operators will swing back to the basic mosquito oils and pyrethrum larvicides rather than placing their trust in constantly changing insecticide formulations when resistance to DDT develops.

Therefore, in conclusion it may be stated that in New Jersey, with its open salt marshes, its highly polluted diked marshes, its vast upland and flood plane problems, that the swing is back to the basic, fundamental Headlee System, taking with it pre-hatch controls and adult control only as long as they remain safely effective. It is further forecast that the next ten years will see a great development in mechanical drainage equipment to overcome the high cost and lowering efficiency of hand labor for drainage purposes.

President Murray: Thank you very much. I would say that in general your concepts are quite similar to ours, followed by modifications based on the local situation.

Next we have an old friend of the CMCA. He has been to every meeting that I have ever attended, and I think he came to some before me. Don Rees, Chairman of the Division of Biological Sciences, University of Utah, Salt Lake City, will present some information on the Cooperative Measures Applied in Mosquito Control in Utah During 1956.

Dr. Rees.

COOPERATIVE MEASURES APPLIED IN MOSQUITO ABATEMENT IN UTAH DURING 1956

DON M. REES, Ph.D., *Chairman*
Division of Biological Sciences
Department of Zoology & Entomology
University of Utah, Salt Lake City, Utah

Cooperation is defined as, "collective action for mutual profit or common benefit." Not infrequently programs that start out as cooperative end according to the old Latin axiom with each participant saying in effect to the others, "I have achieved my purpose; how are you doing?" Fortunately in Utah our cooperative ventures in mosquito abatement in 1956 were more unified.

In this report, I propose to name and briefly explain the major cooperative programs that were in operation in Utah during 1956, then discuss in greater detail the applied cooperative water management experiment that was applied during the year.

The Utah Mosquito Abatement Association comprises the most extensive and perhaps the most effective cooperative mosquito control effort in the state. It was organized in 1947 and on March 8th and 9th, 1957, the tenth annual conference of the association will be held

at the University of Utah in Salt Lake City. At these annual conferences an attempt has been made to solicit the aid of representatives of all of the agencies interested in this program. To date the response to invitations to participate has been most gratifying and the meetings very successful.

One of the oldest cooperative arrangements conducted in the abatement program in Utah is the arrangement made in the Field Training Program for entomologists and biologists between the Department of Zoology and Entomology at the University of Utah and the three mosquito abatement districts in Salt Lake County. This program had its beginning in 1928 when the University was requested to provide technical services for the Salt Lake City district three years after its organization in 1925. The program has been in operation since this introduction and at present graduate students in entomology at the University are encouraged to attend school for six months during the fall and winter quarters and work for an abatement district during the spring and summer quarters. This obviously is a cooperative effort mutually advantageous to the University and the mosquito abatement districts. It is a training program for entomology and biology majors, and it provides an excellent source of man power for the districts who need employees on a seasonal basis. In 1956, in addition to Jay E. Graham and Glen C. Collett, who are full time district managers and during the winter quarter are part time University students, seven other graduate students were employed by the abatement districts during the spring and summer months of 1956.

In the Box Elder Fly and Mosquito Abatement District an arrangement has been adopted in the fly control work whereby the district assesses the farmers on the more isolated farms for the major part of the costs for treating their property with insecticides for the abatement of flies. It is assumed the property owner living on these farms are largely the beneficiaries of such fly abatement work and therefore should pay for the service.

A legislative committee has been conducting a study for several years on ways and means of amending the existing Utah state law relating to mosquito abatement districts. This committee was organized by the Utah Mosquito Abatement Association and representatives of all state, county and municipal agencies interested in or involved in this program have been invited to participate. The amendments to the state law proposed by this committee and approved by the state association have been submitted to the office of the Attorney General, where they are being formulated for presentation to the current state legislature.

Close cooperation has always been maintained in Utah between the abatement districts and the governmental health services; municipal, state and federal. At present the Salt Lake City district is working on plans with the Logan Field Station of CDC, USPHS, to conduct some flight range experiments on the marsh mosquito *Aedes dorsalis*.

The arrangements of the Cooperative Drainage Committee in Salt Lake County has on previous occasions been called to your attention. This program was started in 1948 and has been in operation each year since; its successes deserve honorable mention in this report. This cooperative drainage program was established to unify the drainage systems in Salt Lake County and provide for maintenance of all drains in the system. Each year Salt Lake City Corporation through the Streets Department, Salt Lake County through the Department of Roads and Bridges and Flood Control and the Salt Lake City Mosquito Abatement District, contributes $10,000.00 each to this fund, a total of $30,000. The plans for expending these funds are prepared and approved by a committee representing these agencies. The direct supervision of the work is assigned largely to the manager of the mosquito abatement district. The work to date has been very successful and satisfactory to all of the agencies participating. The South Salt Lake County and the Magna Mosquito Abatement District have now joined in this cooperative effort and are directing drainage work in these districts as part of this coordinated county drainage plan.

DeLore Nichols, when he was County Agricultural Agent in Davis County, and Secretary of the Board of Trustees of the Davis County Mosquito Abatement District, organized in 1954 the Davis County Correlation Committee. Representatives of all agencies engaged in water management in the county were invited to participate. Sub-committees were organized to study different aspects of the water management problem in Davis County and make a report with recommendations to the committee as a whole. The response from all agencies was excellent. The program is progressing with encouraging results.

The cooperative water management experiment previously mentioned in this report was instigated in October 1955 when representatives of the Salt Lake City Mosquito Abatement District, University of Utah, Logan Field Station and the Utah Fish and Game Department agreed to study the water management problems on the marshes north and west of the city on the shores of the Great Salt Lake. This area is the most extensive and prolific producer of *Aedes dorsalis* in the district. It is also an important waterfowl marsh. In the study an attempt was to be made to determine how the water could be managed on these marshes to provide maximum benefits for waterfowl and produce the fewest mosquitoes. This was to be followed by the application of this information on suitable test areas on the marshes where the study was conducted.

At the first meeting it was agreed to select as study and experimental plots one governmental unit and one privately owned and operated waterfowl marsh. As the governmental unit, Farmington Bay Bird Refuge, owned and operated by the State Fish and Game Department, was selected. Later the officers of the Lake Front Fur and Reclamation Company, a privately owned company, agreed to work with this committee using their property as a study area. These preliminary plans were reported by me in the 1956 Utah Mosquito Abatement meetings.

During the year members of the committee repeatedly visited both of the selected areas to obtain information on existing conditions. Later efforts were concentrated on the Lake Front properties, as this company planned to do some improvement work on 2400 acres of their property during the summer. As a result of these studies the committee recommended certain repairs of existing dikes and spill boxes and the construction of a considerable number of new dikes and spill boxes on the Lake Front properties in order to

confine available water on the property within definite boundaries and maintain it at a constant level.

Robert A. Wilkins, representing the Salt Lake City Mosquito Abatement District, did the engineering work after plans were prepared and accepted. The main dikes and spillways were all installed with a dragline by a construction company according to specifications and under Mr. Wilkins' supervision. Some of the small bordering dikes were constructed with the mosquito abatement district's D-4 caterpillar tractor. Approximately 8000 linear feet of major dike were constructed and eight large spill boxes or wiers were installed in these dikes. An additional 13,000 linear feet of smaller dikes were constructed with the blade on the caterpillar tractor.

As a result of this work, the water on most of this property can now be readily controlled or managed. The results of this attempt at better water management on this property has not been determined, as the work was not completed until late in the season but it undoubtedly will greatly reduce mosquito production and improve the waterfowl habitat.

During the coming season we plan to continue this program and concentrate more on the Farmington Bay Bird Refuge. If successful we hope to use these areas to help introduce better water management practices to adjacent areas.

Reference Cited

Rees, Don M., 1956. Water management for mosquito abatement on the waterfowl marshes in Utah near the Great Salt Lake. Abst. and Proc. Ninth Ann. Meeting, Utah Mosq. Abate. Assoc.

President Murray: Thank you, Dr .Rees.

Now let us hear about what it is like up North. Milton H. Buehler, Technical Director, Mosquito Control Section of the City-County Health Department, Eugene, Oregon, will tell us about Mosquito Control Developments in the State of Oregon.

Milt Buehler was down in California early last summer looking over some of our problems. I think he went back instilled with the idea that we do have some mosquitoes down here. We hope we gave him some guidance.

Milt.

MOSQUITO CONTROL ACTIVITIES IN THE STATE OF OREGON DURING 1956

M. H. Buehler

Technical Director
Mosquito Control Section
Lane County Health Department
Eugene, Oregon

Generally speaking, mosquito control in the state of Oregon progressed satisfactorily during 1956. Most of the organized mosquito programs had a more difficult season this year than was experienced last year. In all areas of the state the mosquito control season was several weeks longer than experienced in previous years. In Lane County the general situation was made worse by the fact that extreme resistance to DDT was encountered.

DOUGLAS COUNTY

Perhaps the most important development occurred in Douglas County where an intensive study was made on methods of controlling mosquitoes in log ponds. The study is being conducted as a cooperative effort by Douglas County, the Vector Control Section of the Oregon State Board of Health, and the U. S. Public Health Service. A series of complicated and exacting tests were made on various types of log ponds using various methods of application and insecticidal materials. Biological studies were made relative to the animal and plant life present. Chemical analyses were made on waters from several ponds at periodical intervals throughout the season. The findings of this study have not been released at the present time; however, they should be out some time in March. It is hoped that this study will give us enough information to direct more intensified research toward solving the log pond mosquito problem.

VECTOR CONTROL SECTION OF THE STATE BOARD OF HEALTH

The Vector Control Section of the Oregon State Board of Health has been very active gathering additional information on mosquito species prevalence and density throughout various sections of the state. Several surveys have also been made to determine the mosquito problem in areas where future programs are contemplated. Since many of the areas surveyed have quite severe mosquito problems, it is hoped that organized programs will be started in the not too far distant future.

An encephalitis survey was made in Baker, Union, and Malheur Counties in cooperation with the U. S. Public Health Service. Approximately 700 mosquitoes were collected for virus studies as well as 178 blood samples taken from horses, chickens, and humans in the area.

While making routine mosquito collections good specimens of both adults and larvae are being saved to start a permanent mosquito collection. It is contemplated that, at some future date, matched sets of specimens will be available for all sections of the state.

The Vector Control Section has also started a joint program with the State Park Service to control mosquitoes in some of the recreational parks along the coast.

SHORT COURSE

A three day short course on mosquito control was held at the Oregon State College during the last week of February, 1956. The course was conducted jointly by the Oregon State Board of Health, Entomology Department of Oregon State College, the U.S.D.A. Field Station at Corvallis, and representatives from the U. S. Public Health Service. The course included: identification of mosquitoes and other aquatic insects; mosquito survey methods; effectiveness and use of insecticides; and mosquito control methods. All of the organized programs in the state had representatives attending his short course. Plans are under way for another short course to be held some time in March of this year.

PROPOSED LEGISLATION

The development of resistance to DDT in Lane County and the resulting increase in cost of mosquito control by using more expensive chemical insecticides has focused our attention to the fact that it is imperative that greater emphasis be placed on source reduction. Furthermore, the property owner must assume some responsibilities for the production of mosquitoes on his property if mosquito abatement activities are to have any degree of success. Upon reviewing existing state laws pertaining to mosquito control, it was found that they were unrealistic with respect to the amount of funds that could be provided and the control measures that could be undertaken. Consequently, a more favorable law has been submitted to the legislature for enactment. The new law provides for the control of all types of vectors including mosquitoes: authorizes the formation of districts; authorizes the district to levy a special tax; requires the property owner to assume responsibility for all unnecessary production of vectors; authorizes the district to perform the work necessary when the property owner refuses to do so, the cost of such work then becomes a lien against the property; provides for annexation of territory or consolidation with other districts. The law is quite similar in many respects to the California mosquito abatement law.

President Murray: Thank you very much, Milt, for telling us a little bit about Oregon.

Now we come back to California. Harold Gray and Russ Fontaine have been doing some investigative work on malaria in California since the beginning of time, I believe. (Laughter)

Harold Gray, Past President of the CMCA, Past President of the AMCA, Honorary Member of both of those organizations, and many other titles, will present a little bit on his studies on malaria in California.

Harold.

Mr. Gray: This morning you had the pleasure of listening to one of the two really great Health Officers the State of California has been fortunate in having. I would class Malcolm Merrill right along with Wilbur A. Sawyer, who was Secretary of the State Board of Health from about 1914 until 1916. But unfortunately Dr. Merrill, in saying a few things about me this morning, overlooked the fact that for many years I walked in the shadow of a very great and a very wonderful man, Bill Herms, and what little I have been able to accomplish must be considered primarily as a reflection of what that man was.

One of the things that Bill interested us in from the very beginning was what has happened in the past in California. We were trying to evaluate why California was in the shape it was in so far as malaria was concerned, when we first started mosquito control work in 1910. So all through these years I have had a considerable amount of interest in the subject of the history of malaria in California.

At the second meeting of this Association in 1931 Mr. G. P. Jones, who was then with the State Board of Health, wrote a paper on the history of malaria in California, and Jones went as far as he could with the material apparently available at that particular time. In recent years we have obtained a lot more knowledge, and especially in 1955. Then a gentleman by the name of Dr. Cook in the the Entomology Department of the University of California went back over some very old records and discovered a lot of heretofore neglected material. In the time that is allotted to me I will attempt to give you a thumbnail sketch of what has happened.

EDITOR'S NOTE: At the conference Mr. Gray presented an extemporaneous summary of "A history of malaria in California"; however, this document is herewith printed in its entirety. Some reprints of this paper are being made available through the California Mosquito Control Association.

A HISTORY OF MALARIA IN CALIFORNIA

HAROLD FARNSWORTH GRAY *and* RUSSEL E. FONTAINE

Preface

In 1931, Guy P. Jones[1] wrote a brief history of malaria in California. Since that time our knowledge of the disease in this state has been greatly extended. For the benefit of others we have deemed it advisable to prepare a more complete history. We have searched many old records with reasonable diligence, and found numerous items which appear to have escaped previous attention. There are letters and documents in the period 1810 to 1850 which we have not seen, which may add some details, but it is not probable that these will materially change the general picture presented herein.

We have not presented in this paper a large number of widely scattered historical references which we have consulted. Lists of these have been prepared and will be deposited with the Library of the School of Public Health, University of California, at Berkeley, and with the State Department of Public Health.

Introduction

There seems to be little doubt that malaria was not an indigenous disease in California. The evidence on this point, while of the negative type, is nevertheless reasonably definite and convincing. It is most improbable that this disease could have existed among the aboriginal residents of what Stewart Edward White called "the lovely land", prior to its apparent introduction about 1830[2], without there having been some indication of its prevalence recorded by the Spanish missions along the coast, or by some of the early explorers. While many of the early trappers and explorers were illiterate and left no written records, nevertheless Lewis and Clark, and Jedediah Smith, were literate. The remaining fragments of Smith's journals, and his letters, do not indicate the presence of any disease similar to malaria encountered on his trip in the San Joaquin Valley in 1827, and in the Sacramento Valley in 1828. The central valley of the state had been explored in parts by Fages in 1772, by the Garce's in 1776, by Moraga and Zalvidea in 1806, and by Father Jose Viader in 1810. If malaria had been then present, it is probable that some members of these exploring parties would have been infected, and that some note of

the disease would have appeared in the records of the missions or pueblos.

As late as 1840 John Bidwell, then in Missouri, wrote that Antonine Robideaux described California as a beautiful land, with no malaria, saying that only one man had ever had a chill there, which was so unusual that people traveled many miles to see him shake. However, Robideaux must have been referring to the southern and coastal areas of the state, where malaria has never been endemic, and not to the central valley, which was at that time relatively unknown except to a few trappers and explorers.

The history of malaria in California is primarily the history of the disease in the great central valley and its adjacent foothills. It appears to have been introduced in 1830 or 1831 by fur brigades from Oregon, and in 1833 had become epidemic among the Indians, with such severity that many areas were practically depopulated. As the Anglo-Americans entered and began to settle the valley, it attacked them also. With the "gold rush" of 1849 and later, it was epidemic in the mining camps. There appears to have followed a period of moderate to high endemicity, with frequent sharp local epidemics, until about 1880. Thereafter malaria appears to have begun a slow and general decline, more noticeable in the San Joaquin Valley. This decline was interrupted locally with the introduction of new irrigation systems, or by certain mining operations, as for example at Cherokee in Butte County.

After about 1920 the disease began a comparatively rapid decline and, except for a few small outbreaks, disappeared as an endemic disease in the state. This decline has occurred in the presence of large numbers of one of the effective vectors *(Anopheles freeborni)* in the rice growing areas of the state.

While we may doubt that malaria will become endemic in the state again, it can and probably will appear from time to time in limited epidemics under fortuitous juxtapositions of carrier, vector, and an unprotected population. A review of the history of the disease in this state therefore can be of somewhat more than historical value to the present and future public health and mosquito abatement personnel in California.

The Land and the People

California is not one area, but several areas with wide divergences in characteristics. The usual tourist to Southern California sees little of the state, and has slight idea of its great variations in climate and topography, and even less idea of its remarkable beauty. To the east of the main cordillera of the Sierra Nevada range and its southern extensions in the Tehachapi and San Bernardino Ranges the land is desert or semi-desert. Along the coast west of the San Bernardino Mountains in the southern part of the state is an area with a relatively cool climate tempered with breezes and fogs from the ocean, and with a low annual rainfall. This cool coastal climate continues northerly to the Oregon border, in the area of the Coast Range and its valleys draining generally westerly to the ocean. At the northern end of this section heavy winter rains are common. In general in this region the sustained daily temperatures are not sufficiently high to permit the effective development of the malaria *plasmodium* in the vector mosquitoes.

The Coast Range and the Sierra Nevada Range unite at Mt. Shasta, about 40 miles south of the Oregon border. North of Mt. Shasta is an area of elevated valleys with cold winters and warm summers, in which malaria has occasionally been present, and easterly to the Nevada state line are the lava beds and high plateaus, cold in winter and with moderate to warm summers.

Between the Sierra Nevada range on the east and the Coast Range on the west lies the incomparable central valley, a region of generally level land about 430 miles long from Redding at the north to the foothills of the Tehachapi Mountains at the south, and with a general width at from 60 to 80 miles. The valley is drained by two main rivers, the Sacramento from the north and the San Joaquin from the south, both discharging into the ocean through San Francisco Bay. Below about Hanford, the delta of the Kings River diverts the flow of the Kings and Kern Rivers southerly into a basin which a century or more ago was an extensive swamp in winter. At present the great demand for irrigation water has largely dried up this area. Tulare Lake and Buena Vista Lake being the present-day residue. This valley is an area with moderate rainfall toward the south and heavy rainfall to the north The winters are usually cool but seldom below freezing, and at times in winter warm spells may occur. In summer, from late June to early October, the climate is generally hot. Daily summer temperatures are usually about 90° F., but there are spells when the maximum daytime temperature will remain well above 100° F. The nights during summer are warm, seldom falling below 65° F. The foothills areas on the east side of the valley, up to about 2500 feet elevation, are usually hot during the day, but with somewhat cooler nights than on the valley floor.

The valley floor is generally very fertile, needing only water and cultivation to produce large crops in a wide variety of temperate and semi-tropical zone types. Cotton, rice and citrus fruits are widely grown today, along with the deciduous fruits, forage crops, and animal husbandry. Between about 1860 and 1900 very extensive wheat, barley and oat crops were grown, with range cattle in many areas. Prior to the occupation by the white man the magnificent profusion and variety of wild flowers and vegetation bore testimony to the natural fertility of the land, and this lush vegetation supported a tremendous population of wild animals, deer, tule elk, rabbits, beavers, rodents, and aquatic wild fowl, as well as bears and various predators. The rivers had many fish, with salmon especially numerous. It may also be inferred that there was a very great abundance of insects, and that several species of mosquitoes were numerous in much of the valley area. There are several references in early reports to the great abundance of mosquitoes.

Jedediah Smith in his Journal makes at least one mention of numerous mosquitoes in the central valley. The best evidence as to mosquito prevalence comes from the Journal of John Work[5]. That Work and his hardship-inured trappers should comment on annoyance from mosquitoes indicates that the numbers of anthropophilus mosquitoes must have been very large indeed. For example:

On June 1, 1833, while trapping on the Sacramento River a few miles north of its confluence with the Feather River, he commented "We are much annoyed with muscatoes, they are very numerous . . ." Again on

June 4 "Muscatoes are like to devour us in every situation that is sheltered a little from the wind . . ." On June 6 in the area of the present city of Sacramento "This was a busy day, and were much annoyed during the heat of the day by sand flies and now by swarms of musquitoes which are like to devour us . . ." On June 11 while travelling along the Consumnes River, he noted "There were great numbers of sand flies during the day and now in the evening musquitoes are rising in swarms; they were so numerous last night that the people slept very little . . ." On June 20 on the Mokelumne River he reported "Excessively warm, not an air of wind, the heat is oppressive. In the morning and evening were dreadfully annoyed by musquitoes." On June 22 "The musquitoes annoyed us so much that with the heat scarcely an individual has been able to sleep these last three nights . . ." On June 30 at French Camp Creek "Scarcely a breath of wind, and we are like to be suffocated with heat and devoured in the mornings and evenings and during the night with musquitoes. . ."

Mosquitoes continued to torment the party in the same area throughout July. On August 12, while travelling up the Sacramento Valley homeward bound for Vancouver with most of his party ill with malaria he noted: "Raised camp and proceeded with the traverse of Deception Creek (Butte Creek, near Durham in Butte County). As if the heat was not sufficient we are like to be devoured with swarms of muscatoes. . ."

Of course, Work could not distinguish between *Anopheles* and other species of mosquitoes, but his remarks present fairly clear evidence that in addition to the night- biting *Aedes* (probably *dorsalis* and *vexans)* and probably the crepuscular *Culiseta incidens.* The "sand flies" he mentions may have been *Leptoconops.* Certainly these biting gnats could have been present in large numbers, for Gray personally remembers such tremendous swarms of the gnats (then called "buffalo gnats") in the area southerly from Willows in the spring of 1910 that horses and cattle were driven frantic and survey crews would have to suspend operations.

In this gentle land lived a rather sparse population of Indians of several tribes[3]. By linguistic groups, they were the Wintun on the west side of the Sacramento Valley, the Maidu and the Yana on the east side of that valley, the Miwok in the central area generally easterly from the confluence of the two main rivers, and the Yokut in the San Joaquin Valley. Kroeber estimated their populations in 1770 to have been approximately as follows: Wintun, 12,000; Maidu, 9,000; Yana, 1,500; Miwok, 9,000; and Yokut, 18,000; or a total of nearly 50,000 in an area of roughly 30,000 square miles. The population density was therefore between one and two persons per square mile.

Cook[2] estimates that more than 20,000 Indians died in the central valley in the epidemic of 1833, and that this number was about three-quarters of the total Indian population of the area. He considers that the original Indian population of the central valley has been much underestimated, and that a factor of two or even three should be applied to previous population estimates. There is an obvious discrepancy between the population estimates of Kroeber and Cook, but it is not vital in this discussion.

As there was a very wide variety of food materials naturally abundant, the valley Indians developed no agriculture nor animal husbandry. Since the climate was mild, housing was primitive. The result was a people with a very primitive culture, who were contemptously termed "Digger Indians" by the American whites, who, during and after the Gold Rush days of the 1850's ruthlessly hunted them down and nearly exterminated the valley tribes. Kroeber estimated the survivors of these tribes to number not more than about 3,400 in 1910.

The Spanish-Mexican occupation of California had no observable effect upon the valley Indians, since the Spaniards settled in the coastal areas, and penetrated into the central valley infrequently and sporadically for brief periods only. The first permanent white settlement in the valley was that of John A. Sutter at the confluence of the Sacramento and American Rivers in 1839. Sutter employed Indians in a wide variety of tasks, in return for subsistence, and treated them reasonably well. Prior to the gold rush, whites from Sutter's Fort, especially John Bidwell, established farms and ranches, generally north from Sutter's Fort, as far as Cottonwood Creek in Shasta County. White settlement of the San Joaquin Valley was subsequent to the gold rush, and was independent of Sutter's Fort. The settlement of the San Joaquin Valley, in spite of smaller resources of water, ultimately greatly exceeded the settlement of the Sacramento Valley.

The Vectors

In the absence of any indications to the contrary, we must assume that the four *Anopheles* species present in California today were present at least two hundred years ago and doubtless many thousands of years before that. Of the four species, two are efficient vectors, and two have little vector potentialities under the natural conditions of their habitat.

Along the coast the dominant species is *Anopheles occidentalis* Dyar and Knab. This species has been found in Alameda, Contra Costa, Del Norte, Humboldt, Los Angeles, Marin, Mendocino, Monterey, Napa, Orange, San Benito, San Francisco, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, Sonoma and Ventura Counties. All of these counties are coastal, with the exception of Contra Costa and Solano, which are "fringe" coastal and valley areas. All of these counties except the northern coastal tier of Del Norte, Humboldt and Mendocino were occupied by the Spanish settlers, among whom malaria was unknown. There are three explanations possible for the absence of malaria in the coastal counties: (1) the climate was not and is not sufficiently warm during any continuous period for the effective development of the *plasmodium* in the mosquito; (2) this species was not sufficiently numerous to permit the establishment of an endemic malaria in the region; (3) this species is not strongly anthropophilus. Probably all three factors have been at work, but probably (1) and (3) have been the more important.

The second *Anopheles* is *Anopheles franciscanus* McCracken. This species has been found in every county of the state except Lassen, Modoc, Mono, San Francisco and Sierra. It is seldom very numerous in any locality, and it seldom attacks man. There is no evidence that under natural conditions it is an effective vector of malaria in this state.

The third *Anopheles* is *Anopheles freeborni* Aitken. This species has been found in all counties of the state

except Alpine, Del Norte, Humboldt, Mariposa, San Francisco, Santa Cruz and Tuolumne. Diligent search would probably show its presence in Tuolumne County. It is reasonably anthropophilus, but attacks large animals as well as man. It enters homes readily. There is no doubt that it is an effective vector of malaria, and in many parts of the central valley and the Sierra foothills it has been present in large enough numbers to not only maintain an endemic malaria but also to propagate epidemic malaria. It has often been very numerous in irrigated areas. However, at present there are extensive areas in the Sacramento Valley with very large numbers of *A. freeborni,* and no malaria. One of us[4] has recently discussed this problem in some detail and the point need not be further discussed here.

The fourth *Anopheles* is *Anopheles punctipennis* Say. This species is widely distributed throughout the United States. In California it has been found in all counties except Colusa, Imperial, Los Angeles, Modoc, Mono, San Benito, San Bernardino, San Diego, San Francisco, Sierra and Ventura. We believe that it could be found in Colusa County. The vector capacity of this species has been discussed elsewhere[4] but in brief it is an efficient vector under appropriate conditions. It was probably the most important vector in the devastating epidemic among the Indians in 1833, was probably very important in the mining camps in the 1850's, and was probably the actual vector in some modern and recent outbreaks of malaria in the state. It has been in the past, and in some areas, still is, quite numerous near natural streams and water courses.

California therefore has had during historical times two species of *Anopheles* which are efficient vectors of malaria, and in the central valley both species have been in the past sufficiently numerous to satisfy Ross's criteria for the maintenance of endemic malaria. Except in the rice growing sections of the central valley, both species appear to be much less numerous at present than in the years prior to say about 1920, due to a number of environmental factors, of which mosquito control is one.

The Introduction of Malaria

There can be little question but that malaria is not a disease native to California. The available evidence, although of a negative type, makes it reasonably certain that it was not present among the indigenous primitive Indian population of the Pacific Coast area prior to the advent of the white man.

How, then, and when, was the disease introduced? For a long time it was thought that it was introduced by the early Anglo-American immigrants during the gold rush period subsequent to 1848. A recent study by Cook[2] indicates that it was introduced into the central valley probably in 1830, and nearly destroyed entire Indian tribes Cook's material has been added to by our own searches among early written histories, diaries, and other documents, and a fairly clear picture of what happened can now be presented.

The early Spanish settlers in California established their missions, presidios, pueblos, and ranchos fairly close to the ocean. The furthest inland probably was the Soledad Mission in the Salinas Valley, about 30 miles in an air line from the coast. In this coastal area, with its relatively cool climate north of Santa Barbara, it is doubtful that the sustained summer temperatures are sufficiently high to permit the effective development of the *plasmodium* of malaria in the *Anopheles* mosquito. Furthermore, the two dominant Anophelines in the coastal region, *A. occidentalis* and *A. franciscanus,* are definitely not anthropophilus; of the two other species, *A. freeborni* has been relatively scarce, and *A. punctipennis,* which we are convinced is an effective vector[4] under appropriate conditions, has been numerous only in restricted locations in the coastal area.

The Spaniards who settled along the coast were well acquainted with the disease from past experience in Mexico and Spain, and if it had been present in the area of California they occupied during the long period from about 1542 (Cabrillo) to the American acquisition in 1846, it is certain that some reference to it would have appeared in the records at the missions, or would have been observed and reported by the various explorers along the coast, or otherwise would have been noted in official reports or correspondence. But so far as we have been able to determine, there is no record of malaria in California prior to about 1830. This is the more remarkable for the reason that almost certainly some of the Spanish immigrants can be presumed to have had malaria infections upon leaving Mexico. Probably in the long voyages or cross-country trips to get to California, and in the absence of re-infections in California, the disease died out in such immigrants.

For a long time we were of the opinion that there could have been no malaria in the Sacramento-San Joaquin Valley prior to about the period of the 1849 gold rush. Our reason for this opinion was that the Spanish settlers along the coast coast made a number of excursions and explorations into both valleys, mainly the San Joaquin, and if malaria had been present among the Indians, it would be probable that the Spanish settlers would have brought infections with them. However, an examination of the rather meager records of explorations and punitive expeditions from the coast shows that most of them were made either in the spring or in the latter part of the year, perhaps to avoid the intense summer heat of the valley, and in a period of low transmission rates for malaria. Therefore, the absence of malarial infections among the Spanish settlers along the coast does not necessarily imply its absence among the Indians of the central valley.

However, two exploring and fur-trapping expeditions were in the central valley in 1827. While little is known about the party of Robert Campbell from New Mexico who trapped apparently in the "Tulares" country (the area in the vicinity of Lake Tulare and the southerly part of the San Joaquin Valley), Jedediah Smith and his party of trappers arrived in Southern California late in 1826, and trapped the tributary streams of the main rivers as far north as the American River by April of 1827. Smith then left most of his men, under Rogers, to continue trapping, crossed the Sierra Nevada, apparently via Ebbetts Pass, and after great difficulties reached Great Salt Lake in late June. After re-fitting, he started back with 18 men in July, arrived at San Bernardino in August, and then went up the valley to meet the men left on the American River. During late 1827 and early 1828 he headed up the Sacramento Valley and crossed into Oregon via the Trinity and Klamath Rivers, en route to the Columbia River. Nowhere in Smith's diary is there any indication that the party suffered from malaria. In 1828, the party sent by McLeod

of the Hudson's Bay Company to avenge the massacre of Smith's party, was guided down the Sacramento Valley by Turner, one of Smith's men, had a successful hunt, and returned to Fort Vancouver. Also in 1828-1829 a party of Hudson's Bay trappers under Ogden entered the Sacramento Valley, apparently from the northeast, and had a successful hunt. Neither party suffered from malaria, as far as can be determined. Also in 1830 Ewing Young, from New Mexico, following Smith's trail, entered the central valley from the south, and trapped on the tributaries of both main rivers, meeting a party of Hudson's Bay trappers under Ogden. There is no indication of malaria in the personnel of either party, although on the basis of the presence of malaria in Oregon in 1830 possibly some cases could have been present in Ogden's party.

Making, therefore, the very reasonable and probable assumption that malaria had not been effectively introduced into into the central valley prior to 1830, it is necessary to examine the situation in Oregon. It is quite certain that there was no malaria among the Indians along the Columbia River or its tributaries prior to 1829. The records of the Lewis and Clark expedition in 1805-6 give no indication of its presence at that time. David Thompson's exploration to the mouth of the Columbia in 1811, and the Astor expedition by land and sea in 1811-12, do not appear to have had any experience with malaria in the Columbia Basin. We do not know of any malaria among the Hudson's Bay Company people prior to 1829, though we are not of the opinion that all the evidence on this point has been examined.

But there is one very significant point easily ascertained from the records, and that is that malaria did appear among the Indian tribes of the lower Columbia River in 1829 or 1830; that it was a new disease to these Indians, by their own accounts; that, correctly or incorrectly, they connected its initial presence with the visit of the ship Owyhee, Captain Dominis; and that the disease acted as an infectious disease does when introduced into a completely non-immune population, becoming an acute disease which spread rapidly and had a high mortality rate.

Ascribing the initial infection to the Owyhee may be incorrect, for at least three other ships (Dryad, Isabella, and Vancouver) were in the lower Columbia during 1829 and 1830.

The Owyhee sailed from Boston via Cape Horn and arrived at Fort Vancouver in February, 1829. We do not know what ports it stopped at en route, but there were no doubt several in the Latin America countries where malaria could have been contracted by members of the crew. It spent the winter of 1829-30 at Scappoose Bay above St. Helens, and returned to below St. Helens for the summer and autumn of 1830, when it departed for Hawaii. Malaria broke out among the Indians in the vicinity of St. Helens in the summer of 1830, and spread rapidly among the Indians along the lower Columbia and the Willamette Rivers. It may easily have first appeared in the latter part of 1829, without being remarked.

There can be no question but that the epidemic which occurred among the lower Columbia Indians in 1830 and subsequent years was malaria. (Note: Scott, in his article on Indian Diseases as Aids to Pacific Northwest Settlement – in the Oregon Historical Quarterly, XXIX (2), 144-161, indicates that the malaria epidemic began in 1830. Bancroft, in Works, XXVIII, 502-504, states that the disease began in 1829. We believe that late 1829 is probably the correct date.) An examination of the reports of the Hudson's Bay Company, with confirmation from various other sources, makes the determination of the disease quite definite. While the high mortality rates of the disease among the lower Columbia River Indians is of considerable epidemiological interest, and is corroborative evidence as to what happened later in the central valley of California, the important point is that the Hudson's Bay Company people acquired the disease, and carried it to California with the various fur brigades which trapped the central valley streams, from at least as early as 1829 until about 1846, when objections apparently were raised to these trapping incursions into Mexican Territory, possibly by the Mexican Government, or possibly by John A. Sutter. We do not have documentary proof of this point, but suspect it to be the fact.

In any event, it appears certain, from the evidence presented by Cook[2] that malaria appeared among the Indians of the central valley of California possibly in 1830, probably by 1831, and certainly by 1832. The Ewing Young - Kit Carson group of trappers arrived in the central valley in 1829 and stayed until October 1830, coming from New Mexico. Carson states that their party met Ogden with 60 men in the San Joaquin Valley, apparently in 1830. There is no mention of malaria during this expedition in the extant reports of Young, Carson or Ogden. Ogden notes that when he returned to Fort Vancouver in the autumn of 1830 he found a few of the Hudson's Bay people suffering from intermittent fever. On the basis of this evidence it appears to be probable that malaria had not become prevalent among the Indians or trappers in the San Joaquin Valley in 1830, but may have been introduced into the Indian tribes in Northern California, possibly as far south as the upper end of the Sacramento Valley. From this point it could easily have spread southerly by ordinary migration, but since it is generally understood that parties of trappers from the Columbia area, in groups of from a dozen to perhaps 100 men, among whom after 1830 there must have been a number of men with gametocytes in their blood, it appears more probable that the rapid spread of the disease through the central valley was facilitated by these trapping expeditions. We hazard an hypothesis that the basis for the tremendous epidemic of 1833 was laid by trapping expeditions in 1832, with the speculation that some infection of the native population in the northern part of the Sacramento Valley in 1831 was possible. Certainly it was present among the Indians along the Feather River in 1832, as Work[5] on December 2 of that year states that "there appears to be some sickness resembling an ague prevailing among them".

Ewing Young and his party met a party of Hudson's Bay trappers on the American River in 1832 (Bancroft's Works, XX, 392), but there does not appear to have been any mention of malaria among them. On the other hand, Young and a party including Hall J. Kelley in 1834 went north through the valley (Bancroft's Works, XX, 410; and "History of Sutter County, Thompson and West, Oakland 1879, Chap. 14) and reported that they were stricken with malaria near the

Merced River and as far south as the Kings River, and nearly everyone of the party was afflicted.

It is of course possible that malaria could have been introduced from the southeast, or via San Francisco Bay, but there is no evidence available to substantiate such an hypothesis. On the other hand, there is fairly compelling evidence to indicate that malaria was introduced from the north, by trapping parties from the Columbia River area, possibly in 1831, and probably no later than 1832. At any rate, the stage was set for the tremendous and very fatal epidemic of malaria among the central valley Indians in 1833, which has been so well described by Cook[2] that we need not review all his data here. But, to corroborate this material we present the remarks of Bancroft (Works, XX, 357-358).

> "A terrible pestilence, an intermittent fever often prevalent in that region, is reported as having almost depopulated the whole valleys of the Sacramento and San Joaquin in the autumn of 1833. Warner, with Ewing Young and a party of trappers, passed up the valley in the autumn of 1832, noting a dense Indian population; but in the following summer when the party returned the country was strewn with the remains of the dead wherever a village had stood, and from the headwaters of the Sacramento to Kings River only five living Indians were seen. The trappers themselves were attacked by the fever, and some of their servants died. There may be some exaggeration in this narrative; but there is no reason to question the general accuracy of Warner's statement; especially as Vallejo wrote in May of the same year that a pestilence, which he supposed to be smallpox was causing fearful ravages on the northern frontiers; and as Edwards in 1837 found on every hand abundant and revolting signs of the pestilence, which was described to him by Ewing Young from personal observation."

There seems to be some doubt as to Bancroft's date of 1833 in the foregoing statement, as we have not found any record of Ewing Young being in the central valley in 1833; he was apparently there in 1832 and in 1834. However, this discrepancy in dates does not invalidate the general description of a tremendous epidemic which carried off most of the Indians in the central valley. The Journal of Work[5] shows that three trapping parties, those of LaFramboise, Young and himself, were in the valley in 1832; Work was there in 1833, and noted malaria among the Indians in the northern end of the valley. Young, with Hall J. Kelley, the botanist, went north through the valley in 1834, but does not appear to have been in the valley in 1833.

It therefore can be fairly certainly established that malaria was introduced into California from Oregon no later than 1832, and possibly in 1831; its introduction into Shasta valley in the present Siskiyou County may have occurred as early as 1830, but that is doubtful. The disease was disseminated southerly, probably by the La Framboise party in 1832, and fulminated in the 1833 epidemic.

Once introduced, nothing short of a 100 per cent depopulation of the area would have extirpated the disease, in the state of sanitary practices and medical knowledge at that time. There were evidently enough Indians surviving to keep the *plasmodium* in circulation, and trapping parties from the north undoubtedly brought in additional *plasmodia* each year until such expeditions were suspended in 1846, and until the arrival of Americans in appreciable numbers in 1845 in the central valley provided sufficient whites to form an adequate reservoir.

For unexplained reasons the presence of malaria in the central valley during the early period of American immigration appears not to have been noticed by the modern writers on the subject. Jones[1] makes no mention of it prior to the gold rush, merely saying that some of the white settlers prior to 1830 may have brought malaria with them, but there was no definite proof of it. He said that the most important and certain sources were found in the enormous migration that came after 1848. But John Marsh[6], who termed himself a doctor and who entered the central valley in late 1836, and who began the development of his ranch in April of 1838 on the valley floor easterly from Mt. Diablo, treated the Bolgones(?) Indians for malaria, which afflicted many of them. There is also correspondence between Marsh and John A. Sutter in which Sutter (October 2, 1844)writes to Marsh that he has no quinine and so cannot supply him with any.

John A. Sutter arrived in California at Monterey by ship in July, 1839, and in August of that year set forth up the Sacramento River and late in the year began the building of his establishment near the junction of the American River with the Sacramento. By the end of 1842 he had from 30 to 40 white men connected with his operations, plus a considerable number of Indians. Apparently references to malaria in the records at Sutter's Fort have been overlooked. But in Lenhard's "A Pioneer at Sutter's Fort" mention is made of an attack of chills and fever he suffered in November of 1846. In the "New Helvetia Diary" there are many references to illness at Sutter's Fort and in the upper valley, much of it apparently malaria, as early as 1846.

In late 1841 the Bidwell-Bartelson party of 31 men and one woman, from Independence, Missouri, traveling overland and crossing the Sierra Nevada probably via Carson Pass, arrived at John Marsh's ranch. John Bidwell and several others went to Sutter's Fort, where Bidwell became his general factotum, and later developed considerable land in the Chico area. It is of course possible that some malaria infection came in with this and probably with later overland immigrants, but any such increments of infection were by that time of slight importance.

In late 1841 Lt. Emmons with a command from the the Pacific Coast exploring expedition of Lt. Wilkes (USN) travelled from Vancouver, Oregon, down the Willamette Valley, mapping en route to California. There were 39 in the party, 12 military and 27 civilians. They were much delayed by attacks of chills and fever. On October 9 the party reached the confluence of the Pit and Sacramento Rivers, and by October 17 were at the junction of the Feather River with the Sacramento. (See Vol. 5, U. S. Exploring Expeditions, pp. 228-249). Coming so late in the year it is not probable that this group added appreciably to the already prevalent malaria in the Sacramento Valley.

In 1843 a party of 53 persons under L. W. Hastings came into the Sacramento Valley from Oregon. En route near the Rogue River they met a party of drovers driving cattle from California to Oregon. About one-

third turned back to Oregon, but about 34 men and women continued on and most of them settled in the valley. In the same year the Chiles party guided by Joe Walker arrived, part coming in via the Pit River and part via Walker Pass.

In 1844 Fremont arrived on his second exploring expedition, crossing the Sierra Nevada probably by Carson Pass, and going up the San Joaquin Valley and out via Walker Pass. Also in that year a group of 36 containing the Kelseys returned from Oregon, arriving in June. The Stevens-Murphy company, approximately 51 men, women and childen, left Council Bluffs in May, and arrived in two sections in the valley in December, one section going via Truckee Pass, the other westerly from Lake Tahoe and down the Rubicon and the middle fork of the American River.

In 1845 five groups of settlers arrived in the valley. In July there arrived at Sutter's Fort from Oregon the McMahon-Clyman company of 43 persons. In September there arrived at Sutter's Fort the Swasey-Todd (or Snyder-Blackburn) company, 13 young men, who came overland via Truckee Pass. Little is known of the third company, which came overland apparently via Truckee Pass, and consisted of apparently 15 men guided by Sublette. It arrived at Sutter's Fort in October. The fourth party, the Grigsby-Ide Company, about 100 persons, coming via Truckee Pass, arrived at Sutter's Fort in December, and the last party of immigrants for the year, 10 men led by L. W. Hastings, arrived at Christmas. Also in December Fremont arrived at Sutter's Fort with part of his exploring group, coming via Truckee Pass; the remainder of his group, under Joe Walker, went around via Walker's Pass into the San Joaquin Valley.

After 1845 the main transcontinental routes to California were adequately known, and there is nothing to our purpose to record further the various parties who entered the central valley in 1846 and thereafter. There is abundant evidence in the available records that malaria was well established in both valleys, and that it continued as a recognized and fairly frequent ailment at the various settlements in the valleys during the next few years. We have, however, no means of knowing what the morbidity rates were, as we know neither the numbers of cases nor the number of people during the period prior to the gold rush.

On pages 7, 11 in the Gregson Memoirs there is a reference to much sickness among the 1846 immigrants to Fort Sutter. Some of it may have been malaria brought across the continent with the wagon trains. There is a specific reference to a Doctor Gilde who, when he was attacked by malaria had himself bled, and died soon aferwards.

THE AMERICAN PERIOD

On July 7, 1846, when Commodore Sloat raised the American flag at Monterey, effectively began the American occupation of California, which was confirmed by the ratification of the Treaty of Guadelupe Hidalgo February 2, 1848. With the discovery of gold near Coloma on January 24, 1848, California entered the turmoil of the great immigration of gold seekers, who came overland by wagon train, and by ship either around Cape Horn, or via the Isthmus of Panama, with lesser numbers coming from China, Central and South America, and Australia. Undoubtedly new strains of *plasmodium* were introduced during this period. It is generally assumed that *vivax* malaria was the principal, if not the only agent from 1830 to 1848, but after that time the probabilities are that *falciparum* and *malariae* (quartan) parasites arrived, much of the *falciparum* having been picked up during the crossing of the Isthmus of Panama.

Since the cause of malaria was then unknown, we have no factual data on these several species of *plasmodium*, but the few medical records of the period indicate a classification based on symptomatology which to some degree shows a differentiation between benign tertian, malignant tertian and quartan malarias.

It might be possible to get a more detailed record of malaria in California during the period from 1848 until the first biennial report of the State Board of Health in 1870-71 by a careful study of the many volumes of letters in the Bancroft Library, but this laborious task we have not had the time to attempt. Many of the published memoirs of the pioneers and early settlers contain references to malaria. For example, the "Shirley Letters" written by the wife of a pioneer physician in the gold camps contain various notices of fevers which were presumably malaria and which were treated with quinine. There are occasional references to chills and fever in Bayard Taylor's "'Eldorado" (1849-50). But there is little available which would give a quantitative indication of the prevalence of malaria.

The nearest approach to quantitative statistics are those presented in Senate Ex. Doc. No. 96, 34th Congress, 1st Session. This is the report by R. H. Coolidge, M.D., Assistant Surgeon, U. S. Army, entitled "Statistical Report of the Sickness and Mortality in the Army of the United States, Compiled from the Records of the Surgeon General's Office, embracing a period of sixteen years, from January, 1839 to January 1855." The material on troops in California is found on pages 437-467.

The figures for malaria are included in the classification of "Fevers," of which there are seven sub-divisions. Of these seven, four are presumably principally malaria infections, namely, "Febris intermittens quotidiana," "Febris intermittens tertiana," "Febris intermittens quartana," and "Febris remittens." We have segregated these four, in the Northern California military posts, as follows: (Note: The Nothern California posts were San Francisco; Fort Miller on the San Joaquin River just within the foothills; Sacramento; Benicia; Sonoma; Camp Far West on Bear Creek (River) at the base of the foothills; Fort Reading near the site of the present Redding; Fort Jones in Scott's Valley at the site of the present Fort Jones; and Fort Humboldt near the site of the present Eureka).

In the Southern California posts the reports were as follows: 1849–24; 1850–47; 1851–32; 1852–139; 1853–30; 1854–46.

In the Northern California posts the malaria cases by years were: 1849–81; 1850–173; 1851–243; 1852–648; 1853–534; 1954–430; total for six years–2109.

We were unable to reconcile the figures in the detail tables on pages 464-467 with the summary table on page 453. We are therefore using the figures on the detail table.

Northern California Posts – Malaria Cases–1849-1854

Quarters	*1st*	*2nd*	*3rd*	*4th*	*6 years*
Aggregate Strength	1518	1474	1699	1706	6397
Cases	322	377	788	622	2109
Deaths	0	1	1	1	3
Case rate per 1000	212	257	464	364	330

The greatest number of cases (391) occurred in the third quarter of 1852, but in that quarter the mean strength (833) was nearly four times the average strength; the rate per thousand for that period was 470, which was not appreciably different from the average for the third quarter for the six-year period.

In a footnote on page 452 it is stated: "A comparison of the statistics of diseases at Fort Reading with the abstract for all the posts in Northern California, show that *one-half* of the entire number of cases of intermittent fever reported, occurred at this one place. The Fort was abandoned on account of its unhealthiness, in March, 1856."

A few remarks from this report concerning some of the other posts are of interest. Concerning Benicia Barracks (which was not in a malarial area) the following appears on page 448: "Every summer, since the establishment of this post, some of the troops of the garrison have been engaged in field service in the upper country; the men have invariably returned (particularly from the Sacramento Valley) prostrated by fevers, dysentery and scurvy."

Concerning Camp Far West ,on page 449 it is said: "In common with the whole Sacramento Valley, this post is very sickly from June till October. Although there are no marshes within twenty miles of the post, it is considered one of the most unhealthy points in the Valley. . . . This post was abandoned on account of its unhealthiness, and the troops moved to the upper or northern part of the Valley of the Sacramento, where they established a new post, which was named Fort Reading."

Of Fort Miller the following report was made on page 445: "The following remarks respecting the diseases at this post are taken from a recent report by Assistant Surgeon Murray: 'Diarhoea, which, next to remittent fever in a mild form, is most frequently met with. . . .'."

These Army reports are the principal factual material presently known to the writers, but there are almost certainly other materials which could be found by a professional historian with sufficient time available to make an exhaustive search of the materials, such as newspapers. Corroborative evidence of malaria prevalence can be found in advertisements (in newspapers and magazines) of "chill tonics" and other anti-malarial nostrums. Gray remembers that such advertisements were common in the Valley newspapers as late as 1910-19, and frequently were seen on roadside signs. Fontaine had the opportunity to examine the original diary of John Bidwell, who, after serving as Sutter's right-hand man until the discovery of gold in 1848, spent the rest of his life in the area which is now Butte County. This diary contains frequent references to sickness, much of it, particularly in the summer months, quite evidently malaria.

A German physician, F. Praslow, travelled in California in 1857, and recorded his observations in "The State of California." From a translation by F. C. Cordes printed in 1939 we excerpt the following items:

Page 48:–"During the summer of 1849, malaria was very prevalent, and cases appeared in great numbers from the back country and from the tropical coast lands, especially Panama." (Notes: He is evidently referring to people coming from the Sierra foothill mines to San Francisco, and arriving at San Francisco by ship.)

Page 58:–"Malaria. This disease occurs in most of the lowlands of the state. In the northern part the Indians especially suffer from it, and, as cinchona bark is unknown to them, they have the intermittent type and its sequelae to such a severe degree that entire tribes have been exterminated by it. Contributing to this is the fact that, due to their mode of living, they frequent the lowlands where they carry on their fishing, an important factor in their livelihood. In the southern part, malaria is seen on rare occasions. Only in the lowlands of the coast is an occasional mild case seen. The principal site of the disease is in the lower-lying portions of the so-called Great Basin. Aside from the cases brought in, it is rarely seen in San Francisco and cases occur there near the water or in the vicinity of neighboring lagoons. On the other hand, the disease is really endemic in the lowlands of the Sacramento and San Joaquin Rivers, and it is considered almost miraculous if one lives in this area for any length of time without contracting it. As a rule the fever has the tertian form and these, relatively speaking, are the cases that recover most rapidly. The quotidian form, on the whole, is very rare, somewhat more frequently one finds the quartan fever. While the lighter forms of tertian-typhus occur in varying intensity throughout the year, the intensive, obstinate cases occur in July, August, and September. The usual treatment here also is the use of cinchona bark and quinine, and occasionally arsenic and other remedies; yet one frequently finds cases that resist all treatment and are cured only by remaining for a long time in higher altitudes."

In 1856 the first railroad in California was constructed, between Sacramento and Folsom. To build it numbers of Italian laborers were imported and, it can be presumed that they brought with them the *falciparum* parasite. At any rate an extensivly virulent type of malaria is reported to have occurred in that area during the period of construction[9]. Construction of the Central Pacific Railroad from Sacramento through Placer County, which was completed in 1869, wreaked havoc with the health of the local residents, according to verbal reports made to Gray in 1910 by Harry Butler of Penryn and various old time residents of Loomis and Auburn. They attributed the intense and pernicious malaria to the Chinese, Italian and other foreign laborers employed in the construction work.

One interesting item was obtained from the "History of Tehama County" published in 1880 by Elliott and Moore, San Francisco. On page 18, in describing the founding of Red Bluff in 1850, it is said "The founders of Tehama gazed with admiration upon the elevated plateau which offered such great natural inducements to build a city; secure against inundation, above the poisonous malaria so destructive of health in the low bottoms of the Sacramento."

Many of the counties in the central valley of California have prepared histories. The detailed examination of these earlier histories would undoubtedly produce items indicating the relative prevalence of malaria. In this connection it is interesting to note that

during the period up to about 1900 there was little tendency to deny or conceal the presence of malaria. After about 1900 there developed a "chamber of commerce" attitude that malaria was a deterrent to economic development and should not be discussed publicly. As late as 1911 Professor Herms was strongly criticized and even threatened when he tried to do something about malaria in some of the valley towns.

We shall not attempt to go into detail as to the prevalence of malaria in the Central Valley for the period from the gold rush days until about 1870. All the available evidence is to the effect that malaria was present throughout the Valley, but with some variation in intensity, being rather less intense in most of the San Joaquin Valley, and more intense in the Sacramento Valley, with certain areas, particularly Marysville, Oroville, Placerville and Colusa having high degrees of prevalence.

We suggest to the State Colleges in the Central Valley, as interesting projects for their history departments, a detailed study of old documents, reports, letters, newspapers and other sources. Considerable information on malaria prevalence, by counties, in the period 1850-1900 can be obtained, which we do not now have the time or facilities to explore.

Gray[8] in searching the early (and fragmentary) records of death in Northern California counties, found the following reports which, under the various nomenclatures in use at the time, were probably malaria:

Butte County

Year	*Population*	*Deaths*	*Death Rates*
1859	---	8	---
1860	---	1	---
1889	18,021	5	27.8
1890	17,939	10	55.8
1891	17,856	14	78.5
1892	17,774	8	45.0
1893	17,692	7	39.6
1894	17,610	17	96.5
1895	17,528	8	45.6
1896	17,445	5	27.7
1897	17,363	5	28.8
1898	17,281	7	40.5
1899	17,199	8	46.5
1900	17,117	7	40.9

Shasta County

1873	---	3	---
1890	12,133	3	24.7
1891	12,651	4	31.6
1892	13,170	1	7.6
1893	---	---	---
1894	14,202	1	7.0
1895	---	---	---
1896	15,244	3	19.7
1897	15,762	2	12.7
1898	16,281	5	30.7
1899	16,799	4	23.8
1900	17,318	8	46.1

Tehama County

1891	10,024	1	10.0
1892	10,132	1	9.9
1893	---	---	---
1894	---	---	---
1895	10,456	1	9.6
1896	10,564	4	37.9
1897	10,672	1	9.4
1898	10,780	4	37.1
1899	---	---	---
1900	10,996	4	36.4

Yuba County

1873	---	4	---
1889	9,738	4	41.1
1890	9,636	5	52.0
1891	9,533	6	63.0
1892	9,431	6	63.6
1893	9,330	7	75.0
1894	9,229	6	65.0
1895	9,128	3	32.9
1896	9,027	6	66.5
1897	8,925	2	22.4
1898	8,823	5	56.6
1899	8,721	8	91.7
1900	8,620	5	58.1

Also, in Placer County, one malaria death was recorded in 1896 and one in 1900. No attempt was then made to search the early death records in the counties in the San Joaquin Valley, but these records may give some information for the period 1870-1900. However, useful statistical records of either deaths or cases, particularly of cases, cannot be expected until after 1900 at the earliest. The early Californians were too busy trying to develop the state to pay attention to statistics. Neither state nor local health officials had achieved substantial public respect. There was no effective law relating to the reporting of births, deaths or morbidity, no effective administrative machinery for such reporting, and no health officers trained to use the statistics if they were available.

Furthermore, malaria was such a common factor in the malarious counties that few people thought it worthy of comment. They merely took their quinine with their coffee at breakfast. It was not until after the discoveries of Ross and Grassi and others, that malaria was a disease transmitted by *Anopheles* mosquitoes, and that it could be prevented by controlling these mosquitoes, that any interest began in the reporting of malaria. But, as Sir Ronald Ross has well said, "The world requires at least ten years to understand a new idea, however important or simple it may be." So it is not surprising that it was not until late in 1909 that William B. Herms began his crusade against malaria in California, nor that it would take at least an additional ten years before there began to be a reasonably effective reporting of malaria cases.

But this does not mean that the state health authorities took no interest in the problem. In the first Biennial Report of the State Board of Health (1870-1871), "typho-malarial" fevers are included in a table of the six most prevalent diseases in the state, there having been reported 237 such deaths for a population of 256,783.

The Second Biennial Report (1871-73) commented on malaria prevalence and presented a map showing the distribution of the disease in California, using figures from the 1870 U. S. Census, on the basis of the number of deaths from malaria per 10,000 deaths from all causes. The highest mortality rates (from 550 to 900 per 10,000) occurred in Sacramento, Amador, Placer,

and El Dorado Counties, but all the northeast counties had high rates. The lowest rates (under 100 per 10,000) were reported from the northwest coastal area and from the southern part of the state. We quote in part from the narrative (p. 54).

"The census map discloses the fact that the whole State is more or less subject to malarial diseases, in a slight degree. The broad level plains of the Sacramento and San Joaquin Valleys are specially proclivous to ague and other fevers, and it is very questionable whether the extensive systems of irrigation, now under discussion, will not add to their insalubrity. Residents of the low, rich lands in the interior of the State, where the summers are long and hot, are liable to be much debilitated in autumn, from the continued heat, even if they escape a positive attack of fever. The superaddition of moisture, under these conditions, must prove detrimental to the public health.

"Throughout the whole State there must continue to be more or less of malaria for centuries to come, if not for all time. Much of the land, especially in the vast tule regions, is of such a nature that probably it can never be effectually drained, and could not be profitably cultivated even if drained. Nevertheless, in careful and thorough drainage lies our only hope of escape from malarian influence.'

In the Third Biennial Report (1874-75) forty-three pages are devoted to a special section entitled "Malarial Fevers and Consumption in California," by Thomas M. Logan, M.D., Secretary of the State Board of Health (pp. 113-156). We quote in part as follows:

"NATURE AND CAUSES OF MALARIAL POISON"

"Up to this time but little is known, according to the latest authority[1], of the nature of malarial poison. The older observers (Mascati, Vaucquelin, Fontanelle), merely demonstrated the presence of decomposing organic matter in marsh-exhalations, and the theory has long been generally accepted that malarial poison is exclusively the result, in gaseous form, of the decomposition of vegetable organisms, such as carbonic acid gas, carbureted hydrogen, and according to Schwalbe, carbonic oxysulphide.

"But although no analysis of the air has yet disclosed any immediate principle to which the unhealthy influence of malaria or marsh-miasm may be ascribed, still, if we admit its existence as the efficient cause of the disease in question, it is easy to see why the rates of mortality by these fevers in California, thus determined by positive statistics, are just in the proportion in which they are found in certain parts of the State. A rich alluvial soil, abundant vegetation, rivers and creeks whose banks are subject to overflow, and inundations of vast prairie lands, which every year occur to a greater or less extent—these conditions, conjoined with a high summer temperature, together with sudden and sharp transitions from the heat of mid-day to chilling nights, are the well recognized hypothetical factors concerned in the production of malaria; and it is precisely in those regions where the greatest mortality and sickness, caused by malarial diseases, as just seen, happens, that the concurrence of all the conditions, just enumerated, is met with in the fullest degree. Of all the elements which enter into the sum of these conditions, water seems to play the most active part.'

Dr. Logan also quotes from various newspapers to indicate the prevalence and severity of malaria in various localities (dates not given).

The Placer Press, Auburn

"Almost everybody living west from Gold Hill is either down with fever, or chills and fever, or more or less affected by the miasmatic poison generated and floating around in that locality. The cause of this unusual sickness is generally chargeable to the reservoirs of the several ditches. They are filled with sedimentary water, which spreads over a large plain during the day, exposing a great surface of wet vegetable matter to the sun, as the water is drawn down. This is a most unfortunate fact, as without reservoirs the county cannot be mined, and sickness destroys the ability to labor. What can be done to remedy the evil?"

The Butte Record, Oroville

"The work on the deep shaft has been suspended, in consequence of illness among the company that has it in charge. A great deal of sickness exists among the bluff miners, more than any previous years."

At about the same time there appeared the following card, addressed to the editor of the Record.

"The undersigned, citizens of the Town of Oroville, having witnessed with deep regret, during the past month, the sickness which (heretofore unknown to us) is this Fall afflicting nine-tenths of our people, injuring business, and which now threatens to impede the future growth and prosperity of our town would respectfully suggest that, as it is now a conceded fact that our sickness is the result of inhaling the miasma arising from the stagnant waters to the south and west of the city, a meeting be called at the Court House, on Tuesday evening October nineteenth, at seven o'clock P.M. for the purpose of taking steps to remove the nuisance."

The same paper also made the following remarks:

"The successful working of the river claims demands a longer season of dry weather; the health of the country seems to require rain. Health is of vastly more consequence than the accumulation of gold, and we pray for rain even at the expense of the river miners. Accounts from other sections of the State show that this region is not the only one infected. Similar complaints to those experienced here prevail along the Yuba and in many of the mining and agricultural districts of the foothills."

It is most peculiar that the citizens of Oroville should have used the phrase "hitherto unknown to us," since malaria was an old resident of the Oroville area, from 1833 at least.

Dr. Logan devotes several pages in expounding upon the environmental conditions having an apparent "modifying" and "ameliorating" influence upon the prevalence of malaria, as follows:

"Cities and large towns, it is well known, seldom suffer from malarial fever, and are to be considered as in some degree presenting opposite conditions to a sparsely settled country. As the buildings extend out, and the closely inhabited portions expand, and by so doing lessen the area of humid and exposed soil, the disease recedes. The medical history of New York, Buffalo, Auburn, Syracuse, Philadelphia, Charleston,

[1] Ziemssen Cyclopaedia, vol. 2, 1875.

Savannah, Louisville, etc., illustrates this . . .

"Now, with regard to Sacramento, whatever of reason there may be in the opinion formerly advanced by me, that the so-called cholera of eighteen hundred and fifty-two, when the city was in a transition stage between country and a filthy, ill-conditioned town, traversed in all directions by sluggish, stagnant sloughs, was nothing more than a highly malignant form of malarial fever, there certainly, since a better order of things obtains, has not been witnessed, to the best of my knowledge, a single case of malignant fever within the city proper. All of the cases since met with here, have been of the simple intermittent variety, originating in the suburbs, and especially in that portion bordering on the American River, where the amount of deposit is enormous."

In speaking of the "amount of deposit" Dr. Logan was referring to the detritus resulting from the hydraulic mining operations on the American River at Dutch Flat and Gold Run.

Much of Dr. Logan's report is devoted to observations of the benefits of the eucalyptus trees in malaria prevention.

"These evidences go far to establish the fact that the *eucalyptus globulus* has a good effect in preventing the spread of malarial diseases, and that it may serve decidedly practical purposes in this particular. But the most remarkable accounts from the eucalyptus tree are those that come from nearer home. We find in the Kern County Courier an indorsement of the claims of this tree, which we copy, being confident that it will inspire confidence in what we have said on this subject. The editor of the *Courier* derives his information from personal observation, he being the owner of a farm upon which the matter was tested. He states his observations and experiences as follows:

In regard to the anti-malarial influence of the eucalyptus, we have this conclusive evidence. We have given it what we regard as a reasonably fair test on our own farm. This is cultivated by two families, or companies, of Chinese. One company lives near the north and the other the south end of the premises, about three-fourths of a mile apart. The localities both parties inhabit are favorable to the development of malaria. The soil is rich, moist, and teeming with vegetable life, and the free sweep of the prevailing wind is obstructed by the intervention of dense thickets. As might be expected, they have, every year, during the heated term, suffered with malarial fever. Last Winter we determined to test the much vaunted virtues of the eucalyptus. In February we gave to the party at the north end two ounces of the seed with directions that it should be planted near the house. It germinated finely, and produced several thousands of young plants, but the frost killed most of them. About twelve hundred, however, survived. These, when the heated term commenced, had attained an average height of two feet, and emitted a strong aromatic or camphorous odor, perceptible at a distance of a hundred yards. In due time the party at the south end were visited by their usual mildly distressing fever, but up to the present time we have looked in vain for the first symptoms to develop in the other. They are all, to their own astonishment, in the most robust health. These trees now average more than three feet in height, and the atmosphere of the house is strongly impregnated with their odor. We have investigated in vain for other causes to which to attribute the anomalous state of health of the inmates, and can find none but the reputed sanative properties of this tree. We have finally become convinced from the evidence of our own senses that it will do all the current accounts given of it allege, and propose, the coming season, to plant it on all the waste places and corners on our farm we can spare from other purposes. If everybody would do likewise, the great valley of Kern County might soon take rank among the sanitariums of the State, because as yet no disease, except a mild type of malarial fever, has shown itself. Every land owner, be his possessions large or small, should put it in the light of a duty to plant more or less of the eucalypti."

In discussing the vital records, Dr. Logan had this to say:

"The highest death rates are found in Santa Barbara and Marysville. The mortality by consumption in the former place, as well as the total mortality, is aggravated by extraneous causes — the advent of the phthisical and other valetudinarians in search of a more favorable climate, which invalidate any legitimate deductions as to local salubrity. Not so with the latter place, which affords an exemplification of what has been advanced in another part of this report respecting the slow toxic effect of malaria in the production of phthisis. Our statistics show a high death rate here, both from malarial fevers and consumption, the ratio per one thousand of population being in both cases 3.2. As is well known, pulmonary affections are often associated with repeated attacks of intermittent fever followed by malarial cachexia; and in this way we can account for the large ratio of deaths by consumption in Marysville, which is confessedly proclivous to malarial diseases." . . .

Concerning racial immunity and malaria, Dr. Logan explains the higher than average mortality of the Negro and Chinese as follows:

". . . the greater liability of the Negro, especially to pneumonia, and other diseases of the respiratory organs, and the tubercular diseases in general, appears to be chiefly instrumental in the production of a large comparative mortality; while, on the other hand, the well attested exemption from malarial diseases, diptheria, and scarlatina, in squaring the account, would leave a very small, if any balance at all, against the Negro race. The Fauna, Flora, and races of men have been created with different inherent adaptations for each particular clime. Transplanted to an uncongenial soil they do not flourish, but on their native grounds are strong and hardy. This well established fact presents the reason why the Negro is so proclivous to various inflammatory diseases of the respiratory organs, while he seems to luxuriate on the malaria of his native zone.

"The remarks respecting the mortality of the Negro race apply, in a certain degree, also, to the copper-colored races, which include Chinese and Indians. These constitute about ten percent of the population, while the mortality is 11.3 percent. This, however, does not represent the real rate, inasmuch as the

Chinese decendents are excluded from the computations for some localities. The mortality of the Chinese by malarial fever was frightful, in the neighborhood of Oroville, during the months of August, September, October, and November, and yet this does not appear in the table. 'The Chinese,' according to Dr. Vance, 'are scattered from this place down the Feather River, for three and one-half miles – in all about seven thousand – mining, almost entirely with the rocker, and more or less naked, and in the water. A few died in the early part of the Summer, but little attention was attracted until August, when they began to die more frequently. I have been at a cabin wherein there would be fifteen to twenty occupants, and one-half of them sick with fever – either intermittent, bilious, or typhoid – all of whom could have been cured by proper treatment. I have prescribed for about two hundred, and of these my druggist says, five have died.

" 'A prominent Chinese merchant has just informed me that the dead amount to about one hundred. The following is the undertaker's list: Deaths in August, 18; September, 23; October, 30; November, 12; add twenty per cent not reported, and we have a mortality of 100'."

Dr. Logan further stated:

"The remaining special diseases it remains for us to consider, in this connection, have been placed in our table (No. 1) under the general term of typho-malarial fevers. In this class, as stated elsewhere in this report, have been included all the varying forms of those fevers supposed to be dependent on one or the same poison – the different grades described by medical writers, from the simple intermittent to the continued and pernicious, bearing a pretty direct ratio to the intensity of the poison. These diseases proved most fatal (32 deaths) in November, and least fatal (5 deaths) in May, which was the healthiest month in the year. Their percentage of mortality to other diseases occurred in the following localities, in the order in which they are respectively named, as follows: Colusa, 15.5 per cent; Marysville, 13.5; Placerville, 11.5; Napa, 7.7; Oroville, 7.2; Siskiyou, 7.1; Stockton, 6.6; Dixon, 5.9; Sacramento, 4.7; Petaluma, 4.4; Folsom, 4.1; Oakland, 3.9; San Francisco, 3.0; Watsonville, 2.2; Redwood, 2.2; Los Angeles, 2.0; and Santa Barbara, 0.9. In San Diego County, Truckee, St. Helena, Santa Cruz, and Downieville, there were no deaths by these fevers. These facts corroborate what was stated in former reports, that the whole State is more or less subject to malarial diseases. They fail, however, to afford a correct idea of the real state of the case in certain localities."

Comparatively little space was given to malaria in the Fourth Biennial Report (1876-77, F. W. Hatch, M.D., Permanent Secretary). For the purpose of determining the boundaries of the malarial areas, a circular letter was sent to a large number of physicians in the state. The replies indicated the Sacramento and San Joaquin Valleys, with the adjacent Sierra foothills, as being the pricipal afflicted region, with little or no malaria in the coastal counties or in southern California. Dr. Hatch said it was unnecessary to dwell upon the evidences of malaria in the Central Valley. Their prevalence was well understood, and he says in conclusion:

"Doubtless this brief exposition of the malaria centers of the State will require modification in time, as the cultivation of the soil progresses, as drainage is rendered more perfect, and hygienic laws are more closely observed. Already in the Sacramento Valley great changes have been affected in these respects, and it is familiar to the observation of the residents of many portions of this valley that, where fevers were once frequent and severe, they are now less common, and almost uniformly mild."

Turning now to the Fifth Biennial Report 1878-79), we find the following items of interest on pp. 15-16.

"The last report of the California State Board of Health records a mortality of four hundred and six against fevers. The classification for statistical purposes is sufficient. But in every locality there are special and characteristic forms of fever observed by the local practitioner which, in themselves, differ materially as regards symptomatology, prognosis, and treatment, from the accepted orthodox types. Southern California offers no exception to this rule. Indeed, the peculiar forms of disease that are, as it were, indigenous to a climate acknowledged as exceptionally excellent, ought to be more or less familiar to the profession. For the death-rate may not be a true indication of the prevalence of disease in a given locality, as instanced in Dr. Hatch's report in the case of Yreka, Siskiyou County, where malarial diseases prevail 'to the extent of seventy-five cases in the hundred' during certain months, and yet the mortality, from all fevers combined, is only four. And so it may be said, if the combined mortality of fever in Santa Barbara and Los Angeles is only thirty-six, these figures do not settle the quesiton of the immunity of the localities mentioned from malaria.

"The statistics of the State Board have established this fact, that malaria is found everywhere throughout California, and the conditions surrounding the etiology are about the same everywhere, for this paludal poison is not confined to the valleys and moist lands, but is present as well in our foothills, in our dryest mesas, and on the highest mountains. Still, of the true malarial types the cases are few, mostly imported, this side of Bakersfield. . . .

"The classic chill and fever is rarely met with here, except, perhaps, along the river bottoms and among some of the cienegas. . .

"In 1878 the total mortality by remittent and intermittent fevers is given as 53, of which 23 were in the Sacramento and San Joaquin Valleys – less than one-half – although, according to the reports of 'Prevalent Diseases,' the ratio of cases of periodical fever occurring in these valleys as compared with all other portions of the State is very much greater. The fact is another corroboration of the statement often made as to the mildness of the malarial fevers of the valleys of California. Probably not more than two-thirds of the cases occurring in the localities from which the reports of sickness are received ever find their way into the returns, many of those who suffer being in the habit of treating themselves."

The following interesting item was found in the "Report of the State Engineer to the Legislature of the State of California – Session of 1880, Part I, page 25", written by William Hamm Hall.

"Fully as trying was the experience of the members of Parties Numbers 1, 3, and 4, along the rivers and swamps in the San Joaquin and Sacramento Valleys. On one occasion nearly every member of the Party Number 1 was stricken with malarial fever."

In the Sixth Report of the State Board of Health dated June 30, 1880, on page 58, we find the following items of interest written by F. W. Hatch, M.D., being a special study of the sanitary conditions of Sacramento. In his introduction he describes in general the climatic and health situation throughout the Central valley. He says, "Along the whole of this extent of country, a distance of perhaps 500 miles, malarial fevers constitute the prevalent forms of disease; malarial influence affects and modifies almost all the diseases usually brought under the observation of the physician."

He continues further, "As late as 1852, the mortality in the city (Sacramento) by diarrhea and dysentery amounted to 150, from cholera to 102, and from malarial fevers 140."

In 1878 the mortality in the city with a population larger by some thousands was for diarrheal diseases, only 19 and for fevers, malarial and typhoid, only 27. "It is to be noticed that the excess of deaths in Sacramento is due, in part to malarial or remittent and intermittent fevers. The malarial element as already mentioned is a constant one. It appears to be inseparably connected with the topography of the valley. . . . If we could eliminate from the fevers proving fatal here, the malarial element, the deaths by the class of disease would be greatly reduced. But even during the past year the mortality by intermittent and remittent fevers was only .4 per 1000 population. . . . The recollection of the past, and its disasters by flood, linger as the phantoms of an unpleasant dream; they fail to look beyond the fact of the chill and fever of which they may have been the occasional victim; they predict the failure of any system of drainage or sewerage."

In the Seventh Report for the period from July 1, 1880, to December 31, 1881, on page 106, we find an appendix on "Irrigation and Drainage" written by J. P. Widney, M.D. We have selected therefrom the following:

"The conclusion seems to be fairly just and legitimate, then, in the absence of any other apparent cause, and from what we know of the close connection between defective drainage and malaria, that, in this case, the relationship is that of cause and effect. With thorough drainage, the places which, by all other rules, should develop malaria escape it almost entirely; without drainage, the places which, by all other rules, should be free from it, develop it constantly and actively.

"The whole history of irrigation in southern California goes to impress this lesson: that, to escape malaria, drainage must go hand in hand with irrigation; that unless it does, the water which brings wealth brings also disease and death.

"The cienaga lands of Los Angeles could easily be drained by a few large, deep canals, with lateral ditches, but as yet, it has seemed impossible to get the people who are the chief sufferers to unite in carrying out the work.

"It is probable, that in the great interior valley of the Sacramento-San Joaquin, entirely away from all sea breeze, and with a Summer temperature much higher than in Southern California, the exemption from malaria, even with thorough drainage, would not be so complete, yet in the light of the foregoing facts it is safe to say that such drainage would unquestionably render the poison much less active.

"Apart from any question of health, drainage is the solution to another difficulty – alkali. Thorough drainage, with irrigation, will leach out the soil and reclaim it, while without drainage the experience of irrigators is, that alkali increases, until eventually the lands become entirely worthless."

The implication from Dr. Widney's remarks is inescapable that about 1880 malaria was present in the Los Angeles area. This is contradictory to the general impression that malaria was not endemic in southern California. The present writers do not have the time and facilities available to investigate this interesting problem, and we therefore suggest its study to a medical historian or to the School of Public Health at UCLA as a research project. It is not inconceivable that malaria could have been endemic in certain local areas in Southern California under careless irrigation, just as endemic malaria has been present at various oases in desert areas in North Africa.

Irrigation was introduced into California at an early stage of the Spanish-Mexican occupation of California, by the missions and pueblos, but it was not until 1871 that the first irrigated "colonies" as such were established, one at Riverside and the other at Anaheim. By 1890 there were slightly more than one million acres under irrigation, most of it in southern California and in the San Joaquin Valley.

The Ninth Biennial Report (1884-86) has several things to say about malaria. The following appeared on page 70.

"The fatality from these diseases reached the number of forty-seven, the great majority being from remittent, or so called bilious fever. The highest death rate in any month being six, the mortality can truthfully be adjudged as small when we consider the number of persons that yearly suffer from paludal fevers. It has been noticed that malarial fevers have increased in those sections of country where irrigation has been inaugurated to increase the fertility of the soil. Pernicious fevers are, however, rare in California, and very seldom, indeed, is the algid form witnessed. The ordinary forms of paludal fevers yield readily to quinine, and those living in regions where they prevail seldom call a physician to their aid, being content to take their quinine with their coffee as a morning beverage."

Also, on page 187, George M. Kober, M.D., in reporting on Surprise and Goose Lake Valleys in Modoc County states that he has seen a few indigenous cases of malaria in his practice.

"The few indigenous cases of malarial fever, which I have observed here, occurred in persons living in the low lands; they were by no means typical cases of remittent fever, but nevertheless, due to malarial poisoning. The majority of the cases treated by me were imported. In view of all the facts, as I review them, I consider malarial fevers extremely rare in this region, and the tendency in imported cases is to ultimate recovery": He also reports: "I was informed by one of the pioneers of this valley that when the company of the Second California Volunteer Cav-

alry arrived here in July, 1865, a great many of the men were suffering from 'chills and fever' contracted in the Sacramento Valley, where the company was mustered in, and that 'after a few months they looked like a different set of men'."

In the Tenth Biennial Report (1886-1888) there is an article, "Irrigation and Forestry considered in connection with malarial diseases," by H. T. Orme (pp 224-227). We quote the following:

"The subject of irrigation in a sanitary point of view has for some time occupied the attention of physicians and other scientists. It is a subject upon which opinions differ, and in a country where the system is so extensively practiced as in California, it becomes of the first importance to ascertain its effects upon the general health of the population. The study is an interesting one to the sanitarian, on account of the different effects observed in the different localities.

"Irrigation has been practiced in California since the establishment of the early missions, more than a century ago; but little improvement has been made in the application of the system, the object of the cultivator being to get the water upon his land without regard to the methods employed. The establishment of irrigation companies, however, bids fair to remedy this evil, and careful investigation and scientific research will doubtless soon develop the best methods of irrigation and their proper application to different localities. I have thus far personally investigated this subject only in the locality in which I reside (Los Angeles and vicinity), and the result of my observations convinces me that no evil effects are to be dreaded from irrigation *when properly conducted.* The higher lands, when planted with trees and vines and well irrigated show no traces of malarial influence. The soil, being a gravelly loam, readily absorbs the moisture, and the conformation of the land affords ready surface and subsoil drainage.

"It is mostly on alluvial lands that evidences of malaria are manifest. In some sections along river banks the soil, fertile with humus (the dead matter of prior vegetation), is charged with the elements of malaria, which only await a summer temperature above 60 degrees and an upturning of the surface to induce that poisonous fermentation which destroys health and endangers life. Such regions, however, are limited, and wherever the character of the land renders it susceptible of drainage, the evidences of malaria disappear. . . .

"Therefore, in this connection the subject of forestry or arbor-culture may be properly considered as prophylactic to malarial or miasmatic diseases. It is a well established fact that in malarial districts the planting of shrubs and trees has had the effect to greatly modify, if not entirely remove, the malarious influence. . . . But far more efficacious than all, owing to the rapidity of its growth, its wonderful powers as an absorbent, and the balsamic exhalation of its essential oil, is the Australian blue gum tree *(Eucalyptus globulus).* The genus eucalyptus contains over seventy species, of which six or eight have been introduced into California. Inferentially it may be said, that similar properties prevail among the species, though they may differ in their proportion of properties.

"In a valuable paper read before the Medical Society of the State of California, Dr. W. P. Gibbons says: "It has not been proved, though asserted until belief is established, that the aroma of the eucalyptus is effective in preventing the incubation of intermittents."

Of course we are now aware that the real effect of the planting of eucalyptus was to lessen the amount of surface water in which mosquitoes could develop, and thus reduced the *Anopheles* population in a limited area.

It is interesting to note that although Laveran had in 1880 described the causative *plasmodium* of malaria in the blood of patients, news of this discovery, and its implications, apparently had not reached California physicians in 1888.

The Eleventh Biennial Report (1888-1890) went into considerable detail as to the prevalence of malaria, month by month. The deaths reported were as follows: Fiscal 1889–74; Fiscal 1890–43. There was also an attempt to indicate the distribution of the disease, by reporting the localities in which it had been noticed by physicians. We have made the following tabulation from both the Eleventh and Twelfth Biennial Reports, listing the various localities and the number of months in which they were mentioned.

Alturas 1, Anderson 9, Angels Camp 2, Bakersfield 8, Benicia 2, Bodie 2, Brownsville 1, Calico 1, Chico 6, Cloverdale 4, Colfax 1, College City 1, Colton 1, Cottonwood 12, Dixon 4, Downey 3, El Monte 2, Elsinore 1, Etna Mills 2, Fresno 12, Folsom 1, Fort Bidwell 1, Galt 3, Grass Valley 1, Gridley 4, Hanford 2, Igo 4, Ione 7, Kingsburg 1, Knights Ferry 16, Lakeport 1, Lemoore 6, Lincoln 2, Livermore 1, Lockeford 9, Lodi 7, Loomis 1, Los Angeles 1, Mariposa 1, Marysville 3, Merced 2, Middletown 1, Millville 2, Needles 4, Newcastle 6, Newman 2, Nicholaus 1, Oakdale 2, Oakland 2, Ontario 2, Ophir 1, Oroville 1, Pacific Grove 1, Pleasanton 1, Red Bluff 2, Redding 8, Rochlen 2, Rio Vista 2, Riverside 1, Sacramento 5, San Diego 1, San Bernardino 4, San Francisco 4, San Jose 1, San Pedro 1, Santa Cruz 1, Sausalito 2, Selma 1, Shasta 4, Sierra City 2, Sesson 2, Tehachapi 1, Traver 1, Truckee 10, Tulare 4, Vacaville 1, Visalia 3, Wheatland 6, Williams 3.

Too much analysis should not be given to such a tabulation, since its basic data are very incomplete and irregular. In some towns evidently the doctors did not report malaria; Oroville was a conspicuous example. The frequency of reports from Truckee is easily explained; many people from the Central Valley went to Lake Tahoe for summer vacations—in some cases primarily to escape the malaria season—and had relapses while there. The doctor at Knights Ferry in Tuolumne County must have been conscientious in reporting his cases. There are confirmatory evidences of several areas of known high endemicity, the Placer County area from Rocklin up to Colfax, and the Shasta County area around Redding, Anderson and Cottonwood.

The Twelfth Biennial Report (1890-92) begins to present both morbidity and mortality reports for malaria. Efforts evidently were being made to obtain better death records, and the reporting of cases of communicable disease. But it required a long period of educating the doctors to bring about reasonably good

reporting. As late as 1919 Gray, then State District Health Officer, was struggling with scant success to get physicians to use the standard nomenclature of causes of death. And reasonably adequate reporting of cases of communicable diseases had to wait the time when a considerable part of the population was served by full-time health departments.

For Fiscal 1891, 54 deaths from malaria were recorded, and in Fiscal 1892, 42 deaths. The morbidity reports were as follows:

	July	Aug.	Sept.	Oct.	Nov.	Dec.
1891	321	368	379	292	213	139
	Jan.	Feb.	Mar.	Apr.	May	June
1892	118	176	181	191	150	118

It may now be appropriate to describe the areas in California which are definitely known to have had endemic malaria from its introduction about 1831 up to 1900.

In general, it may be stated that much of the Central Valley was afflicted, from the area around Bakersfield at the south to Redding and its environs at the north. In addition, much of the foothill area of the Sierra Nevada Mountains, up to about an elevation of 3,000 feet, was also malarial in numerous areas, even upon the ridges when seepage from mining or irrigation ditches occurred. Endemic areas in the foothills included, from south to north, Mariposa, Sonora and Columbia, the Angels Camp-Jackson region, Placerville, the Rocklin to Colfax area, Dutch Flat and Gold Run, Grass Valley and Nevada City, Downieville, Oroville and Cherokee.

The west side of both valleys had little or no malaria above roughly an elevation of 500 feet, due presumably to less rainfall and relatively little run-off from the east slopes of the Coast Range, and even in the lower elevations malaria was at a low prevalence except in localized places such as Colusa and Tehama.

Continuing north from the Redding area, there was an endemic area in Shasta Valley, including Etna Valley and Yreka in Siskiyou County, and another endemic area in Fall River Valley in Shasta County.

There may also have been an endemic area in Los Angeles County in the 1870's and 1880's, but further research will be necessary to establish this conjecture as a fact.

We are also of the opinion, which is difficult to prove as a fact, that malaria in the Central Valley as a whole probably reached its peak prevalence about 1880, and thereafter began to decline, with local interruptions resulting from the introduction of new irrigation systems, as for example, at Los Molinos about 1911, and at Anderson-Cottonwood in 1918. Probably each new irrigation project resulted in a greater or less increase locally in the prevalence of malaria. But the general trend, certainly after 1900, was toward a lessening of the amount of malaria, the trend being most noticeable, and earlier, in the San Joaquin Valley, where the annual rainfall was appreciably less than in the Sacramento Vallley.

We consider it possible that malaria would have continued to decline in California after 1900, toward a point where it would have been of little or no economic or public health importance, even without the mosquito control operations which began in 1910. This decline would have been parallel to the decline observed generally in the United States, and particularly along lines similar to the disappearance of malaria in the upper Mississippi Valley, as described by Ackernecht[10]. Mosquito control operations accelerated this natural decline, and in some localities (for example, at Penryn in Placer County) brought it to an abrupt end. Mosquito control also eliminated certain endemic areas, such as Los Molinos in Tehama County, and the Redding-Anderson-Cottonwood area in Shasta County. But in the Shasta Valley in Siskiyou County, malaria disappeared naturally without any attempt at mosquito control, so far as we have been able to ascertain.

A very interesting side light on the effects of malaria is contained in two typescripts in the possession of the State Librarian. These were written by Harry E. Butler of Penryn (in Placer County), who in January, 1957 at the age of 85 was living in Oakland. Mr. Butler was raised in the Penryn area and spent most of his life there, and wrote from his own personal knowledge. The two typescripts are entitled respectively, "The Placer County Citrus Colony of Loomis (California) 1889-1896 (the English Colony)", and "History of First Malaria-Mosquito Control Campaign in U. S. at Penryn, California, 1910-12." The date of writing of the first is not certain; the date of the second was April 15, 1945. Both typescripts were sent to the State Library on February 15, 1946.

Mr. Butler states that malaria was present in the foothill areas of Placer County at least from 1860 (we now know, however, that it must have been present for many years previously, probably as early as 1833). There had been some placer mining in the gulches and ravines during and since 1850, and he mentioned that there were two or three shaft mines in the 1880's, where he had seen many miners lying in rows at the bunk houses, stricken with malaria. As a result there was a heavy turnover of labor, and at least partly on that account those mines were abandoned before 1890. Granite quarries employed many men from 1875 to about 1895, but a large percentage of the men were laid off every other day with chills, and their families suffered severely from malaria.

Fruit orchards were started on a commercial scale in the late seventies and early eighties, and from the beginnings the orchardists depended almost entirely on Chinese labor, as the Chinese seemed to endure the malaria, while white labor could not or would not. In 1894 there began in influx of Japanese laborers, who eventually took over practically all the labor needs of the area.

The "English Colony" at Loomis was initiated in 1889 by J. Parker Whitney of Boston and London, England, who owned 25,000 acres in the Whitney Ranch near Loomis. Some 2,000 to 3,000 acres of rolling foothills in the Penryn-Loomis area began to be developed, starting with the arrival of the first colonists from England in 1890. The peak development of the colony was reached in 1892 and 1893, but the colony had faded out within the next ten years.

These Englishmen tried to establish an English countryside in the Placer County foothills between Loomis and Newcastle, a region well adapted to fruit growing, as well as to their sports of riding to hounds, coursing matches, cricket, tennis, fetes, picnics and hunting. They built fine homes in which they dispensed hospitality and gracious living, and established a Citrus Colony

Club. They even established an agricultural college. While the colony lasted it was a colorful episode in California history.

But malaria, plus the financial depression of 1893-1897 ruined the colony. It might have weathered the depression, as many of the owners were wealthy, but they could not withstand the malaria. Gradually they moved away, a few to return to England, many to other parts of California, and some to British Columbia and other places. Their fine houses gradually disappeared; a number burned down, some were torn down. Shortly after the colony had faded the orchards began to come into full bearing, and worked by Oriental labor, began to be very profitable. Today the area is one of the premier fruit areas in the State. But malaria was the basic destroying agent of the English colony.

After 1892 and until 1909 malaria receives scant attention in the biennial reports of the State Board of Health. In the 13th Report (1892-94), other than the reports of morbidity and mortality due to malaria, no mention is made of the disease.

On April 16, 1894, the State Sanitary Convention was held at San Jose but nothing concerning malaria was noted in the proceedings.

Morbidity reports of prevailing diseases from 63 towns and districts with an aggregate population of 493,624 outside of the larger cities show malaria exceeding all other diseases reported during the following periods inclusive: July 1892-February 1893; May 1893-October 1893; and April 1894-June, 1894.

In the 14th Report (1894-96), morbidity reports of prevailing diseases from 48 localities outside of the larger cities and towns show malaria exceeding all other reported diseases during the following periods inclusive: July 1894 through December 1894; July 1895 through November 1895; and June 1896.

The only mention of malaria beyond the usual statistical report was that made by J. R. Laine, M.D., Secretary of the Board, in his paper titled "Public Hygiene" presented at the 4th Annual Sanitary Convention held at Los Angeles April 20, 1896. He says: "The waterborne diseases are cholera, typhoid fever, *malarial fevers*, and diarrheal complaints. . . . Malarial diseases may be contracted in other ways than by water, but water is a prolific cause of malarial diseases. Water taken from sources having the paludal germ or water taken from wells in marshy places or regions known to be malarious, may be the cause of the disease."

The 15th Biennial Report (1896-98) apparently was not printed, and the 16th (1898-00) and the 17th (1900-04), also very brief, lists the deaths from "typho-malarial" and "intermittent" fevers combined, as follows:

Population	*Period*	*Deaths*
704,431	July 1899-July 1900	30
546,435	" 1900- " 1901	18
680,041	" 1901- " 1902	19
755,648	" 1902- " 1903	23
969,328	" 1903- " 1904	30

In the 19th Report (1904-06) and the 20th Report (1906-08) there was nothing on malaria.

The absence of particular mention of or interest in malaria, in these reports for the period 1892-1909 does not mean that the disease was not present or even prevalent in the Central Valley. While we are of the opinion that there was a gradual decline in the total amount of malaria in the Central Valley during this period, we think that the indications are that the decline of malaria in the San Joaquin Valley was definite and appreciable, except in a few local foci of endemicity; on the other hand, malaria continued at a relatively high endemic rate in the Sacramento Valley and the Sierra foothills. For example, from numerous conversations with old residents and physicians had by Gray during the period 1910-1919, it is fairly certain that malaria was quite severe in lower Placer County, Yuba County, Butte County (especially at Cherokee and Oroville) and Shasta County (especially around Redding), and was present in less degree at Tehama and Los Molinos in Tehama County, in Shasta Valley in Siskiyou County, around Grass Valley and Nevada City in Nevada County, in parts of Sacramento County, and around Colusa. Yolo County, and the western parts of Colusa, Glenn and Tehama Counties, appear to have had very little malaria, which was also the case with the west side of the San Joaquin Valley.

A detailed study of malaria, county by county, in the Central Valley, is desirable, but we do not have the time nor facilities to make such studies. It is our hope that the Bureau of Vector Control in the present State Department of Public Health will stimulate the several county health departments to make such studies, possibly in cooperation with the various State Colleges.

We now come to the time when the discoveries of Ross, Grassi, Celli, Manson and others had demonstrated that malaria was transmitted only by the *Anopheles* mosquitoes, and the practical application of this fact had been successfully made by Gorgas and LePrince in Cuba and on the Panama Canal. This knowledge was slowly accepted by the medical profession, and even more slowly by the general public. But by 1909, three men in California combined to bring the new knowledge to bear upon the malaria problem in this State. One of them was William Brodbeck Herms, a newly appointed (1908) Assistant Professor of Entomology in the College of Agriculture in the University of California. He had suffered severely from malaria as a child in Ohio, and intended to be a physician. But when the news about the transmission of malaria by mosquitoes came to his attention, he decided to become an entomologist.

Another was Dr. William F. Snow, the new Secretary of the State Board of Health. Dr. Snow promptly recognized the importance of malaria in the rural areas of the State. In the 21st Biennial Report (1908-10) he said (p. 25):

> "*Malaria* has taken its toll of human lives amounting to 192 for 1908 and 1909, but the active growth of citizens' organizations to fight the malaria-carrying mosquito, and the open policy of encouragement adopted by the newspapers, bid fair to make this needless loss of life and attendant expense a thing of the past."

He also, in a Bulletin of the State Board of Health (December, 1909) termed malaria "the Minotaur" of California and made a strong plea for measures to reduce its incidence. Until his resignation in 1914 to become the distinguished Secretary of the American Social Hygiene Association he strongly supported the work of Professor Herms.

Dr. Snow also estimated the annual cost of malaria to California (see page 6, "Malaria — Cause and Control" by W. B. Herms: Macmillan Co., New York, 1913) as follows:

Deaths of 112 citizens at $1700 (Average economic value)	$ 190,400
6000 acute cases of malaria at average of $20 per year for drugs, etc.	120,000
6000 citizens' earning power reduced 25% by malaria, estimated average income $800	1,200,000
Loss of life, wages, illness from other diseases given opportunity through lowered resistance brought about by malaria, estimating 50 deaths at $1700, and 1000 persons ill at $100 each	185,000
Loss through sacrifice sales of farms and moving expenses of families leaving malaria districts, estimating 250 families at $500	125,000
Loss through depreciation in land values, estimating $1 per acre only on 1,000,000 acres under irrigation in the Sacramento and San Joaquin Valleys	1,000,000
Total	$2,820,400

The extreme conservatism of Dr. Snow's estimate is indicated by only $1,700 as the average economic value of a human life, by an average annual income of only $800, and by an average depreciation in land values of only $1 per acre. An estimate of between seven and ten million dollars per year would have been more nearly in line with actual losses.

The third man was Harry E. Butler, a large fruit grower at Penryn in Placer County. As Mr. Butler tells the story in his "A History of the First Malaria Mosquito Control Campaign in the United States, at Penryn, California, 1910" (previously referred to), Frederick E. Morgan, the young minister of one of the Penryn churches came into his office late in 1909 and said "I've heard a person can get malaria in no other way than from the bite of a mosquito. What do you know about it?" Butler replied, "I've heard that too. Why don't we do something about it?" They discussed the matter, and decided that if their friend Dr. Wallace A. Briggs in Sacramento confirmed the theory they would act.

In a few days confirmation came from Dr. Briggs, so Morgan sent a letter to the University of California, outlining to it the malaria situation in the Penryn area, and asking if it would be possible for the University to conduct a survey and make recommendations for control. Very shortly the University sent Professor Herms, who made a study of the problem and outlined a plan of control operations for 1910. The Penryn Fruit Company (largely owned and managed by Mr. Butler) supplied a small office and laboratory, and contributed almost all the funds for control operations in 1910 and 1911. Without Butler's enthusiastic support nothing could have been accomplished.

It is an interesting and important point to notice that Herms began his operations in the winter and early spring of 1909-10 by talking to and teaching the people at Penryn. A natural teacher, he realized that such a campaign could be successful only if the people involved understood what needed to be done, and how and where. In all his later work for the people of California, Herms never overlooked or neglected that important fact. For successful malaria control the people must support the program, and to gain that support the people must understand the problem.

In one respect Harry Butler's title was partially incorrect. He described the campaign as the "first malaria mosquito" control campaign in the United States. It is probable that at least two malaria control campaigns in the United States antedated the Penryn campaign, one at Brookline, Massachusetts in 1901 and probably earlier, another at Ithaca, New York, in about 1907. Both of those campaigns were based largely on drainage, and there does not appear to have been a clear-cut distinction between Anopheline and Culicine mosquitoes. But at Penryn funds were so restricted that it was necessary to concentrate on the *Anopheles* mosquito only, and to almost ignore the *Culex* species. In that respect the Penryn campaign was the first selective attack upon only one vector species of mosquito for control of malaria in the United States, an idea which was to be developed and used widely by Sir Malcolm Watson and others in many parts of the world, and to which Schwellengrebel gave the name of "species sanitation."

Herms had also had some knowledge of the malaria problem in the State through his connection with the "Agricultural and Horticultural Demonstration Train" operated jointly by the University of California and the Southern Pacific Railroad from 1908 to 1913. On this train one-half a car was devoted to an exhibit of various animal parasites, and an exhibit on rural sanitation, in which mosquito control and fly control were prominent. Herms also, in the summers of 1916, part of 1917, and 1919, with the cooperation of the State Board of Health, conducted a malaria-mosquito survey of the State. A summary of the results of that survey appeared in the Monthly Bulletin of the State Board of Health for January, 1920.

It is also a notable fact about the Penryn campaign that Herms insisted that to the greatest extent possible the places where mosquito larvae were found should be eliminated by either drainage or filling, to minimize the need for repetitive applications of oil as a larvicide. In the foothill area of Penryn, with adequate slopes in the terrain, this was readily accomplished with short ditches or small fills.

The 1910 campaign at Penryn was very successful. Indices of malaria based on school attendance showed a reduction in malaria that year of about 45%. Very little additional work needed to be done in 1911, and by 1912 malaria was a thing of the past in the Penryn area, and except for occasional sporadic cases has not returned. Seldom has such a large effect been obtained for so small an outlay (about $716 in 1910 and about $100 in 1911).

In 1910, also, two other malaria-mosquito control campaigns were begun, one at Oroville in Butte County, the other at the southern end of the San Joaquin Valley at Bakersfield in Kern County. Both were supported mainly by subscriptions by individuals, though the City Council of Oroville contributed about $600 to that campaign. Both campaigns were continued in 1911, but in subsequent years public interest lagged, little money could be collected, and the work ceased. But the work done had appreciably reduced

both the amount of malaria and the annoyance from mosquitoes, so that neither appeared to the local people sufficiently important to require further effort unless the local authorities (county or city) would undertake it. But Boards of Supervisors and City Councils were most reluctant to spend public money on public health projects, and the effective impetus toward the creation of governmental units which could control mosquitoes, and thereby malaria, came not from the public health people, but from real estate developers who were being badly hurt in their pocketbooks by excessive prevalence of salt marsh mosquitoes in areas which had never had malaria.

In 1913 under the inspiration of Herms, with the support of the State Board of Health, a bill known as the Guill bill, was introduced into the Legislature to provide for the organization, powers and financing of special districts for the control of disease transmitting mosquitoes. This bill passed both houses of the Legislature but was vetoed by the Governor (apparently in his opinion it was merely a bill sponsored by a few medical crackpots for the benefit only of a few farmers). But as early as 1906 the communities of San Mateo and Burlingame south of San Francisco had begun mosquito control campaigns against salt marsh mosquitoes, financed initially by private subscriptions. But this method of financing resulted in diminishing returns, and the real estate people were having great difficulty in selling property because of the mosquitoes. Therefore in the 1915 Legislature the real estate lobby introduced a bill to provide for the organization of mosquito abatement districts, which was passed by the Legislature and promptly signed by the Governor, who was uninterested in the sickness and distress of rural residents, but who promptly paid attention to the screams of outraged realtors over their lost profits.

This law, as subsequently amended and incorporated into the Health and Safety Code, is the legal authority under which most mosquito control work is performed in California today.

Under this law a few districts were organized promptly, the first being the Marin County District in December, 1915, followed by the Three Cities District (now San Mateo County District), the Dr. Morris district (now Kern District), and the Oroville and Fair Oaks Districts in 1916, the Los Molinos District in 1917, the Durham District in 1918, and the Shasta District (originally the Redding, Anderson and Cottonwood Districts) in 1919. Of these districts only the Oroville, Los Molinos, Durham and Shasta districts were organized primarily for malaria control, and the Dr. Morris (now Kern) District partly for malaria control and partly for pest mosquito control. The Fair Oaks District in Sacramento County was organized for malaria control, but in a few years malaria disappeared and the District suspended operations. Of the present 43 active districts (excluding operations by health departments) all except four have been organized primarily to abate pest mosquitoes, although in the Delta (Tulare County, 1922) and Pine Grove (Shasta County, 1931) Districts some attention was originally given to *Anopheles* control. We consider these facts to be further evidence that malaria, except in a few circumscribed localities, had ceased to be a matter of primary importance in California by 1915, but people were becoming aware of the economic and nuisance importance of mosquitoes.

REPORTED CASES OF MALARIA, CALIFORNIA
1915 - 1956

Year	Reported Cases	Year	Reported Cases Civilian		Reported Cases Military
1915	527	1940	175		
1916	935	1941	139		23
1917	749	1942	83		64
1918	666	1943	145		1,902
1919	1,055	1944	128		1,543
1920	484				
1921	269			Indigenous Cases	
1922	215				
1923	196	1945	275	35	1,633
1924	107	1946	568	21	656
1925	77	1947	110	18	43
1926	94	1948	46	14	6
1927	58	1949	19	2	10
1928	67	1950	14	6	4
1929	100	1951	33	5	255
1930	94	1952	173	17	753
1931	80	1953	95	32	334
1932	51	1954	41	3	28
1933	84	1955	32	2	99
1934	185	1956	51	6	10
1935	173				
1936	189				
1937	171				
1938	358				
1939	269				

Source: State of California, Department of Public Health, Bureau of Acute Communicable Diseases

The decline of malaria since 1915 is fairly well shown in the accompanying table of reported cases, as tabulated by the State Department of Public Health. In appraising these reports it is necessary to realize that until about 1935 hardly one-half of the actual cases were reported, and during the period 1915-1925, roughly, perhaps not much more than ten percent of the cases were reported. Not only were many physicians negligent in reporting the cases treated by them, but probably many more cases were self-treated than went to doctors.

It is also probable that in the period 1935-1940, which covered the "dust bowl" emigration to California from Oklahoma, Arkansas and Texas, a substantial number of cases among these migrants were not reported.

Beginning in 1941 the State Department of Public Health began segregating the reported malaria cases into civilian cases and military cases, because of the large number of cases acquired by non-resident military personnel operating in the southwest Pacific area of war, and the Burma-India area, who were returned to California for various reasons, including hospitalization and for medical discharge.

It was a fear that the return of these large numbers of infected military personnel (with not only malaria, but also with dengue, filariasis and virus encephalitides might result in an increase in malaria and a possible introduction of Japanese B encephalitis, that stimulated the Legislature in 1945 to provide special funds for mosquito control by the Department, and through subventions to increase the scope and efficiency of

COUNTY	Number Examined	Percent Positive Spleen	COUNTY	Number Examined	Percent Positive Spleen
Shasta	352	12.2	Sacramento	1,145	2.2
Tehama	542	8.6	San Joaquin	333	1.1
Glenn	380	6.3	Stanislaus	693	0 9
Butte	671	3.7	Merced	432	0.9
Colusa	399	4.7	Fresno	216	0
Sutter	549	5.3	Riverside	365	0.8
Yuba	426	5.2	Orange	308	0.9

mosquito control measures by local health departments and mosquito abatement districts. This subvention program, which has been continued to the present time, resulted in the organization of many new districts, the enlargement of others, and the consolidation of some small, inadequately financed districts. The program also improved the techniques and standards of performance of mosquito control operations. The augmented mosquito control program was, however, oriented mainly toward better control of pest mosquitoes and of the vector *(Culex tarsalis)* of virus encephalitis. It is doubtful if these operations had any discernable effect upon malaria, even though an appreciable amount of study of control methods for *Anopheles freeborni* in rice fields has been carried on.

Since 1945 the State Department of Public Health has made epidemiological studies of reported civilian cases and has segregated and reported separately those cases which were evidently acquired within the State (indigenous cases). For a present population of about fourteen million, these indigenous cases are extremely few, and for practical purposes, it may be said that malaria is no longer endemic in California. However, there are apparently a few minor foci of infection still to be cleared up, as evidenced by six indigenous cases in 1956.

But although definitely dying out in most parts of the Valley, the disease was still prevalent in a number of "hot spots" after 1912, and continued at a low rate in other areas. The irrigation project at Los Molinos in Tehama County was nearly ruined by malaria, but was rescued by the company's engineer, T. H. Means, with the advice of W. B. Herms and Gray. The Redding area in Shasta County was probably the worst. In 1915 Frank Kelly and J. C. Geiger ran 435 blood smears at Redding, and found 35 positives (8.1%). In comparison, in 1916 K. F. Meyer ran 636 blood smears at Chico and Gridley in Butte County, with only two positives.

With the opening of the Anderson-Cottonwood Irrigation District in 1918 the disease flared up in epidemic form in the Redding area. Gray[11] studied the economic loss caused by malaria in the area in 1918, and on the basis of case histories found 590 cases in 1,081 persons (54.5%). In 1919 S. B. Freeborn at Anderson found out of 119 blood smears 29 positive (24.4%) and on case histories 86 positive (72.3%).

In 1926 Carley made a spleen index survey in 14 counties, with the following results:

The trend of diminution from north to south is very evident, with Shasta and Tehama Counties still leading.

Dorothy Beck in the 1930's made several blood smear surveys. In 1930 she found 1.7% positive out of 708 persons in Shasta County, and less than 1.0% positive out of 401 persons in Tehama County. In 1937, out of 531 smears taken in Yuba, Sutter and Butte Counties, none were positive, but in 1939, out of 525 smears taken in Yolo and Yuba Counties, there were six positives, or just over one percent.

The "dust bowl" migration of the mid-1930's set off several small epidemics of malaria. One of the most interesting occurred near Lodi in San Joaquin County in 1934, starting among migrants camped along the bottoms of the Mokelumne River. In 1934 there were 69 cases in this group, and in 1935 some 37 new cases were traced to this source.

In 1938 there was a small epidemic in Yolo County, with its focus in the migratory labor camp near Winters. There was 49 cases in the camp itself and twelve more within a radius of four miles. There was also a small outbreak among reservation Indians in Kings County. Another interesting item was a small outbreak of *falciparum* malaria near Woodlake in Tulare County in 1938.

In the Winters outbreak it is almost certain that *A. freeborni* was the primary vector, but in the Lodi outbreak it appears to us probably that *A. punctipennis* was the primary vector.

After 1919 the *reported* cases of malaria in the state show a definite downward trend – in the face of improved reporting – until 1932. From 1934 the trend is then upward, to a peak of 358 in 1938. This upward trend we believe was due mainly to importations from the "dust bowl" migration. The trend was then downward again until the advent of World War II, when there was another upsurge of reported cases. Excluding military cases, the increase was probably due to immigration of workers in war industries, mainly ship building and airplanes. Since 1946 the trend has again been down, with one sharp outbreak[12] in 1952 of 35 cases of *vivax malaria* (Korean strain) among Camp Fire Girls at Lake Vera in Nevada County, an area from which malaria had been absent since about 1930.

It is a somewhat surprising matter that so few cases of malaria appear to have resulted from the influx of Mexican "braceros" – agricultural laborers – into California. While many of them went into Imperial County and other southern counties where transmission of the disease would be improbable, large numbers went into the San Joaquin Valley, and lesser numbers into the Sacramento Valley, where transmission was possible. Perhaps some of the indigenous cases reported since 1945 may have resulted from this source. It is probable that five of the indigenous cases of malaria reported in Sacramento County in 1956 can be attributed to Mexican labor as the source.

CONCLUSION

In concluding this history of malaria in California a few statements should be presented concerning the reasons for the natural decline of the disease over a period of some 125 years since its introduction about 1830. Gray, in the Craig Memorial Lecture[4] of 1955 to the American Society of Tropical Medicine and Hygiene, presented six factors which he considered to have had an appreciable influence on the natural decline of malaria in the State. They were irrigation; water storage and river regulation; urbanization and the location of towns; animal husbandry; housing; and illumination at night.

After considerable further thought, we are now of the opinion that we have overlooked one factor of importance, which has occurred so gradually as to be almost unnoticed, unless one can project his mind back over a century or more and visualize certain natural conditions then existing, which the march of civilization has distinctly changed. This is "clearing", the inevitable destruction of natural forest as a result of agricultural and urban development.

Such early descriptions of the Valley and Sierra foothills as we have seen give a picture of a well wooded plain east of the main rivers, and of many trees in the foothills up to the forest belt generally above the twenty-five hundred foot line. Trees, many of them cottonwood, were dense along the rivers and streams. On the western side of both valleys trees were (and still are) relatively sparse, and southerly from the delta area trees were generally sparse on the east side of the San Joaquin Valley as compared with the Sacramento Valley, except near the streams debouching from the mountains.

In general, this distribution of trees seems to have coincided with the areal distribution of malaria. And as considerable shade seems to be favorable to the presence of *Anopheles punctipennis*, and less favorable to *Anopheles freeborni*, it is possible that *punctipennis* may have been relatively more numerous under the natural conditions originally occurring on the valley floor and in the lower foothills, and *freeborni* relatively less numerous, than was the situation after about 1910 when entomologists began to study these mosquitoes. Agricultural development greatly reduced the number and relative density of the natural trees, in order to make way for orchards and various crops. Both citrus and deciduous fruit trees, and olives, provide much less shade than the oaks and other natural trees. Construction of towns also destroyed many trees, and large numbers of trees, especially oaks, were cut down for firewood.

It is possible that this condition somewhat parallels the conditions in the Ohio River Valley and much of the upper Mississippi River Valley. When first entered by the white man, these areas were reported to be generally a magnificent, extensive hardwood forest, which was gradually cleared under the march of civilization, until at the present time the remaining "wood lots" are but remnants of the original forests. Malaria was a constant companion of the early settlers, but gradually declined in prevalence as farming, industry and the growth of towns changed the environment. Even though today *Anopheles quadrimaculatus* appears to be reasonably abundant in many parts of the area, malaria is no longer present. It seems probable that *punctipennis* is much less prevalent than it could be expected to have been, according to its ecology, under primitive conditions.

Today, in parts of the Sacramento Valley, *A. freeborni* appears to be about as numerous as when we first began to study it in the 1910-1920 period (in the rice areas it is more numerous) and yet malaria has practically disappeared. For several years past no indigenous case of malaria has been reported in the rice field area of the Sacramento Valley.

The reasons for the decline and practical disappearance of malaria in California will make a fascinating study. But we are by no means sure that this region has seen the last of this disease. It is conceivable that a major economic depression could occur, or that there could occur a breakdown of civilized life as a result of war, and in either case malaria could again become "the Minotaur of California". On this somber note we conclude this history, with the fervent hope that such a disaster will not befall this lovely land.

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President Murray: Thank you, Harold and Russ. Did you say what species of mosquito was responsible?

Mr. Gray: If I remember correctly, a number of years ago when Ted Raley was Superintendent or Manager – whatever they called him up there in Marysville – Ted made the remark that he thought that *punctipennis* was quite a bit more important in his area as a carrier of malaria than *freeborni* was.

Stan Freeborn was present at that meeting, and he jumped all over poor Ted. Ted wasn't quite as experi-

enced in those days as he is now, and about all Ted could do was tuck his tail between his legs and subside. I think I jumped on him, too.

I now apologize to Ted for that piece of work that both Stan and I did to him, because Russ and I are quite well convinced, even though Stan Freeborn doesn't entirely agree with us, that *punctipennis* has been a much more important vector of malaria than many of us thought.

Of course, I am now repeating my Craig lecture in Boston over a year ago, but the evidence is pretty much to the effect that the epidemic of malaria among the California Indians in the early 1830's was very largely transmitted by *punctipennis*, that the malaria among the miners in the lower reaches of the Sierra streams in 1849-50 was probably *punctipennis*. Later, however, in the period of early irrigation, it is probably that *freeborni* was a more important vector than *punctipennis*. But when you come to some of the later outbreaks, like around Lodi in 1934 and 1935, and in Nevada County in 1952, it was probably *punctipennis* which was more effective a vector than *freeborni*. So I think if you ever run into malaria again you can look for *punctipennis*.

(Applause)

President Murray: Thank you.

We are right on schedule. We have fifteen minutes for a recess to go out and get some fresh air. Please be here promptly at 3:15.

(Short recess)

President Murray: May the afternoon session come to order, please.

I have mentioned several times that we have exhibits outside and downstairs. These exhibitors have taken some of their time and they have contributed financially to present their products to us. It is my plan to have some of these exhibitors introduced at this time.

I would like to have you stand as your names are called and, after I have given these, if anybody else is here who has been overlooked, please say so.

We have Kennard Jones and Gary Larentson of Homelite. Are they here? They may have gone out. They are from the Homelite chain saws and pumps. We have John Bean represented here. Is there an agent present for them?

International Harvester Company, John Fullenweider.

Mr. Fullenweider: Here.

President Murray: There he is. What have you been exhibiting over there?

Mr. Fullenweider: We have an electric saw. Gentlemen, we don't have much. One of your counties here — I believe it is Alameda County — has a four by four unit, four wheel drive unit, with some of your mosquito control equipment mounted on it. We have a three-quarter ton unit out here with a portable power unit on it which we will be very happy to demonstrate.

I believe that comes up tomorrow.

President Murray: Tomorrow at 11:00

Mr. Fullenweider: So at that time if you gentlemen do have any questions or are interested in either one of those units or components in them, we will be very happy to try to answer them.

President Murray: With Pacific Pump and Supply Company is Mr. Williams. Mr. Williams is right here.

Mr. Williams: We have a table downstairs in the lobby. We will be glad to answer any questions you gentlemen might like to ask on F. E. Meyers spray equipment, pumps and complete sprayers, also the hydro-portable pump spray guns and spray accessories. We will be glad to help you on any questions you might have.

President Murray: Thank you.

Mr. Jones of Homelite.

Mr. Jones: We will be here tomorrow to demonstrate our equipment during the demonstration period. I will be back I guess.

President Murray: Fine.

Mr. Jones: We will bring our own logs and a little brush and what-not.

President Murray: Davis Tree Service, Mr. John Davis.

Mr. Davis: Don't let the tree service fool you, fellows; I know you are not concerned with that. But the whirlwind power duster sprayers, granular formations are broadcast through this KD Whirlwind unit I have on display downstairs. I hope you can all see the demonstration tomorrow. I don't think I can say anything here that will convince you as well as seeing that in operation. Thank you.

President Murray: Thank you.

Jim Hester of Moyer Chemical Company.

Mr. Hester: Besides having a few lines of agricultural and mosquito control material, we are emphasizing this year a product called Weedazol. You have all heard of it and probably have all seen it. It is an amino-triazole formulation in use particularly on cattails and tules. We are featuring that at this time in conjunction with a spreading material penetrant called X-77.

You might note that we have some pictures down there in our display which are taken of our laboratory. We have an analysis laboratory, and in conjunction with that I would like to extend an invitation to one and all to visit our laboratory facilities at any time that you are in San Jose. We are located at 1310 Bayshore Highway right here in San Jose. Thank you.

President Murray: Thank you.

Willys Motor Company, Kent Robinson.

Mr. Robinson: We have a fully equipped CJ 5 jeep out in the parking lot, and we also have a brand new forward control jeep which I think a lot of you have never seen, probably, and we would like you to see it.

President Murray: Thank you.

John Schramer of the H. D. Hudson Manufacturing Company.

Mr. Schramer: We have down in our display space our new five gallon per minute pump and also our new ten gallon per minute pump. I am sorry to say that these are both power take-off models so it will be a little difficult to actually demonstrate them or actually see them in use. However, I would be happy to explain to any of you gentlemen the complete workings and the job that it can do for you. Thank you.

President Murray: Thanks. Are there any others? I don't want to overlook anyone.

At 11:00 o'clock tomorrow, as showing on our schedule, we will have this live demonstration outside.

Are there any announcements from the floor? Tomorrow there is a little problem relative to where we are going to meet. There are two meetings: The Busi-

ness Meeting of our CMCA and an operational type meeting. We believe there will be more persons at the operational meeting than at the Business Meeting, perhaps fifty or sixty or so and this room will take care of that better than they could be cared for in other rooms in the hotel. It is likely that the operational individuals will meet here and those going to the Business Meeting will meet in the El Camino Room, which is out around the corner.

Dr. Duncan, it is my understanding, may be able to be here tomorrow. His talk is not long, but it is going to be a help to us to have it. It may be that we will all meet here at 9:00 o'clock sharp and hear what he has to say and then split.

Now we will conclude this afternoon's part of the program with some of the persons from our Federal Government who have had a lot to say about mosquito control in this country.

At the present time Dr. A. D. Lindquist is in Washington, D. C. He is head of the Entomology Research Branch, Insects Affecting Man and Animals Section.

Dr. Lindquist will give some information on Recent Research on Mosquito Control by the Entomology and Research Branch, USDA.

Dr. Lindquist: Mr. Chairman, Members, and Friends of the Association: About three months ago I received a letter from Dick Peters asking if I could attend and participate in this Conference, and I am very happy that arrangements could be made so that I could be present.

It is always a great pleasure to come to California. After all, I lived here at one time and worked here. I was thinking back, and that was almost twenty years ago when I was transferred from Texas to California to work not on mosquitoes, but on gnats, of all things, up at Clear Lake, California. Of course, they are pretty close to mosquitoes, so I guess I can qualify for almost being a mosquito control worker.

EXAMPLES OF RECENT RESEARCH ON MOSQUITOES BY THE ENTOMOLOGY RESEARCH BRANCH

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Research to find more effective and lower cost methods of controlling insect pests is a continuous and increasingly important function of the Entomology Research Branch of the U. S. Department of Agriculture. Public recognition of the deleterious effects of insects and the part that research plays in developing control methods is gratifying to entomologists even though this recognition means expanded efforts. For example, the reduction of an insect population by 75 percent can frequently be accomplished rather easily by cultural or insecticide methods, but this degree of control is usually not sufficient to prevent economic damage or undue nuisance to humans and livestock. I am sure every mosquito-control worker has experienced demands for more and better control even though the last 4 or 5 percent of an insect population is difficult and costly to destroy. This is only one of the reasons why Federal, State, and industrial workers have found it necessary to continue research to find better control measures.

The fact that mosquitoes, as well as other insects, are outwitting man by becoming resistant to insecticides has placed an added burden on research organizations. A vast amount of work has gone into the evaluation and development of substitute insecticides and formulations, as well as into studies directed towards a better understanding of the cause and nature of resistance and to find a remedy for it. More than ten years ago, with the advent of DDT and other organic insecticides, we were in an excellent position regarding control of most of the insects affecting man. In spite of current difficulties, the over-all situation today is better than before DDT and similar materials were available. With all the research going on in the United States and other countries of the world, we can expect that new materials and methods will be found. Furthermore, with greater emphasis being placed on the elimination of mosquito-breeding areas, this phase of control is certain to continue to move forward.

The widespread increase in irrigation of crops has brought new problems in mosquito control. Millions of acres are being placed under water, and the consequent increase in mosquitoes will come as an unpleasant surprise to citizens in these areas. Farmers and their livestock are the first to be affected. Nearby urban centers are next in line to be troubled by these pests. Since control by individual farmers or groups is usually impracticable or prohibitive in cost, in many of these areas nothing is done to protect the livestock or people. Mosquito production can be reduced greatly by proper land leveling and management of water, but research is needed in new areas to develop practical, low-cost procedures. Studies are also needed in older irrigated areas to find ways and means of avoiding costly releveling procedures and of properly managing water under existing conditions.

The demand for better insecticides has taxed the productivity of research workers for the last ten years, and prevented them from continuing basic work on biology of the pests and undertaking new long-term studies on other approaches to control. This situation is still with us, but several research organizations are again turning towards basic work in biology, physiology, and new methods. This is indeed a step in the right direction and provides a ray of hope for future mosquito control with a minimum of insecticides.

Control with larvicides

Although much has been learned about the relation between the structure of chemical compounds and their biological activity, it is not yet possible to predict the insecticidal effectiveness of compounds. Therefore, in order to find new insecticides an empirical screening program must be conducted. At our Orlando, Florida, laboratory all new compounds obtained from industry, our Branch chemists, and other sources are screened in simple tests against mosquitoes as well as body lice, house flies, and cockroaches. As would be expected, most of the chemicals are not very toxic to insects and are therefore discarded.

TABLE 1

Per cent mortality at 48 hours of *Anopheles quadrimaculatus* larvae exposed to compounds showing promise in screening tests.

Compound	:0.1 p.p.m.	:0.05 p.p.m.	:0.025 p.p.m.
Thimet	-----	100	100[a]
Chrysanthemumic acid, 6-bromopiperonyl ester	100	100	90
Chrysanthemumic acid, 2,4-diemethylbenzyl ester	100	70	56
Am. Cyanamid 12503	100	92	----
Chrysanthemumic acid, 1,2-dibro-4,5-emthylene dioxybenzy ester	100	46	----

[a] 76% mortality at 0.01 p.p.m.

Last year approximately 725 chemicals were screened against fourth-instar larvae of *Anopheles quadrimaculatus*. Approximately 34 of them caused from 50 to 100 percent mortality at 1 p.p.m. or less. The results with five of them are given in table 1. It will be noted that Thimet, a systemic insecticide applied to cotton seed and showing much promise against cotton insects, is the most effective material, causing 76 percent mortality at 0.01 p.p.m. This compound has a high mammalian toxicity and probably will not be widely used in mosquito control. Usually DDT gives about 100 percent mortality at this concentration. Of interest are the chrysanthemumic esters synthetized by our Branch chemists. Many of these materials are highly effective synergists of pyrethrum, and some of them are also insecticidal when used alone.

Last year aerial sprays containing malthion or Chlorthion plus auxiliary solvents gave between 89 and 99 percent control of resistant salt-marsh mosquito larvae when used at 0.25 pound of the toxicant per acre. At 0.1 pound per acre the 24-hour control was 78 percent for malathion and 60 percent for Chlorthion. These tests were conducted in Pinellas and Brevard Counties, Florida.

The control of larvae by introducting insecticides into the irrigation water before it flows over fields has been under investigation in this Branch periodically for several years. The recent discovery of a water-soluble material Dipterex (Bayer L 13/59) (Gahan *et al.* 1955) suggested a re-examination of this method. A low-cost water-soluble or solubilized insecticide which would remain active in water flowing for long distances in canals and over fields and pastures would be a boon to mosquito control in many situations.

The perfect insecticide for this purpose has not yet been found, but good progress has been made in evaluating a few materials in this way. The introduction of solubilized parathion at 0.01 to 0.1 p.p.m. into irrigation water being applied to California pastures eliminated all *Aedes nigromaculis* mosquitoes breeding within one-fourth to three-eighths mile. Control was not complete at greater distances. *Psorophora* larvae breeding in Arkansas rice fields were eliminated from areas as large as 10 to 30 acres with parathion at 0.5 p.p.m., 20 acres with Dipterex at 0.5 p.p.m., and 5 acres with Phosdrin (Shell OS 2046) at 0.25 p.p.m. The maximum distance the treated water moved through fields before any larvae survived was approximately one-fourth mile for parathion, at least one-half mile for Phosdrin, and 1.8 miles for Dipterex. In the rest of the field treated with Dipterex, the larval density averaged 0.09 per dip, whereas untreated fields averaged 5 to 10 per dip. The total distance traversed by the treated water was approximately three miles. More research is needed in the formulation and evaluation of these materials as well as a search for new water-soluble insecticides.

The use of granular insecticides for control of mosquito larvae has been popular for several years. Granules usually penetrate overhanging vegetation and reach the water surface more readily than liquid sprays. To obtain more information along this line, work on the characteristics of granular insecticides was initiated at Orlando. Information was needed on how evenly and rapidly various insecticides were released from different carriers upon contact with water. In beaker tests parathion on attapulgite became evenly distributed in all except the lower ¼ inch of water within 24 hours. Samples of water were drawn from several levels and tested chemically and biologically.

In other tests granular attapulgite, vermiculite, and diatomite containing 1 per cent of parathion showed faster release rates than 10 per cent formulations. The greater surface exposed to the water due to the larger amount of diluent probably was responsible. Bentonite did not behave in the same way as the other carriers. The addition of Triton X-100 and kerosene to attapulgite formulations had no effect on the release rate of parathion. However, the addition of Velsicol AR-60 or the introduction of 1 inch of soil in test breakers decreased the amount of insecticide released in the water. This work is being continued.

Aerial sprays against adult salt-marsh mosquitoes

Solutions of malathion in fuel oil, of Chlorthion plus trichloro-ethylene in fuel oil, and of Dipterex in water were applied by airplane to marsh, hammock, and citrus grove areas in Florida for the control of adults of *Aedes taeniorhynchus* and *sollicitans*. The sprays were applied at 3 to 4 quarts per acre from Stearman and Piper Cub airplanes at swath intervals of 50 to 125 feet. Malathion and Chlorthion gave equally good results at comparable dosages, as indicated in table 2. Dipterex gave excellent immediate control at 0.5 pound but not at 0.25 pound per acre.

Malathion is being widely used in Florida and has given excellent results against DDT-resistant mosquitoes. Equally good results have been obtained in California, but there are indications that the usefulness of this insecticide may be short-lived here because mosquitoes may be developing resistance to it.

TABLE 2

Per cent reduction of adult salt-marsh mosquitoes in Florida following treatment with various aerial sprays. Pretreatment count of mosquitoes landing on men, 47 to 364 per minute.

Terrain	Dosage (lb. per acre)	*Malathion*		*Chlorthion*		*Dipterex*	
		After 6 hours	After 6 hours	After 6 hours	After 24 hours	After 24 hours	After 24 hours
Citrus grove	0.5	100	92	98	74	96	61
	.25	91	63	99	90	63	60
Open marsh	.25	99+	59	96	61		
Mangrove	.25	64	54	56	58		
	.1	70	50	83	18		
Hammock	.1	23	8	22	0		

Attractants

The use of attractants for drawing insects to a poisoned food, an insecticide-contaminated area, or a trap has been of interest to entomologists for many years. The success of methyl eugenol in attracting male oriental fruit flies to a poison bait has stimulated interest in research on attractants for other insects. Recently angelica seed oil was found to be more effective than any other material ever tested against the Mediterranean fruit fly, but the cost of about $75 per pound and the extremely limited supply prohibited its wide-scale usage. Our Branch chemists succeeded in isolating fractions of the oil that were carrying the attractive principle, and some of these fractions were almost as attractive to the Mediterranean fruit fly as the original material. This and other examples suggest that mosquito attractants may be a promising field of research.

Studies were initiated to test as mosquito attractants the thousands of chemical compounds available at Orlando. When the candidate chemical was placed on a white filter paper and hung in a cage of mosquitoes, it was found that, aside from its odor, the color of the chemical had a bearing on its attractancy. This led to a study of the attractancy of colored paper discs with the object of selecting the most attractive color for the standard in testing for chemical attractants. Food coloring was used for the red, yellow, and blue shades, and clothing dye for the black. The secondary colors were made by mixing each pair of primary colors in equal proportions. White filter paper discs were colored with various concentrations of the dyes in water. The brightness of each disc was measured in foot-candles of reflected light under standardized conditions which gave a reading of 70 foot-candles for white. Two discs were hung in a cage of mosquitoes, and after 30 seconds the mosquitoes resting on each side were counted. The positions of the discs were reversed and a second count was made. The different concentrations of each color were tested against every other color with a white disc as standard. A rather complex statistical formula was worked out to determine if a color actually was attractive.

Within any color the darker shades were progressively more attractive than the brighter shades to *Aedes aegypti*. Tests with shades of color giving a reading of 40 foot-candles showed yellow to be the most attractive, followed by orange and red, which were more attractive than green, violet, black, blue and white. Reaction to color differed with different species, *taeniorhynchus* being attracted to darker shades of the brighter colors than *sollicitans* or *aegypti*.

We do not yet know how this information can be utilized, but we are confident that basic studies of this type will provide a better understanding of mosquito habits and preferences which could result in better application of control measures.

Conclusion

In conclusion, I wish to state that investigations on new insecticides, repellents, attractants, and other materials for control of mosquitoes are continuing. The public demand for information and recommendations for alternate and new ways to economically control the various species of mosquitoes under different conditions is increasing, and research efforts cannot be reduced in the foreseeable future—rather they will gradually increase. Research progress has been good considering the numerous problems facing us.

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President Murray: Thank you very much, Art, for this contribution on scientific information. I heard someone say that we didn't have very much real science on the program of this conference, but you have given us quite a digestible mouthful.

Last, but certainly not least, we have the other major branch of our United States activities on mosquito control.

The USDA—Department of Agriculture—engages in certain phases of basic research that are a very important part of our Government; while the U.S. Public Health Service, aiming in a different direction, nevertheless are actually doing some research work on mosquito control and insect control.

Dr. S. W. Simmons, Chief of the Technology Branch of the U.S. Public Health Service.

COMMUNICABLE DISEASE CENTER RESEARCH DEVELOPMENTS IN MOSQUITO CONTROL*

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This Association's interest in problems created by mosquitoes is one that is shared by many people and organizations throughout the United States. A large number of organized groups and abatement districts formed for alleviating the mosquito problem attest to this fact. In the United States there are approximately 125 tax-supported mosquito abatement districts and a much larger number of organized programs supported by direct appropriations or from public subscriptions, operating within cities and counties and on military bases. Twenty-four states have laws pertaining to mosquito control. Your own state of California, along with Florida, Illinois, New Jersey, and Virginia, has been a leader in planning and carrying out mosquito control programs.

During the past year, we have in the Communicable Disease Center received more requests for assistance with mosquito problems than ever before. There were 101 requests from 41 states, Alaska, Puerto Rico, and the Virgin Islands that resulted in field trips to give assistance on mosquito problems. Twelve of these requests were for assistance on problems of an epidemic or disaster magnitude principally in connection with encephalitis outbreaks.

Many factors are responsible for an increased recognition of the adverse effects of mosquitoes on the health and welfare of man. Public health authorities have emphasized the positive aspects of individual and community health in contrast to the older thinking that health is the mere absence of disease. Thus, the people affected by mosquitoes are more keenly aware of them and responsive to the disease and related public health problems created by mosquitoes .

The continued growth and development of the country has created favorable conditions for mosquito production in a number of areas. This is particularly true with respect to the rapid expansion in irrigation and agricultural practices. In addition, man has extended some of his industrial and agricultural activities into coastal and other areas normally inhabited by mosquitoes. The increase in the country's population has resulted in unparalleled growth in home construction and the development of new suburban areas. The past decade of economic prosperity has been accompanied by an unprecedented expansion in all forms of outdoor recreational activities. All of these factors have brought about a closer association in recent years between man and mosquito populations in many areas of the country. However, the recognition of the problems created by mosquitoes and the standard of living in the United States have reached the level where the majority of people concerned will no longer tolerate the adverse effects of mosquitoes.

Results of preliminary epidemiologic surveys of the mosquito problem amply justify the attitude of the general public in requesting more and better mosquito control. A survey made in portions of Montana and Utah in 1955 (1) showed that:

1. About three-fourths of the families reported severe annoyance from mosquitoes and interference with outdoor activties of themselves or their children.
2. The majority of individuals suffered some type of injurious reaction to mosquito bites; about half of them had abrasions from scratching bites, a significant percentage of which showed evidence of secondary infection.
3. The economic impact of mosquitoes was evidenced by the fact that over half the families reported that mosquitoes interfered with their vocational activities, about half of them used some type of home medication for mosquito bites, and about 3 per cent took their children to physicians for treatment of mosquito bites.

Studies in 1956 in Utah and Nevada have given similar results. These surveys, of course, did not consider disease transmission, which is one of the principal problems associated with mosquitoes. The number of calls for assistance on the mosquito-borne encephalitides during the past year was the highest in history.

The Communicable Disease Center is carrying on investigations to assist the states in meeting their mosquito problems. Our work concerns the ecology and control of mosquitoes and the health hazards associated with the use of chemicals on control programs.

Investigations on mosquito problems in the Western States have given major attention to source reduction or preventive measures. Cooperative studies with the Agricultural Research Service in northern Montana have given promising results on the development of improved irrigation practices which will prevent mosquito production and increase crop yields. Water conservation and other source reduction measures in the panhandle area of Texas may also mutually benefit mosquito control and agriculture.

Residual larvicide tests were carried out on irrigated pastures, meadows, fields, and wastelands in Montana during the past year in an area where resistance has not yet developed (2). Preflood treatments with water emulsions and granular formulations of dieldrin at 1 pound per acre and heptachlor at 1.5 pounds per acre were found effective for the full 14-week period of observations; emulsions and granular formulations of DDT at 3 pounds per acre were effective for 6 to 9 and 8 to 14 weeks, respectively; granular chlorthion at 1 pound per acre was effective for 6 weeks.

Postflood treatments with emulsions and granular formulations of DDT at 3 pounds per acre, dieldrin at 1 pound per acre, and heptachlor at 1.5 pounds per acre were effective for essentially the full 14-week period of observation. Granular chlorthion was effective for 6 weeks and EPN for at least 7 weeks when applied at 1 pound per acre (2).

Promising results were also obtained from the residual larviciding of Oregon log ponds with dieldrin, heptachlor, and DDT. At Chinook, Montana, barrier-zone residual applications of DDT emulsions on farmsteads reduced daytime populations of irrigation mosquitoes

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but provided no appreciable protection from mosquito annoyance at night.

Preliminary tests definitely show that certain of the organic phosphorus compounds, such as parathion, malathion, and EPN, maintain long residuals, at least under laboratory conditions. They, particularly the less toxic compounds, may be our first line of defense in emergencies and even on certain routine programs, and relatively safe techniques may be devised ultimately for the use of some of the more toxic ones. Tests in rice fields in the Mississippi Delta have shown that the addition of insecticide formulations into irrigation water at the source is unsatisfactory for controlling *Psorophora* mosquitoes except in those terraces nearest the point where the water enters the field (3). Both parathion and dipterex were used in these tests at rates of 0.02 ppm and 0.25 ppm, respectively.

In cooperative studies with the Florida State Board of Health, parathion- and malathion-impregnated pellets have proved successful in the destruction of salt-marsh mosquito larvae when applied by airplane at the rate of 10 pounds per acre, giving insecticide dosages of 0.1 and 0.4 pounds per acre of parathion and malathion, respectively. Larval counts ran as high as 1,000 per dip before treatment, whereas after treatment, the range was from 0 to 3 per dip. Pupae appeared to be unaffected.

Studies on the ecology of mosquitoes have yielded some very worthwhile information, particularly on the blood feeding habits of *Culex tarsalis*. Investigations on Oregon log pond mosquitoes have provided information on the comparative ecology of *C. tarsalis, C. stigmatosoma,* and *C. pipiens* which will be very useful in the development of control procedures.

During 1956, plans for mosquito prevention and control were developed for incorporation both into the construction and into the maintenance of about 100 Federal Water Resource Projects located in various areas of the United States.

It is axiomatic that one of the more important problems facing mosquito control operations today is the development of resistance to insecticides. In the decade since house flies were first reported resistant to DDT in Italy, the number of resistant species has steadily increased and at least 40 varieties of public health importance have been reported to be resistant to one or more insecticides. Of this total, 19 are mosquitoes and include such important disease vectors as *Aedes aegypti, Anopheles albimanus, A. gambiae, A. sacharovi, A. sundaicus, A. quadrimaculatus, A. stephensi, Culex pipiens fatigans, and C. tarsalis.* Nine mosquito species are known to be resistant in the United States: *A. quadrimaculatus, C. tarsalis, C. pipiens, Ae. dorsalis, Ae. nigromaculis, Ae. sollicitans, Ae. taeniorhynchus, Psorophora confinnis,* and *P. discolor.*

Because of the world-wide importance of this problem, the World Health Organization has launched an international program of surveillance and research, and the Communicable Disease Center has participated extensively in determining the status of research at various laboratories throughout the world. Visits were made by our people to 80 laboratories in 35 foreign countries during the past year. Information was obtained from 30 additional laboratories in the United States and Canada. A member of the Secretariat of the World Health Organization surveyed laboratories in Africa. The data procured dealt with the present and potential research interests of 118 laboratories, and was furnished to the World Health Organization for use of the Expert Committee on Insecticides. In July 1956, the Expert Committee met, and an international collaborative program of research on resistance of insects to insecticides was formalized and initiated. The principal objectives of this program are (1) to collect and disseminate information on the insecticide resistance problem, (2) to promote needed research, (3) to facilitate procurement of personnel and funds, (4) to adopt standard test methods for use on control programs, (5) to procure and test new insecticides, (6) to provide liaison with participating laboratories, and (7) to sponsor meetings and conferences to obtain better international cooperation and exchange of information. A program of this magnitude will naturally take considerable time, but we trust that all of you, if called upon, will give your full support to it. As for our own research, we hope to be able shortly to increase considerably our investigative activities on the resistance problem with particular reference to the more basic or fundamental aspects of the program such as biochemistry, physiology, genetics, and ecology.

In the chemical control of arthropods, we have the ever present problem of the health hazard involved in the use of new pesticides and, in this connection, our laboratory at Savannah, Georgia, has investigated some 31 compounds. Since DDT is the most widely used insecticide, special attention has been devoted to this material. Human volunteer studies involving 51 men given DDT at rates of 3.5 and 35 mg. per man per day for varying periods up to 2 years resulted in no signs or symptoms of poisoning (4), the larger dosage was about 200 times the daily rate received by the average man from his normal diet (5). The storage of DDT in man was found to be proportional to dosage (4). Maximium storage of DDT for a given dosage level is reached in about a year, following which no increase occurs as long as the intake level remains the same. A step forward in the diagnosis of DDT poisoning has been made in the determination of DDA in urine and the correlation of the amount to the DDT intake. This not only gives us a diagnostic tool to determine DDT storage in the human body but, in addition, facilitates experimental work with this compound.

A study was made to determine the effect of organic phosphorus compounds in producing miosis in airplane pilots (6). Two drops of 0.05 per cent TEPP in each eye produced slight miosis and a slight increase of near accommodation. Two drops of 0.1 per cent TEPP produced maximum miosis, an increase in near and far accommodation, and a decrease in light perception, but no inability to judge distance. Two drops of 0.1 per cent TEPP in only one eye produced unilateral miosis and other expected changes in the treated eye. It also caused all the volunteers to complain of difficulty in vision, 4 complained of difficulty in judging distance, and 6 made sensorimotor errors of fumbling, stumbling, or other clumsiness. From these tests, it is evident that unilateral contamintaion of the eye by spillage or other accident accounts for the occasional inability of pilots applying TEPP to judge distance adequately. The incoordination accompanying this inability can be a serious threat to pilot safety.

Studies at Savannah on organic phosphorus compounds included the testing of chlorthion, DDVP, demeton, diazinion, EPN, malathion, and OMPA for paralytic effect on experimental animals (7). No delayed paralytic effect was found with the compounds, but chickens dosed with malathion and EPN developed leg weakness immediately after dosage. This effect has not been reported concerning man, but the tendency of these compounds to cause leg weakness in chickens should emphasize the desirability of avoiding unnecessary exposure when using these materials.

Now let us revert to the problem of mosquito control per se and consider the present needs in relation to this problem. Although a number of states are facing their responsibility and are expending large sums of money in support of mosquito control activities, their efforts cannot solve the over-all problems. The greatest needs include (1) more information on the role of mosquitoes in the transmission of disease, particularly encephalitis; (2) additional information on the public health importance of mosquitoes aside from disease transmission; and (3) more effective and economical prevention and control techniques that can be utilized in the many areas and under the various conditions where mosquito populations create problems. Very few states are conducting any research to meet these needs. Local operations necessarily are directed to the immediate task of killing mosquitoes or of preventing their production. Little time or resources are available to devote to operational research and development work. In many instances, available information on the most recent developments in mosquito control does not reach local organizations or, for one reason or another, may not be applied in their control programs. Thus, in addition to the need for development of more effective and economical control methods, there is a need for more effective means of providing information on new developments to local mosquito control organizations and assuring its use, where applicable, in their operations. It is believed that a comprehensive national program of investigations, demonstrations, and technical consultation is badly needed to meet effectively both the immediate and long-time needs associated with the increasing mosquito problems of this country.

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President Murray: Thank you very much, Dr. Simmons.

Dr. Lindquist: Someone asked who is making this powder, and I said Hercules Powder. I think there are maybe two or three companies that are interested in it. I have been told that the Johnson Wax Company of Racine, Wisconsin, is interested in formulating and marketing the material when the final approval is given.

President Murray: Thanks, Art.

Are there any announcements?

(No response.)

We will see you later.

(Whereupon, at 4:25 p.m. on Monday, January 21, 1957, an adjournment was taken until 9:00 a.m. Tuesday, January 22, 1957.)

TUESDAY MORNING SESSION

JANUARY 22, 1957

The Twenty-Fifth Annual Conference of the California Mosquito Control Association, Inc., reconvened at the De Anza Hotel, San Jose, California, and was called to order at 9:20 o'clock a.m., President W. Donald Murray, Visalia, California, presiding.

President Murray: We shall bring our meeting to order.

In order to compete with yesterday's closing on time, we will start now and try to equal that record.

We wish to thank all of you for looking so bright this morning.

I would like to make an announcement that is not on your program. This evening at about 8:00 o'clock we will have some movies for those who do not want to go out into the town. If you have nothing else to do, I understand that Tommy Mulhern has obtained a movie showing scenes of Yosemite. It is a very pretty film.

There is also to be seen the Shell film, "The Rival World," which is a very general, nontechnical film on insect control. It is very beautifully done. There has been a request for a repeat on that outstanding film of the Delta Mosquito Abatement District, "The Pasture Mosquito," which we showed last year, when the sound was not quite up to par. The sound has now been improved, so you are welcome to come to see those films.

Are there any other general announcements that should be made?

(No response.)

Following the talk by Dr. Duncan we will split. The Operations Program will be in this room, and the Business Meeting will be in the room in the corner of the mezzanine.

At this time it gives me great pleasure to present Dr. Carl Duncan of the San Jose State College.

WELCOME

CARL D. DUNCAN, Ph.D.

Chairman, Department of Natural Sciences
San Jose State College
San Jose, California

Dr. Murray and Gentlemen assembled: Your Chairman could have said: It gives me great delight to present such a person on realizing the embarrassment under which I greet you and to see how he is going to manage to get out of the predicament that is his.

I stand before you as the Late Dr. Duncan, the little man who wasn't here yesterday when the bell rang and the roll was called. (Laughter)

I am reminded of a friend of mine, Mr. Albert Wilson of Palo Alto, a consulting gardener and horticulturist, who has a radio program – or had – and various and sundry civic groups and garden clubs and so on. In the late June of 1939 my wife and I met him one balmy evening up on Treasure Island where we had gone to enjoy an evening at the fair.

We were chatting pleasantly when his face suddenly became frozen in a somewhat disconsolate attitude, and he slowly took out his watch and looked at it and said, "As of this moment I am scheduled to begin an address to the Santa Rosa Women's Garden Club. And he was on Treasure Island and Santa Rosa was quite a distance away. I don't know how he ever made his amends.

I am quite sure that they weren't under circumstances as auspicious as these under which I greet you this morning. The best thing that I can say about a situation of this sort for me is that it is very nice to be among friends. And I am sure that I am among friends because some of you I recognize as colleagues whom I have known for a number of years, and there is a sprinkling of my own former students among the group here this morning, and there are others in your organization scattered over the State of California serving, in one capacity or another, the communities in which they live. I am personally proud of their accomplishments for myself and for the college as well, and I anticipate that San Jose State College, which I represent, will continue to be interested in the program of not only the control of mosquitoes alone, but the whole of the vector control program and all of the associated sciences.

I thought that this morning I would very briefly like to present to you a few contrasts that pertain to our own field that will be in part familiar to most of you. To some, however, some of the contrasts may be new, and they may give you some ammunition to use in future talks which you give or something on which to perhaps reflect a little.

Officially I am here to extend the greeting and welcome of the State College, and I am a little bit delayed. I wish that I could have been in the position to make arrangements for you to meet in ample quarters over at the College, and perhaps in the future such a meeting may be arranged. But right now, as I think most of you are aware, like most of the other state colleges we are suffering severely from growing pains. You can appreciate how severe those are when I state that last spring some of our chemistry laboratories had classes scheduled in them for fifty-six hours a week from 7:30 in the morning until 10:00 o'clock at night.

We are getting a new building that is nearing completion now, and we expect that, of course, to alleviate the situation considerably; but we are told that we will have probably not less than nine hundred more students next fall than we now have, so in our science areas alone we are adding pretty close to twenty teachers to take care of our share of the additions We, at the present time, simply do not have the space that we should have and would like to have to entertain groups such as this or provide at least for formal meetings.

On the other hand, individually or in small groups you will be most welcome if you have time to come over and visit the College; in particular to visit our Science Building. We have a staff of very able teachers, some of whom, at least, will be free almost any hour to conduct you around if you would like to look about the place. We cannot take you into the new building yet, though. The contractor is pretty careful to try to keep everybody out until the building is turned over to the College because he feels responsible for any accident that might occur.

Now, the contrasts that I would like to present to you are primarily personal observations made over quite a few years.

There is somewhere in the literature of medical entomology a statement to the effect that in the time around 1909 or 1910 an entomologist up in the San Mateo-Burlingame area, using an ordinary bug net and the sweeping technique that you are familiar with, sweeping back and forth through the grasses and the low herbage that filled much of the vacant area out there, was able in fifteen minutes to collect a pint of adult mosquitoes.

At the present time I think you are aware that during much of the year a person might work assiduously for fifteen minutes in such an area in that part of the Peninsula and not get one mosquito. We can count ourselves lucky at San Jose State College now if our students in entomology in the spring can find examples of living specimens of our best-known mosquitoes that are native to the Peninsula area.

Coming down through the years when I was an undergraduate at Stanford back in the twenties, when Palo Alto was still a very modest little community and referred to by many persons as "The Village," I could ride my bicycle out of town and take a walk out into one of the tomato fields that were there and stand and look downwind and see the great big fuzzy gray salt marsh mosquitoes following my scent, coming upwind, and in a space of two or three minutes I would have about two inches of mosquitoes all over the front of me, each one probing, trying to find the part of my body that gave off the delectable odor of blood. Of course that sort of thing is in the past.

Dr. Charles Henry Gilbert, who at that time was head of the Department of Zoology, in which I majored, advertised in The Palo Alto Times, and he gave away a city lot on one of the main streets of Palo Alto – I think it was a little bit under a half mile from the center of town – because he was approaching the age of retirement from the Stanford faculty.

He couldn't see that the mosquito-ridden section of the town in which his lot was located would advance sufficiently in the years he had left to him to return him his investment on the lot, so he advertised in the papers

that he would give this lot away to the first person to come in and pay the taxes on it. That was in 1921.

The same lot, if it were vacant today — which it isn't, of course, and hasn't been for many years — and if it were completely unadorned, or unimproved, as our chemists say, would bring a price of not less than, oh, six to ten thousand dollars, and people would be in bidding for it to get hold of it because the limits of the built-up portion of the city are now a good mile and a half beyond the location of this particular lot.

Changes of this sort are due, of course, to many factors, but a highly important one is the growth of the activities in the field of vector control, of which your Mosquito Control Association is symbolic.

One of the other striking changes that many of you appreciate, because you have lived through it as I have, but which may simply be something to be read from the pages of history books to others among you, is the dramatic change in the attitude of the personnel of our Armed Forces toward the activities of a group of this sort.

When I entered the Navy as a hospital corpsman for service during World War I, the only persons who had even a remote opportunity of receiving a commission in such fields as mosquito control or any other type of vector control were the persons who already were practicing sanitary engineers or doctors of medicine. No one else was eligible for consideration.

The official attitude of the Armed Forces in those days was pretty well exemplified in the statement by members of the U. S. Army that "Fighting is the business of the Armed Forces. You give us the men; and we don't care what they are like, we will make out of them what we want them to be."

World War I, I think, brought to many of those persons their first misgivings, their first doubt, as to whether it was possible simply by military direction to convert any kind of raw human material into the kind of specialists that were needed to give the Armed Forces the protection which they should have.

Not until World War II, however, was well underway did the change really occur, and then it occurred with dramatic suddenness. I had the good fortune to sit in one of the auditoriums at the University of California at the Conference that was held part way through the War to take stock of progress and of needs in regard to vector control if the United States and her Allies were to come out victorious in the struggle that was going on And I heard from high ranking members of the Army and the Navy testimony that when the campaign for Guadalcanal was planned, the mosquito control equipment was put in the bottom of the holds of the supply vessels that were to carry supplies down into the area because it could'nt be important enough for anyone to be worried about until the battle was in full swing against the Japanese.

I heard the same persons say that time, which was only about halfway through the War, "We have changed our point of view completely. Now that part of our equipment goes on last so it can be gotten off first because we have had our lesson."

The forces at Guadalcanal became so rapidly incapacitated by insect-borne diseases that many of the ships could not be unloaded for several weeks. As high as eighty-seven per cent of the entire complement of men stationed at a given area from which battle was supposed to be waged were on the sick list and could not fight.

The only happy thing about the situation was that the Japanese were just as bad off. They didn't know any better than we did. But persons with commissions well up in the ranks of the Army and the Navy, and also as medical men like Dwight Wilbur, for example, whom many of you know as an outstanding MD in this State, made the statement: "We have come to realize that second only to the actual waging of battle is the work that must be done by the people in the field of control of insect-borne diseases. They are just as important as the boys who get off with their bulldozers and start clearing and maintaining an airstrip, and so now we have changed our attitude completely."

Since then, you know, all the Armed Forces have developed into collections of specialists, and now a person with specialized training is sought out to render the kind of service that he can give better than anyone else.

I had the pleasure, and also the surprise, because it was still a surprise, as recently as the twenties to hear Dwight Wilbur say that "I have become convinced that the problem of the control of insect-carrying diseases is a problem that should be put in the hands of an entomologist, not a medical doctor. The medical doctor is interested, but he is interested in the patient and what can be done to cure the person who is already ill. He belongs in the hospitals, whether they are behind the lines or in the field operations, but he belongs in that aspect of our war; and the setting up of the protective machinery that is represented by the mosquito control organization belongs under an entomologist who has been trained to do the job that needs to be done."

Now, those of you whose years go back far enough beyond World War II and may have had some contact with military situations earlier will realize what a tremendous change that sort of thing represents.

In another way I would like to point out a contrast which is less striking and less dramatic perhaps but no less significant. In the early days of the control of mosquitoes the primary thought was extermination, and the primary idea was that the little wiggletails, the larvae, the wrigglers that become the adults, live in water that is always stagnant and they come to the surface to breathe air, and if you pour oil on it, the oil clogs up their breathing and they in time suffocate.

So you do two things. You either ditch a swampy area to drain as much of the water permanently as you can and reduce your other operations, or you spray oil or pour oil on it in order to suffocate the mosquitoes.

Now, of course, the program is much more complicated. It is approached from an ecological point of view. We have changed our point of view not only in this field, but in other fields from the idea that man can wield a big stick and exterminate this group of organism or that group according to whether he likes them or doesn't, to the idea that these creatures have been on the earth a long while. They are competing with us for a place in the same environment.

In most instances the possibilities of complete extermination can be attained only at tremendous cost which is not justified. It is far better that we learn to adapt to control rather than to waste our energies in attempts at total extermination. As a part of this ecological point of view there has also come the realization that the pat-

tern of control has necessary changes with the passing of the years, and it changes with the changes in human society.

The original mosquito control problems up in the Peninsula here were primarily problems of draining marshes and filling in holes here and there, oiling cesspools and that sort of thing. The major job there has now been accomplished, and we have very efficient agencies in operation so that the average household, for example, may now go through a whole summer without seeing one mosquito.

But we have discovered that when a new area is opened up for housing development that what the contractors do with the earth that they move has something to do with the way in which water accumulates in new pockets or holes or low places that are around the periphery of the fill, and there a different kind of mosquito control problem comes in, which you know better than I because you are closer to it, which has to do with the tolerance of a given species to insecticides, things which were effective when they were first used and now are not nearly so effective and have to be replaced by something else.

We have come generally, I think, to accept the idea that the work of organizations such as this is a permanent sort of thing with a long future, that it is going to be subject to continual reappraisal and evaluation and continual change.

I can remember hearing many persons, however, wonder what people in such an organization would do when the time came that the mosquitoes were under control and there was nothing left for you to do any longer because the City Health Department and the County Health Departments, just as a matter of their routine work done by sanitarians, will take care of all the control problems.

Of course, that attitude has pretty well passed out of the picture. We don't anticipate that kind of a situation. We are continually changing the surface of the earth on which we live, sometimes for good, sometimes for ill, and the problems that we face in controlling organisms, in evaluating what we should do to control organisms, are also continually changing.

We know for one thing now that it isn't safe to simply on a wholesale basis try to eliminate large groups of organisms of any sort because we don't know enough about their total inter-relations to know whether in the long run they play a role, whether they are a cog in the machinery that maintains the status of environment in which we live or not We have had some disastrous lessons as to what happens when we do too much damage in a certain area and discover that we have simply given some other kind of creature the green light and it goes ahead and becomes a worse problem than the one which we started with

Then from an educational point of view I would like to point out one more contrast. When I started at Stanford the old idea that anybody interested in insects had to be just a little bit queer was still widespread enough and still common enough that I received my share of ribbing from my friends and neighbors in the San Joaquin area, south of Fresno, where I was living at the time A gathering of this sort staged in those years, which would, of course, have been a much smaller group, would have been looked upon by many a citizen as a gathering of the long hairs who chased insects with a butterfly net.

Today, of course, the public quite widely, generally, recognizes that an organization of this sort is an essential part of the organization that governs or guides the development of a commonwealth such as California, and it is one which a commonwealth could not do without.

I would say that the field of medical entomology or vector control or of mosquito control or any segment of it has at last come of age.

Now, so far as the San Jose State College is concerned, I would like to declare again our continuing interest in the program of an organization of this sort, not only because of personal interest, but because I am proud of the contributions that our graduates have been making and are making as members of your organization They are scattered throughout the States and a few of them in foreign countries.

Ed Smith, whom I think many of you know, is now in that very interesting Indian area where the people are not sure themselves as to how they should be governed. I haven't heard from him since the trouble broke out again down there, but the first letter that he wrote to someone over at the College was a very entertaining and enlightening sort of thing.

We have two concerns educationally. The first is, of course, to maintain an undergraduate program in entomology and all the supporting sciences that will prepare students upon graduation for one of two general areas.

One is to move directly into the actual application of entomological knowledge and the solution of problems, and a number of persons, including Howard Greenfield, have chosen that route to professional competency and to making their own places in the sun.

The other is the route that leads to advanced studies at a university with an ultimate advanced degree in some specialty so the person becomes ultimately a resource individual to whom members of a group such as yours will turn for vital information when a problem is being worked out.

We are interested in maintaining the kind of undergraduate program that will turn out persons competent to move in either direction, depending upon their choice, and we have had a considerable number who have gone into both of these fields.

We also, however, are concerned at present under the authority granted by the State Department of Education in the development of a masters degree program in which some of the minor research problems can be solved. A state college is adequately equipped and is, I feel, an excellent educational institution for that kind of research.

We are not concerned at all with the long range, underlying research problems which the universities consider their proper field and which we also feel is their proper field, but innumerable small problems that might be accomplished within the run of a single school year that might form the basis of the earning of a master's degree. In that area, of course, we are concerned.

For my part I would enlist your support whenever you have an opportunity of talking with a citizen, particularly if he is a legislator, or anyone who is high up in education, and a lot of our educators need themselves to be better educated. If you, from your point of view,

could express yourselves on this matter and say, "Yes, we realize the university handles the long range, underlying programs of research which are in the fields that are classed as basic or fundamental," it would be a great aid; but there is a tremendous number of smaller problems that must be solved that we need desperately to have solved in order to further our own activities, and we recognize that the state college is the proper place for many of those to be carried out.

Now, I think my time is surely up, and I would like to say again: Greetings and a belated welcome to San Jose, and I would like to congratulate you on being members of a vigorous organization with a very bright future.

Thank you.

(Applause)

President Murray: Thank you, Dr. Duncan, for this excellent presentation. We are glad we waited.

We also would recommend that in case your students are having difficulty finding mosquitoes in the Bay Area, just send them over the hill into the Valley, and I think they can get some material.

With this we should quickly separate, the Business Meeting adjourning to the other room and the Operations Meeting remaining here.

CMCA BUSINESS MEETING

W. DONALD MURRAY, Ph.D., *Presiding*

COMMITTEE REPORTS

President Murray: Shall we have a roll call to see if we are a quorum?

(Whereupon, Secretary Washburn proceeded with the roll call, with thirty-three districts being present.)

President Murray: During the past year the official minutes of our meetings have been sent out to all members, giving the action taken by the Board of Directors at these meetings. The Board would appreciate a vote of confidence from the entire membership relative to actions taken by the Board since the last Conference.

(Whereupon, it was moved and seconded that the vote of confidence be put in as one of the resolutions.)

President Murray: Before going into the routine order of business, I would like to present a challenge to the CMCA. I have actually written my report. I don't believe in reading reports, but I want to be sure that I don't get too wound up in this thing. I want to keep it precise.

PRESIDENT'S MESSAGE

W. D. MURRAY
Manager, Delta Mosquito Abatement District

The present CMCA is good! It has been effective in helping to strengthen mosquito control efforts in California, as well as in other states and perhaps countries. It has at times been able to obtain considerable understanding among legislators, and favorable legislative action has generally been forthcoming. As a result of the combined efforts of the CMCA and the several Mosquito Abatement Districts, mosquito control has generally come to be recognized by the citizens of California as a workable, economically sound public-supported program.

Above all, I would emphasize again that the CMCA is a good, effective organization. Any of the following comments to be made about it are simply efforts to obtain further improvements. There are some who say, "Let well enough alone," but such philosophy in a highly competitive world frequently leads to extinction. We cannot rest on our past laurels.

All through the past year I, as President, have been nonplussed repeatedly on the matter of membership, representation, and voting privileges. On careful analysis, it is very difficult, if not impossible, for us to carry on the business of the CMCA and still be legal to our By-Laws. This is not a new finding of mine – it has been known and discussed for a number of years, and an almost routine assignment of past Ways and Means Committees has been to see what might be done about it.

One potential solution considered by individuals, special committees and Ways and Means Committees has been the proposal of a Council of Mosquito Abatement Agencies. However, there has been much reticence by many members of our Association to accept the plans for a Council. Perhaps I can interpret the reasons for this hesitation.

The proposed Council of Mosquito Abatement Agencies was patterned after the California Conference of Local Health Officers. That organization was set up originally as an agency to guide the use of state subvention funds, in other words as a political agency, but it rapidly grew to include professional business. On the other hand, the CMCA was set up originally as a professional agency for the dissemination of professional information, and only later was it increased in scope to work on political matters such at state subvention. In other words, these two organizations, the Conference of Local Health Officers and the CMCA, starting with opposite purposes, the one political and the other professional, have each grown in program to include the other purpose, so that the activities of both organizations now include both the political and the professional fields. The question we must now ask is, "Which, if either, provides the better framework for conducting these two types of business?"

The present By-Laws of the CMCA, officially adopted in 1951, attempted to use the framework of the CMCA to handle both political and professional activities. These By-Laws, especially in relation to membership, representing and voting privileges, are a far cry from the By-Laws of any professional-type organization with which I am acquainted. As a matter of fact, they also are not sound from the standpoint of a political-type organization. Rather, in my opinion, they are an incongruous assemblage of concepts which weaken both the political and the professional needs of our Association. The present CMCA cannot handle either function as well as might be desired.

Our committees which have worked on this matter have been impressed with the merits of the Council of Mosquito Abatement Agencies in overcoming certain of the political weaknesses. We would have official, legal standing in the government of this State. But what about the professional interests? Would we be improving on our present weaknesses in this category? This does not seem likely, because the Council is a closed-shop type of organization, and a professional program is likely to be hampered under such a setup.

Some of the proposers of the Council have maintained that we need both organizations, and that the CMCA would continue to exist for the professional people. However, while they have drawn up fairly well-outlined plans for the Council, they have failed to present a clear picture of the future of the CMCA. In my opinion, their plans would give the Council the right to determine what business it wished to consider, after which it would relegate to the CMCA certain items with which it did not wish to bother, primarily those of a highly technical, professional nature. This concept has not been acceptable to some of us, since, as I wish to repeat again, the CMCA has been a reasonably strong, effective, and above all, a *known* organization.

I believe that most of us still view the CMCA basically as a gathering of professional people. The programs of our annual conferences are almost exclusively professional in scope. Political items such as subvention are a relatively minor, albeit very important, part of our total business. Perhaps we should consider a different approach, perhaps we should turn once again to our CMCA, improve it in every possible way from a professional standpoint, and make certain that it is a good, sound organization for at least one of its two purposes.

One of the weakest points in the CMCA professionally is with relation to membership. At the beginning of the past conference year the Board of Directors established committees. But who could serve on committees? Every professional organization to which I have ever belonged, and which had membership dues, restricted committee appointments to dues-paying members, with dues paid in advance! Please understand, I am talking here specifically of the dues of individual members. Since our Board of Directors was unable to determine who had paid or who would pay his dues, we simply ignored this item.

Having selected these committee members, just what kind of action could we expect them to take? Each Associate Member has a guaranteed right to take part in the discussions and proceedings, but he has no right to vote unless he is a Designated Representative of a Corporate Member. Committees take formal action by voting. Was any Credentials Committee selected at each meeting of each Committee to determine who had a right to vote? Obviously not!

Our Board of Directors makes many decisions throughout the year, generally by vote. Was there a Credentials Committee present to determine who had the right to vote? Remember, only the Designated Representative of a Corporate Member has that right! True, any Officer of the CMCA must be either a member of the Board of Trustees of a Corporate Member or a Designated Representative. Could it be possible that any of our own Officers are not legal? You may find out from the Secretary who isn't.

We have simply not followed the By-Laws on these and other matters because it has not been logical to do so.

What thinking, democratically minded professional man, not a Manager of a Mosquito Abatement District, who had read the By-Laws, would care to become an Associate Member? Certainly very few. We have ostracized the professional people, the University and College staffs, the Federal and State staffs – even the secondary people on our own Mosquito Abatement District staffs.

Perhaps we should ask ourselves how we got into this situation. By piecing together the expressions of many persons over many years, I have arrived at the conclusion that fear, and an urge for power, have been responsible. There is an obvious plan to control votes. But why? Who is afraid of what?

One positive statement given many times in the past was that we wanted to be able to prevent the State from taking over our program.

Twice during the past couple of years the Government of Tulare County has gone to court to challenge the power of the State, and twice the State has accepted a compromise. Was the County afraid? Perhaps, but who gets the Congressional Medal of Honor, someone who without much effort accomplishes a noble deed, or someone who overcomes terrific obstacles, especially fear, to become a hero?

Several weeks ago I heard a speaker present a talk based on a young fellow who came into his office and said he wanted to become a football coach. Why would anyone wish to challenge the obstacles and hazards of this profession? There is no civil service to protect the weak, no tenure to protect the incompetent, no union to fall back on for support, and society seems disinterested in protecting him if he is a failure, at the expense of the successful coaches, as seems to be the current philosophy in many other lines of business.

Does the CMCA need protection, tenure, civil service, closed shop, cradle to the grave security? I think not. I do not say this in braggadocio, but simply in the confidence that there are many strong individuals in this Association who have been alert in the past, and, with strong new blood continuously being infused into our group, we can surely be alert to any dangers which may threaten us in the future.

What do I recommend?

1. I challenge the CMCA to open up membership to all interested, responsible individuals who are willing to pay their own dues, giving them the right to vote, to serve on committees, and to hold office.

2. I challenge the CMCA to eliminate Corporate Membership from the organization. I have heard some who claimed that this would break the backbone of the organization financially. I challenge these persons to give their reasons. According to the contract drawn up by the Delta Mosquito Abatement District with the CMCA, we paid $100 for services rendered, not for the right to vote. Any District admitting they pay their dues as a poll tax should be examined by the State Controller, by their County Auditor, by the State and County District Attorneys, and by their local Grand Jury.

3. I challenge the CMCA to continue to consider a better way to work out problems of a political nature. Perhaps there is still a place for a Council of Mosquito Abatement Agencies, a Council which would act only on business relegated or assigned to it by the CMCA.

4. In spite of some obvious weaknesses, I challenge anyone to produce a better medium for the development of cooperation and understanding among mosquito control workers in California than the CMCA.

President Murray: Continuing with the regular order of business, I would like to make some recommendations to perhaps avoid some confusion. First on the agenda today will be the Treasurer's report. I have checked with Mr. Roberts and a few others, and they recommend that in the Treasurer's report no motion is needed to accept it. It will be received as read.

There is an Auditor's report appended, or following, and action is necessary on the Auditor's report. An action on that report automatically includes action on the Treasurer's report. Any recommendations made by the Treasurer will be acted upon individually, one at a time, at the conclusion of the report.

Standing committees will be called in alphabetical order and, once again, all reports will be received as read. There will be no motion to accept each report: that is automatic. However, any action recommendation which is in the report and which the presenter wishes to emphasize or bring out for vote, I recommend that the presenter of the report himself make a motion to accept a recommendation in that report, someone from the floor second it, discussion, and then the vote. Anyone from the floor can make a motion.

This is being recorded, so please present your name and district clearly. According to parliamentary procedure it is not necessary to do that on the second. The second is merely a courtesy gesture. So anyone can say "Second." We do not need your name.

It is a general rule that there is no discussion until a second has been received. If there is no second the motion dies automatically.

With that, let us proceed with the Treasurer's report.

TREASURER'S REPORT, AUDITOR'S REPORT, AND FINANCIAL REPORT

G. Edwin Washburn, *Secretary*

Gentlemen:

Herewith is submitted the report of the Secretary-Treasurer of this Association, the Auditor's Report for the Period January 1, 1956, to December 31, 1956, inclusive.

In compliance with instructions received at the 1956 conference (January 16-18, 1956) the Secretary-Treasurer is now under the provisions of a surety bond in the amount of $10,000. This bond is as purchased February 13, 1956, from the American Surety Company of New York through a local Turlock insurance agency. The term of the bond is three years. As part of this report is the report of an audit made of the books and accounts of this Association by a certified public accountant. This is the first of this type of audit but will be accepted practice in the future.

By way of the "grape vine" it has come to my attention that the membership, at times, feels that they are not notified of meetings, etc., in sufficient time. If they feel lost they should be in the "boots" of the secretary. It is seldom that meeting notices reach my office in time for proper execution. Many committee meetings, transactions, etc., never reach the secretary. The only way this situation can be helped is for each of you to assume more responsibility for your own part.

Perhaps it would be interesting for you to learn of the volume of correspondence, etc., that flows in and out of the secretary's office.

Never a day goes by but that two to several dozen letters either come in or are sent out by the secretary. No office help is supplied by the TMAD or the CMCA for this task. We correspond to persons all over the world. During 1956 we had correspondence with persons or groups in the following countries:

1. England
2. Italy
3. France
4. Switzerland
5. Germany
6. Holland
7. India
8. Belgian Congo
9. New Zealand
10. Mexico
11. Brazil
12. French Cameroons
13. Canada
14. Hawaii
15. Spain
16. Venezuela
17. Chile
18. Israel

Quite naturally the bulk of correspondence relates to persons or groups in California and other parts of the United States. All of this has been interesting, especially to note the far corners of the globe where persons read the Proceedings. A great deal of interest, world wide, has been evidenced concerning the booklet, "A Guide and Recommendations for the Use of Insecticides in California Mosquito Control."

It is gratifying to realize from the correspondence and in discussions with various groups that the CMCA has taken its rightful place in the world. Collectively we are a greater influence than we sometimes realize.

Respectfully submitted,
G. Edward Washburn
Secretary-Treasurer

January 10, 1957

Board of Directors
California Mosquito Control Assn., Inc.
Turlock, California

Dear Sirs:

We have made an examination of the financial records of the California Mosquito Control Association, Inc. for the period January 1, 1956, to December 31, 1956. We traced receipts from recording in the receipt books to the records and then to bank deposits to ascertain that all receipts were accounted for. Bank checks were traced to the disbursement journal and found to be properly entered.

We would like to suggest that the responsibility for expenditures be placed on someone else in addition to the secretary-treasurer. This could be done either by having two signatures on the checks or having some

other member or members of the organization responsible for approving the expenditures. It is impossible for us to express an opinion as to whether all expenditures during the past year were proper without this type of internal control.

In our opinion, subject to the reservation above, the attached statement of receipts and disbursements presents fairly the results of operation for the period under audit and the cash balance as of December 31, 1956.

Respectfully submitted,

C. E. HILLBERG, C.P.A.

CALIFORNIA MOSQUITO CONTROL ASSOCIATION, INC.

STATEMENT OF RECEIPTS AND DISBURSEMENTS

January 1, 1956, to December 31, 1956

Balance Forward, January 1, 1956		$5,442.85
Receipts:		
Contracted Membership Dues	$2,785.00	
Associate Membership Dues	141.00	
Sustaining Membership Dues	290.00	
Publications	96.50	
Conference Registration Fees & Dinner Dance	717.00	
Refund	19.50	
Total Income		$4,049.00
		$9,491.85
Disbursements:		
Conference Expenses	$ 808.86	
Postage	85.92	
Stationery	101.68	
Travel for AMCA Convention:		
G. Edwin Washburn	241.45	
W. D. Murray	112.20	
Surety Bond	62.50	
Stenographic Service (Conference)	463.26	
Legal Fee (Blue-Green Algae)	60.00	
1956 Yearbook	150.00	
Advertising	108.00	
Herms Award	35.00	
Insecticide Bulletin	390.52	
Telephone	63.15	
Printing Conference Proceedings	1,404.00	
Express	6.71	
Letterhead Material	8.96	
1956 State Fair Booth	319.07	
Flowers	10.40	
Total Disbursements		4,431.68
BALANCE, December 31, 1956		$5,060.17

President Murray: Would you like to make your recommendations?

Secretary Washburn: There is one recommendation, as you noticed, asked for by the Auditor. In past years I have made several recommendations regarding that and other features. They have never been acted upon, except the surety bond, and I would like for this body to accept the recommendation of the Auditor that at least some other person be designated besides the Secretary-Treasurer to sign on the checks.

At the moment, and for all of the time of the CMCA that I have known, only one person, the Secretary-Treasurer, has ever signed any of the checks in payment of bills. It is not exactly accepted procedure.

At least two should sign, presumably the President of the organization, so I would like to move that that recommendation be approved.

President Murray: The motion has been made by Secretary Washburn that two persons, preferably the President and the Secretary, sign. Do I hear a second?

(Whereupon the motion was seconded.)

President Murray: Any discussion?

Mr. Grant (Menlo Park): I would like to propose an amendment to have an alternate, the Vice President, signing in case the President cannot be reached.

(The amendment, having been duly made and seconded, was put to a vote and carried.)

President Murray: Now, by law we have to act on the original motion. The motion has been made and seconded, and we are now ready for the question on the original motion.

(The motion, having been duly made and seconded, was put to a vote and carried.)

President Murray: Any other recommendations, Ed?

Secretary Washburn: No.

President Murray: You made a comment which I think we should bring out again, the amount of business which you do have with the Association, the number of letters or correspondence which you take on with no remuneration.

Secretary Washburn: Part of the job.

President Murray: I would like to entertain any thinking about the possibility of secretarial assistance on that – a clerk or any financial arrangement whereby the CMCA might be able to aid in giving you someone who can write up letters or correspondence or do the duplicating work necessary.

Mr. Holmes (Modesto): Does the Secretary ask for such assistance?

Secretary Washburn: No.

Mr. Chairman, I didn't ask for this.

President Murray: I know.

Secretary Washburn: I have not asked for any further assistance, and I type all the letters that are sent out; I do all the mimeograph work or ditto work sent out or handled by the Association. I do not ask any of the staff of the Mosquito Abatement District to do that for two reasons: It is not strictly district business. I don't feel it is right to take the staff time, other than my own, to do that.

The Board of Trustees of my district has seen fit to let me continue in this office as it is and to furnish what things we have there. The CMCA does supply, of course, stationery, postage, telephone costs; all those.

The secretarial work I do myself. There isn't any done by the district. It would be a very rare occasion that I would ever call on the District Secretary to do it. It gets a little crowded at times, I will admit.

President Murray: I would like to discuss the Treasurer's report.

Mr. McFarland (Temple City): It was brought up at the Directors' Informal Conference about the method of depositing that money. Does that call for action of the Board to have two types of account or do you do that automatically?

Secretary Washburn: That is automatic.

Mr. McFarland: I am asking whether the portion of our balance, the five thousand dollars, will be put in a savings account or checking account.

Secretary Washburn: Now that that has been brought up, Mr. Chairman, I was going to recommend to the Board of Directors – and perhaps this is the place to recommend it instead of to the Board of Directors–that at least three thousand dollars of this five thousand dollars that we have as a balance be placed in a savings account to earn some interest for the Association. The interest earned would take care of the Herms Award and some of the smaller things that we take care of on a regular routine basis.

I see no reason on earth for it to set there in a checking account. It has done so for several years and I have thought about it for some time, and maybe it is time we did something about it by proper authority of the General Assembly.

Mr. McFarland: I would like to move that at least three thousand dollars of the balance be kept in a savings account rather than in a checking account.

Mr. Kimball (Orange County): Couldn't we leave that up to the Board of Directors to recommend that?

President Murray: We have a motion here. Is the motion going to be seconded?

(The motion, having been duly made, was seconded.)

President Murray: Thank you. Now it is open legally for discussion.

Jack Kimball raised the question of whether or not the Board of Directors can take that action on its own. Frankly, it doesn't say so in the By-Laws one way or another.

Mr. Raley (Selma): I would like to raise the question whether it is advisable for this organization to maintain such a large surplus. Districts automatically for the past few years as corporate members have been contributing substantially to the Association. Rather, perhaps, than to hold onto such a large surplus, there might be a thought of, for a period of time until the surplus is used up, the relief being given to the corporate members in a lower dues payment.

Secretary Washburn: Mr. Chairman, in rebuttal to that I would like to suggest to Ted that the balance does seem large at the moment, but you will remember that last year we underwrote Lew Isaak for a period of time. It did not finally come about because there were arrangements made through the State Health Department to take care of his salary from the time he left Kern until he went to Fresno. But there are times when we do underwrite propositions of that nature, which could deplete it very rapidly, in order to further operational investigations for our own benefit. That is part of the reasons, and all of the income, of course, is not from corporate members. There is considerable from standing members and some from associate, but most of it is corporate.

Mr. Grant: I would like to point out, also, that normally our residue at the various times of the year is less than our actual expenditures during the year, which is only a standard running account with most budgetary systems, so I don't think it would be out of order to maintain a balance such as it has been.

Secretary Washburn: Mr. Chairman, you remember now, too, that we have a balance on hand. All of the districts have paid, or most all of them. There are three or four that normally pay who have not and there are several districts who have never paid, but we have most of that income in at the moment.

We also have the Conference expenses, as well as the Proceedings, which will take about twenty-five hundred dollars of this.

President Murray: You anticipate, however, that about three thousand will not be spent in our operations until the next money comes in?

Secretary Washburn: If it is readily available.

Mr. Raley: If there is that concern I can hardly see how we can dare set aside three thousand dollars, then, if we are so close to the brink of disaster. Certainly, if we can even consider, as I see it, the thought of depositing three thousand dollars in a savings account – which is reasonably a dead fund for active use – this thought of being close to the borderline in the payment of current expenses is no reason why we couldn't just as well reduce and dig into the surplus.

Mr. McFarland: I think he is out of order. He is not arguing about the question. That is a matter of another type of policy.

Mr. Raley: It is the question of whether we should deposit the three thousand or eat into it. I certainly think it is pertinent discussion to the three thousand dollar deposit.

Mr. McFarland: You must realize that interest paid every three months will increase the amount.

Mr. Raley: I am not questioning the interest. I am questioning whether we should deposit three thousand dollars, which is the point for discussion. It is my contention that we should eat it up in current expenses rather than deposit it.

President Murray: Any further discussion?

Mr. Kirchen: I believe we should keep a balance on hand for any unknown contingency that may come up in the future. I think the dues are not, from our standpoint, extraordinary at the present time, and they could continue that way. I would be in favor of putting the money into perhaps a building and loan where we get the interest every three months and it is available quickly whenever we need it.

However, during that period of time that it is in there, we get a certain amount of return for at least three months or six months, or whatever time it is, and it is still available.

President Murray: Thank you.

Mr. Kimball: I have a question. Is there a budget prepared for the coming year? Does it show what the anticipated expenses are and what the anticipated surplus will be to determine whether there will be three thousand dollars?

President Murray: That is strictly up to the new Board of Directors.

Howard, would you like to say anything about this? This is an assumption completely new to me, and I don't want to say anything about it.

Mr. Greenfield: I would only ask that in relation to this financial budget that you mentioned, what procedures were adopted last year on that?

President Murray: I should never have spoken to you. (Laughter)

Secretary Washburn: Mr. Chairman, may I back Jack Kimball up in this. For several years Jack has asked that a budget be prepared and submitted to the membership, which was done for two or three years. But the

last couple of years there has been no such budget, and actually I think the budget would conform to the financial report pretty closely. Of course, it varies from year to year slightly but not a great deal.

Mr. Holmes (Modesto): In putting this money in a savings account isn't it customary for the banker to ask for a limited time and that you withdraw it before the time is up or you lose your interest? I don't think it would be worthwhile to put that amount of money in there and then find it necessary to have to draw on that and lose the interest.

Secretary Washburn: I don't think you have to do that.

President Murray: You lose nothing, Roy.

Mr. Holmes: You don't gain anything, though.

President Murray: You don't gain anything if you have to draw it out. If you don't draw it out you gain what interest you get.

Mr. Kimball: I move we table the motion.

Mr. McFarland: I can't speak—

Secretary Washburn: Mr. Chairman, a motion to table is nondebatable.

Mr. McFarland: I will call for a roll call then.

President Murray: Mr. McFarland calls for a roll call vote on tabling this motion.

Are we clear as to what the motion is? Will the mover please state the motion clearly?

President Murray: Let's go back to the original motion.

Mr. McFarland: My motion was that three thousand dollars or more be deposited in a regular savings account so that we can draw interest on this money, which we haven't been doing, and that is all it is.

President Murray: Fine. Is everyone ready for a roll call vote?

Proceed.

Secretary Washburn: Vote either Yes, No, or Abstain. We are voting by roll call now.

President Murray: You are deciding whether to table the motion or to leave it open. If it is left open we can go ahead and process it. If it is tabled it is up to the next Board of Directors. This is strictly for tabling, and not to accept or reject the original motion. You are not rejecting anything as such.

(The motion for tabling was put to a roll call vote and was defeated.)

Secretary Washburn: Seventeen, No; nine, Yes; seven, Abstain.

President Murray: The motion to table has been defeated. We shall now vote on the main motion as to whether or not we shall deposit in a savings account three thousand dollars.

We are likely to have some differences of opinion here. Can you tie that down to a definite figure?

Mr. McFarland: Three thousand dollars or more. Of course, you could have less.

President Murray: The motion was three thousand or more. If you want an amendment you had better put it on.

Mr. McFarland: Three thousand.

(The motion as amended, having been duly made and seconded, was put to a vote and was carried.)

Mr. Portman: I make the motion to the effect that the Secretary of the CMCA be provided with an allowance for secretarial help and service in the sum of five hundred dollars a year.

(The motion, having been duly made, was seconded.)

Mr. Grant: He didn't say how it was to be utilized or for what purpose in the motion.

President Murray: Well, let's have some discussion.

Mr. Geib (Bakersfield): Would it be automatic that five hundred dollars be utilized, or will it be just whatever amount is necessary to meet those requirements?

President Murray: You meant as needed, didn't you, Bob?

Mr. Portman: Yes.

Mr. Grant: That is to be utilized for secretarial help?

President Murray: Bob, there is a little misunderstanding. Is that for secretarial help?

Mr. Portman: Secretarial and clerical help which are necessary for him to fill all the functions of his office.

President Murray: That clears it up, I believe.

Mr. Grant: That would be included in the motion?

President Murray: That's right.

(The motion, having been duly made and seconded, was put to a vote and was carried.)

President Murray: I believe that clears the reports of the Secretary. We are ready for the next committee.

The next committee is the Culicidology Committee, Mr. Ed Loomis, Chairman.

REPORT OF CULICIDOLOGY COMMITTEE

ED LOOMIS, *Chairman*

In view of the numerous activities and recommendations made by this committee during 1956, it was thought advisable that the following report be made for permanent record within the CMCA.

Committee members had the opportunity to meet three times this year, which in itself is an example of the interest in activities and also an example of the need for more collective action in making progress on these same activities or projects. Although Mr. J. Shanafelt, member from Southern California, could not attend any meetings, he was kept advised on the actions and recommendations of this committee. Minutes of each meeting are attached and the business conducted as a result is condensed into the following outline:

A. *Old Business* — holdover from recommendations made by the 1956 committee.

1. Review of report "Survey and Study of the Mosquito Population Measurement Program Conducted by California Mosquito Control Agencies." A separate report was made from a study of the request made in the above first report on evaluating fixed stations versus random sampling as a means of conducting larval surveys.

   The pros and cons of each method have been outlined in a final report by committee members. It was recommended by this committee that this report be circulated to every mosquito control agency in order that they may review the subject with the hope that various segments of these sampling methods be used to supplement their existing program.

   It was further recommended that the value in use of adult mosquito testing station measurement methods could best be attained through application

of this technique during the winter months, and in areas where light traps cannot be used or do not satisfactorily sample the existing mosquito population.

B. *New Business*

1. A survey was conducted by one committee member, Mr. E. Mezger, on the type of field key of mosquitoes needed by operational personnel in mosquito control agencies. Results of this survey will be given on Tuesday, January 22, 1957, at the CMCA annual conference, but highlights of this report are included in the following outline:
   a. Request for a well-illustrated, dichotomy-type key restricted to one genus per page.
   b. Characters used should be circled or pointed to with use of the technical term as applied in taxonomy.
   c. Addition of a glossary of terms and characters used in the key.
   d. Addition of county distributional list.
   e. Addition of a short, ecological description of each species.

   It was further recommended by this committee that approval be made for immediate action by the 1957 Culicidology Committee in preparation and publication by CMCA of this standard operational key.
2. The two-year-old list of current and proposed mosquito investigation projects in California was reviewed by this committee chairman in conference with Mr. T. Raley, Operational Investigations Committee Chairman, and Mr. L. Isaak, member of the Toxicology Committee. It was agreed that the CMCA should approve the review of this list with final publication in the 1957 CMCA Year Book and that additional reprints be made of this subject for distribution beyond the normal mailing list of said year book.
3. The need was recognized by this committee for action on the compilation of biological information on our California species of mosquitoes. This in no way reflected upon similar efforts by Drs. Freeborn, Bohart and Carpenter in their past publication but was stimulated from a review of the current status of biological information available on our mosquitoes. Realizing that valuable records and observations existed within the files of many mosquito control workers, it was decided that each committee member, as a pilot study, select an important species and acquire as complete a review of what is known on the various aspects in the biology of this species. A fill-in questionnaire was produced as an aid in acquiring this information. (See attached.) Due to the long-term basis of this activity it was recommended by the committee that each member continue on his assigned species, that any new members assigned to this committee be given separate species, and that additional culicidologists in California be likewise assigned species upon the recommendation of future committee(s) vote.

E. C. Loomis, Chairman
L. L. Hall
H. Herms
E. G. Mezger
D. E. Reed
J. G. Shanafelt

Mr. Loomis: I have it written down for you, Mr. Chairman. However, there is one item that I would like for approval or discussion by the group, and that is the approval of the recommendation which we have made to the 1957 Culicidology Committee that they sponsor a technical seminar for a source of information for workers here in mosquito control and in research and investigation. This has been sorely needed over the years and was discussed in our business by the 1956 Committee.

I would like to have the approval by the members of this action here since it would be the first action for the 1957 Committee, Mr. President.

That is the only major issue outside of my report.

President Murray: Do you have a time on that?

Mr. Loomis: No. The time and place were going to be discussed by this Committee. It was going to be passed out for opinions and recommendations to CMCA members and other interested personnel from both the Federal and State agencies, as well as from educational institutions.

The host for such a meeting has already been offered by the University of California. They have opened up their door.

The motion, then, is to the effect that the 1957 Committee approve that the 1957 Committee continue this action and draw up plans for a technical seminar.

(The motion, having been duly made and seconded, was put to a vote and was carried.)

President Murray: The next committee on the agenda is the Duck Club Committee, Arthur Geib, Chairman.

Mr. Geib: No report; no action; no recommendation.

President Murray: Thank you. We will finish on time if all the reports are that brief.

Education and Publicity, John Stivers.

REPORT OF EDUCATION AND PUBLICITY COMMITTEE

JOHN STIVERS, *Chairman*

Mr. Stivers: I can't be quite that brief, but I will keep it down.

The Committee engaged in five particular activities last season, starting with the taking of photographs of all of the speakers at last year's Conference and the mailing of prints of those for publicity purposes.

We have carried that a shade further this year in that we sent a questionnaire out to all speakers requesting them to list their local groups and any highlights which might be incorporated in group articles, and we are again taking pictures of those individuals who did return the questionnaire; we are presuming if they didn't they are not interested in local publicity.

We have three exhibits which we set up during the year. The first was at the California State Fair and, apropos to that, I would like to extend the thanks of the Committee to those various districts and the bureau personnel who helped out in managing the booth at the Fair.

We had a modified version of that same exhibit aimed a little more toward a more specialized group at the first Central Valley Regional Conference held in Modesto on October 5, and we have an exhibit downstairs at the present moment.

That is about the extent of our activities during the year.

We would like to make one suggestion, not a recommendation for a vote, but just a suggestion that next year's Committee consider the possibility of compiling a library of all bulletins, pamphlets, and leaflets published by and in general use by all of the member agencies of the Association so that they would be available for source material and use in the writing of future literature.

President Murray: Thank you John, for your report.

Forms, Records and Statistics, Jack Kimball, Orange County, Chairman.

REPORT OF FORMS, RECORDS AND STATISTICS COMMITTEE

JACK H. KIMBALL, *Chairman*

Mr. Kimball: The Forms, Records and Statistics Committee was composed of six active, ingenious members. I would like to read them off so that you will be familiar with the ones who did the damage: Russ E. Fontaine, Ty Muller, W. D. Murray, Robert Portman, and Jack Water.

We had three assignments for 1956, which was the starting suggestion by our President, and the first one was more or less left over from the Committee for 1955. When Don Murray was the active Chairman of the Forms, Records and Statistics Committee and had done all the footwork and all the detail work in laying out the proposed monthly report for mosquito abatement districts, this was passed on to the 1956 Committee, but Don still carried the ball on that, and it wound up on August 31 at our meeting in Bakersfield with the final approval and recommendation for this reduced and condensed type monthly report.

That was accepted and recommended to the Bureau of Vector Control for use in reporting on subvention activities, and it was adopted for the last three months of the year on a trial basis, and I believe that starting in January it is the requirement to follow this type of form.

Don, that is your baby, and you did a wonderful job on it.

The other assignment was on the salary survey and it went down as a Committee project but, as you know, Don has been sending out the forms and typing up all the summary investigation on the salary survey, so this years as President he did all the work in that and sent it out and gave the Committee the credit.

The other job was the publishing of the 1956 yearbook, and that was gotten together and published at a cost of $130.50 to print and mail about five hundred copies. Our district's approval by the Board of Trustees provided the clerical help and the typing, but most of all our entomologist, John Shanafelt, with his home printing did all the print work. We did the typing, but he did all the technicalities of getting this out, so I certainly want to give credit to John Shanafelt, who is not on the Committee, but who is the printer behind the yearbook.

President Murray: Thank you, Jack.

May I say that this yearbook has helped the current President avoid embarrassment which, I understand, certain past presidents have had in coming to the Business Meeting and not knowing who the committees were. All you have to have is this booklet and you can see who your committees are.

Mr. Grant: I knew, but it took me an hour to remember.

President Murray: I didn't think it was you. It is certainly a handy reference, and the whole philosophy of this, I might say, came from Jack Kimball several years ago when he recommended that we consider it. I am sure it doesn't need to go as a motion. This will be continued year after year.

Mr. Stivers: Mr. President, I realize we don't need to accept these reports, but I think that a very definite vote of thanks is due to both Jack Kimball and John Shanafelt.

President Murray: I will accept that as a form of motion for the Resolutions Committee. It includes Jack Kimball, John Shanafelt, and the Board of Trustees of Orange County Mosquito Abatement District as being given a vote of thanks for their part in producing the yearbook. That is in the form of a motion.

(The motion, having been duly made and seconded, was put to a vote and was carried.)

President Murray: Thank you.

Insecticide Committee, Gordon Smith.

REPORT OF INSECTICIDE COMMITTEE

GORDON SMITH, *Chairman*

Mr. Smith: The Insecticide Committee's primary function and the primary reason it was formed was to get together all the information and put it in form for publication, "Guide and Recommendation," for the use of insecticides in California, which has been done and everybody has a copy. That is the major part of the report.

There was discussion, and I think it should be carried on into the future, that this was a beginning in such a work, and there will certainly be questions coming up and changes advisable. Also, as the insecticide picture develops there will be new information to go into it.

The thought was that it should be considered for revision at least in two years time, excepting suggestions and recommendations for changing and also to cover any new information that does come along.

There was also a suggestion that a similar work be put out by the Insecticide Committee on the use of weedicides for mosquito control, slanted at our particular purposes. No action was taken on that, largely on my decision that there was no formal recommendation made, but there still is at the present time a number of the new weedicides that are not well enough known

to actually make definite recommendations on. So I would like to suggest that for future committee activities that that be gone into and the possibility be considered of a similar bulletin on weedicides slanted toward mosquito control problems.

That is my report.

President Murray: Thank you.

The next committee is the Legislative Committee, Dick Sperbeck.

REPORT OF LEGISLATIVE COMMITTEE

DICK SPERBECK, *Chairman*

Mr. Sperbeck: The Legislative Committee had two bills that have been submitted to Assemblyman Brown, both probably of a non-controversial nature.

One is the usual bill that we submit every year to exclude the mosquito abatement districts, the formation of mosquito abatement districts, from the District Investigation Act.

The other one is a bill that is probably more for the convenience of our county auditors and to get it more straight in their minds, and I know from the expression of my own auditor that they were glad to have this change made.

This suggested amendment to the Mosquito Abatement Act repeals the Cash Basis Fund. However, 2313 repeals the Emergency Fund, 2314, and amends 2300 as follows:

> The District Board of each mosquito abatement district, not less than fifteen days before the first day of the month in which the Board of Supervisors of the county or counties in which the district is situated, is required by law to furnish the Board of Supervisors and County Auditor of the county an estimate in writing of the amount of money necessary for the district's purpose during the next ensuing fiscal calendar year.
>
> The amount of money necessary for the district's purpose may include a general reserve for the purpose of defraying district expenses between the beginning of a fiscal year and the time of distribution of tax receipts in the fiscal year. Such general reserve shall not exceed sixty per cent of the estimated expenditures for a fiscal year. The amount of money necessary for the district's purposes may also include an unappropriated reserve for the purpose of defraying unusual or unanticipated expense. Expenditures from such unappropriated reserve may be made only upon an affirmative vote of four-fifths of the members of the District Board. Such emergency fund is not to exceed twenty-five per cent of the estimated expenditures for a fiscal year.

Now, that, as you can see, just simply puts under those two funds any money, instead of cash basis, and some counties were using one method and one another. This simply makes it uniform.

There is an opening for bills. If anything should develop from this Conference, we can still submit bills to the Legislature.

That is my report.

President Murray: Thank you, Dick. Maybe there are some questions that they would like to ask.

Mr. Kimball: I didn't catch that reading. The general reserve is sixty per cent, and what was the cash basis fund?

Mr. Sperbeck: The emergency fund was twenty-five per cent.

Mr. Kimball: Was that within the sixty per cent or in addition?

Mr. Sperbeck: In addition.

Mr. Grant: That gives you a total of eighty-five.

President Murray: Thank you.

I believe that perhaps all of you should understand that it is primarily a change in name. You still have the same fund, but it is called "General Reserve." In many counties they didn't even read the Health and Safety Code to find out what they should have been calling the fund. In our district it is simply called "General Reserve." Other county auditors who might have read the Health and Safety Code might have made it a little awkward at times.

Mr. Robinson: Mr. Chairman, I think we should endorse the action of this Association on those bills.

Secretary Washburn: That is automatic.

President Murray: I am sorry, but the Chair was not addressed.

Chet, did you put that in the form of a motion?

Mr. Robinson: Yes.

President Murray: How would you state that?

Mr. Robinson: Endorse the report of the bills for action by the Legislative Committee.

(The motion, having been duly made and seconded, was put to a vote and was carried.)

Mr. McFarland: Chester Robinson has written me several times during the year about legal opinions on Sections 2350 and 2351 entitled "Withdrawal" that were passed in the 1955 Legislature. He mentioned to me that there have been some other offhand rulings, and I wonder if this wouldn't be an appropriate time to hear those at this time.

Mr. Robinson: We have a letter – I didn't bring it down with me, unfortunately – that states, if my recollection is correct, that that falls on the Board of Trustees before any action can be taken on withdrawal of any section of the district, and what they did down there was essentially illegal.

President Murray: I believe, Mac, that this matter was worked on. No complete solution was reached. It might be suggested that the next Legislative Committee continue working on it.

Howard Greenfield, Membership Committee.

REPORT OF MEMBERSHIP COMMITTEE

HOWARD R. GREENFIELD

Chairman

Gentlemen:

As Chairman of the Membership Committee, I am not pleased to report on the status of the Membership to date. As you gentlemen know, there are four classi-

fications of Memberships: Corporate, Associate, Sustaining and Honorary Members. The Corporate Membership is reported by the Secretary-Treasurer, thus leaving the remaining three classifications to be reported by the Membership Committee.

This year saw a small, but encouraging, increase take place in the Associate Membership. In part, I believe, this increase has been occasioned by the two very excellent publications which were sponsored by the California Mosquito Control Association, namely, the Year Book and the "Guide and Recommendations for the Use of Insecticides in California Mosquito Control." However, an increase of three new members in an Association such as this cannot be viewed with much satisfaction. Certainly fifty-one Associate Members is a drop in the bucket. We should be able to command two hundred and fifty-one members, or even more, and this must be done if the Association is to continue to progress and to grow.

Reporting on the Sustaining Membership, I must admit to partial defeat — not complete defeat — just partial, in that the Association does have a Sustaining Membership, although not a very large one. Why? I am not certain, but in reviewing the Sustaining Membership lists of previous years, one factor seems to stand out above all others — that of the location of the Annual Conference.

Certainly, gentlemen, we are not representing in this group, localities, but we are representing the combined activities of the Mosquito Control Agencies on a State-wide basis, and this idea must be made apparent to those to whom we turn for Sustaining Memberships. Thus, recognition, or privilege in some form for service rendered, must be extended to those that do participate in a supporting position. Needless to say, this year has been very ungratifying in the number of Sustaining Memberships obtained. As of this moment, there are only thirteen Sustaining Members.

Now I come to the one classification I can say I'm happy to report on, that of the Honorary Membership. As you will recall, at our Twenty-third Annual Conference held in Los Angeles, an Honorary Membership was bestowed upon Harold Gray, Manager of the Alameda County Mosquito Abatement District from 1930-1955. It is indeed a pleasure to see Mr. Gray in attendance at this business session.

Recommendations:

The Committee wishes to recommend, to the incoming Board of Directors of the California Mosquito Control Association, that serious consideration be given to methods of building an Associate and a Sustaining Membership commensurate with the financial, technical, and social needs of the California Mosquito Control Association.

Respectfully submitted,

HOWARD R. GREENFIELD, *Chairman*

J. D. Willis

Gardner C. McFarland

John H. Brawley

ASSOCIATE MEMBERSHIPS — 1956

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Delta Mosquito Abatement District
Visalia, California

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12th Naval District
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William K. Jackson
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John J. Ryan
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Office of the Surgeon
APO 633, New York

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William C. Furguson (Niagara Chemical Co.,
Division—Food Machinery & Chemical Corp.)
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Leslie D. Beadle
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G. Edwin Washburn, Manager
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Merrill J. White
Technical Field Representative
Chipman Chemical Co., Inc.
3964 No. Drexel
Fresno, California

Frank W. Mead, Entomologist
State Plant Board of Florida
Seagle Building
Gainesville, Florida

Walter O. Marshall, Tech. Assist.-Entomologist
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1957 – Memberships

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SUSTAINING MEMBERS – 1957

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Automotive Supply Co.
Visalia, California

Fresno Agricutural Chemical Co.
Fresno, California

Chipman Chemical Co.
Palo Alto, California

Sunland Industries, Inc.
Fresno, California

F. M. Speekman Co.
San Francisco, California

Moyer Chemical Co.
San Jose, California

Rohm - Haas Co.
San Francisco, California

Holt Brothers Co.
Stockton, California

Braun-Knecht-Heimann Co.
San Francisco, California

Richfield Oil Corporation
Los Angeles, California

Pacific Guano Co.
Berkeley, California

Food Machinery & Chemical Corporation
John Bean Division
San Jose, California

President Murray: Thank you, Howard.

We will go to the Operational Investigations Committee, Ted Raley, Chairman.

REPORT OF OPERATIONAL INVESTIGATIONS COMMITTEE

TED G. RALEY, *Chairman*

Mr. Raley: In past years a good deal of time at each Business Meeting has been given to a report of the operational activities. The feeling this year was that there would be no report from the individual committees, but I have asked Dick Peters to bring us up to date on the present status of the Operational Investigation and in turn comment on what the future might hold in that.

I have limited Dick to not more than five minutes on that, and then, if I may, I have one recommendation to make to the Board of Directors.

Dick, do you have a comment to make?

Mr. Peters: Continue. You may make your recommendations first.

Mr. Raley: I will make the recommendations and Dick might cut his to three minutes.

The recommendation to the Board of Directors is that within the yearbook in 1957 a list of all Operational Investigations, all studies, all research being conducted within the State of California by any and all agencies be printed, and a reasonably descriptive comment be included with the list on those studies where that information is available. This material will be furnished to the Records Committee by a joint committee group of the Association.

Now, I make that merely as a recommendation to the Board of Trustees and yet, if there is any comment from the Membership, if we could have it now it might guide us in preparing this list.

If you will recall, in 1955 a list was presented in the proceedings, and yet there is a feeling that distribution on that was perhaps limited while if published within the yearbook, additional copies could be run off as the yearbook was published.

This list and the yearbook, itself, of course, could be sent to all universities and to all agencies interested in mosquito control and the problems related to it.

President Murray: Any discussion? Jack?

Mr. Walker: I am not a member, but I still feel that there is some merit in continuing the release of that particular type of information in the Proceedings from the standpoint of the direct references that have been made to it, having been in the Proceedings, and the wider distribution as already provided for automatically, and it also seems to me that that particular type of information is rather foreign and not in keeping with the other kinds of information that are released in the yearboook.

I would like to hear more comments on the relative merits of the two media available before its release.

President Murray: Does anyone else wish to say something?

Mr. Greenfield: Mr. Chairman, I can only state an experience that I have had in the last few months on interagency work. I have been approached by the Agricultural Commissioner's office, the farm bureaus, and the Farm Advisor's office for that very purpose of getting information on these Operational Investigations for their work that they are doing and that they had found the source to occur in the Proceedings and, as such, came to our district to get copies so that they could work from those reports.

We have had a number of commercial companies that have also been interested in obtaining reports that were related to their products or their field of activity, and their source of information was in the Proceedings.

Secretary Washburn: Mr. Chairman, I would like to ask a question of Ted.

It was not your intent necessarily to limit it to the yearbook, was it, but to make that in addition to the listing in the Proceedings? Or am I wrong?

Mr. Raley: For this particular year we had not thought of including it in the Proceedings. The feeling

was that many who do not have access to the Proceedings, particularly in your universities where there is a question of paying the fee for the Proceedings, are not getting this material.

Now, I feel that anyone receiving the Proceedings, of course, has access as well to the yearbook, and yet there might be a problem there. But we felt it would be wise to make that available in a more convenient form so that many of those where finances were a problem could have it without any expense, with no thought of minimizing the benefits we get from including it in the Proceedings.

We did want to present this possibility.

Mr. Grant: Also there is a possibility of putting it in the Proceedings and then having covered reprints of it put out. Once you have it set up in type your costs would minimal, and you can hand it out that way with a title cover on it.

Secretary Washburn: Mr. Chairman, Ted indicated a matter of price and, as far as Proceedings are concerned, most libraries, university libraries and investigational libraries, throughout the country and all foreign libraries that ask for it get the Proceedings without cost.

Mr. Raley: We had in mind, of course, to aggressively canvass and circularize or distribute this yearbook to any and all rather than wait for them to perhaps receive it by chance or through the normal channels. We are missing, we feel, quite a field of interested workers in that they never see the Proceedings, where if we had something similar to the yearbook, we could stimulate interest in the Association, as well as make available to those people a list of the research and investigations that are being conducted; just another facet to create more interest in the California Mosquito Control Association, and it would let more of us know what research is going on.

I venture to say that few of us even have the vaguest notion of what the universities are doing on research related to mosquito control, where with this started and aggressively carried forward, we could build this up to a greater interest and a greater field of information.

President Murray: We have in the yearbook this year an example of simply an address list, but it shows the different groups of the Bureau of Vector Control in different areas. The same type of thing might take about two pages, maybe a little bit more, on, as you say, the research studies.

From the standpoint of practicality, I believe Jack Kimball would agree it would fit in without too much difficulty; would it not, Jack.

Mr. Kimball: I was going to ask that question. Would you have in mind in this yearbook – which gets out in the next couple of months – just a brief summary of what research problems are going on and anticipated this coming year, and the Proceedings include the reports on these?

President Murray: It can't be a long report of research.

Mr. Kimball: In the yearbook you cannot reprint it.

Mr. Raley: This will be only a list with reasonably descriptive comment where that information is available, and it raises a question of whether in yearbooks we should repeat the Constitution and By-Laws each year, or couldn't material like this be used to better advantage to make the yearbook of sufficient size as to merit the work that Jack and his group devote to it.

President Murray: I think that can become a minor problem.

Mr. Raley: This has nothing to do with the report of the Operational Investigations group. That is generally presented in the Proceedings. This is not in any way connected with the report of the activities of that group.

President Murray: That is right. Thanks, Ted. Do you want to call on Dick now?

Mr. Raley: You can have one minute, Dick.

Mr. Peters: Ten minutes ago Ted was nice enough to give me three minutes of his five minutes. Now he gives me one minute of his remaining three minutes. Needless to say, I couldn't possibly cover any one of the five activities the Bureau's investigational program is attempting to work on.

I can tell you, however, that we are studying the irrigated pasture or sheet irrigation flooding type of mosquito problem. We have cooperated closely with the United States Department of Agriculture in studies aimed at computing the ratio of mosquito production to irrigation efficiency. We are gathering significant data in this regard.

The other ramifications of that study include determining the influence of aging on a pasture, and attempting to document what happens to mosquito occurrence in keeping with the amount of water applied.

The next activity is the constant flooding type of mosquito problem, of which the rice field is the primary example. We have sought to analyze the physical, chemical and biological components of rice fields to determine which factors tend to support the rice field type mosquitoes.

We have finally, at long last, received approval from NIH for approximately twenty-seven thousand dollars over a two-year span of time, to investigate the mode of action of blue-green algae in deterring both *Culex tarsalis* and *Anopheles freeborni* in rice fields.

There are other angles we are working on in the rice field problem, including determining the conditions which are conducive to a mosquito laying its eggs in certain rice fields and not in others. We are trying to determine what the nitrogen factor is in a rice field thereby to determine what aspects govern mosquitoes being sustained in a rice field environment.

The next kind of irrigation being studied is the row crop type, best exemplified by cotton irrigation. Observations so far have been largely in the nature of documenting the significance of the mosquito problem, because the acreage is so vast and there exists so much confusion about whether or not cotton is a real problem.

As a result of last year's extravagant use of water we can dispel any question in anybody's mind as to whether or not cotton is an important mosquito source. We found *Culex tarsalis* in great numbers, *Anopheles freeborni* in great numbers, and *Aedes spp.* in considerable numbers in much of the cotton acreage studied.

These findings, of course, have now to be correlated to cultural practices. We have really only started in the cotton study.

The next activity relates across the board to all three previous projects I have mentioned; namely, studying the egg stage of the mosquito and determining how the hatching of mosquito eggs can be influenced so as to prevent the adult mosquitoes from ever coming into being.

These studies are undertaking the more obvious things first: the effect of temperature, the effect of humidity, and the effect of other external stimuli upon the egg. The egg is being examined minutely from the standpoint of its every cell layer in quest of means to somehow interfere with normal hatching.

This is an intricate and complex subject, but I believe we are making some good progress in the direction of seeking applied objectives.

Lastly is the activity on screening and field testing of insecticides. We have received much cooperation on this program from the U.S.D.A. Agricultural Research Service. Art Lindquist and C. M. Gjullin have been very generous in helping us evaluate the insecticidal ways we may use to stem an encephalitis outbreak in the event we have another of those 1952 experiences.

On this subject, I regret having to report that, despite a lot of fine work having been done and despite the excellent capacities of malathion as an insecticide, we are not yet in possession of a method which offers better than fifty per cent control of adult *Culex tarsalis*. I make mention of this to impress everyone with the fact that in research even the best conceived and most extensive efforts sometimes yield negative information. Such data are, however, the building blocks toward achieving eventual success. The only course which seems open to follow is contained in the late Professor Herms' advice: "Know and know well the insect." We must find out where this damn mosquito secrets itself, hides out, in order to know where, and at what time of the day, and how to reach it. We now know well that despite the best applied aerosols and space sprays of all kinds we still haven't gotten adequate control of it in an area.

The other activities that pertain to Lew Isaak's work are undoubtedly most important to the majority of the districts in that the new insecticides available are being screened to determine their utility in mosquito control.

The phosphate insecticides impose a couple of major considerations: One is hazard to humans; the other is their capacity to continue to kill mosquitoes.

The episode that took place in Fresno County last year gave us all a shock in that malathion resistance was unquestionably demonstrated. Parathion, despite its adverse aspects, remains a very potent, effective insecticide. However, we are seeking to find some insecticide(s) possessing the low mammalian toxicity of malathion and the high toxicity to mosquitoes of parathion, hopefully exempt from the bugaboo of resistance.

Now, Ted, it's back to you, for as you can see, the subject is endless.

(Applause)

Mr. Raley: I enjoyed my report on the Operational Investigations very much. Thank you, Dick.

Mr. Robinson: Mr. Chairman, the membership Committee made a report, but I would like to make an addition to it. Harry Stage has recently retired and, as you know, has attended almost all of our Conventions, presented his talks to us, which have been very instructive, and I would like to make a motion that he be placed on the Honorary Roll of our Association.

(The motion, having been duly made, was seconded.)

President Murray: Well, can we elect him in?

> Any individual who has performed some outstanding service in the interest of mosquito abatement in the State of California or elsewhere shall be eligible for election to honorary membership upon recommendation of three or more associate or corporate members after at least ten days notice in writing to all corporate members. Such recommendations shall be presented at the Annual Meeting of the Association and such individual become a member of the Association upon election by a two-thirds majority vote of the representatives of corporate members.

According to this, Chet, your action doesn't fit the By-Laws, as much as our sympathies are with what you suggested. We haven't followed the By-Laws anywhere else. (Laughter)

May we make your motion to the effect that the processing be initiated?

Mr. Robinson: That takes another year unless you do it by ballot during the year.

President Murray: That isn't difficult. Our Secretary has more money now.

I would like to keep that as a motion then. I believe we will continue that as a motion made and seconded. We will call for the question.

(The motion, having been duly made and seconded, was put to a vote and was carried.)

President Murray: Thank you.

Publications Committee, Don Grant.

REPORT OF PUBLICATIONS COMMITTEE

C. Donald Grant, *Chairman*

The principal committee charge was publication of the 24th Proceedings and Papers of the California Mosquito Control Association. By aid of a stenotype reporter, a complete record of the extemporaneous remarks and addresses was made available in duplicate and served considerable aid in avoiding unnecessary delays in the subsequent editing of the complete text. It is felt by the Committee that such a stenotype recording system may be profitably employed in the future in lieu of tape recordings at the Annual Conferences.

Considerable time was spent in the preparation of rules, procedures, and policies in the publications of the Proceedings, the submission of papers therefore, and in regard to miscellaneous booklets of the Association. This report and the recommendations pertaining thereto were approved by the Board of Directors on November 2, 1956, at Berkeley, and copies were subsequently mailed to the membership of the Association by the Secretary.

Respectfully submitted,
Publications Committee
John R. Walker
G. Edwin Washburn
C. Donald Grant, Chairman

President Murray: Thank you, Don.

Source Reduction, Robert Peters, Chairman.

Mr. Greenfield: Don, Bob Peters asked me to present his report as he was unable to be present today, or at any further meeting of this Association for this Conference. He is very regretful that he is unable to be here.

REPORT OF SOURCE REDUCTION COMMITTEE

ROBERT H. PETERS, *Chairman*

The Source Reduction Committee of the CMCA held one meeting during the late fall of 1956. Other meetings were somewhat limited first by the pressure of control operations, and later by the fact that your chairman also was presented with the chairmanship of the program committee for this Conference.

The following four recommendations were made at this meeting for the Source Reduction Committee for 1957:

1. That an expanded education compaign regarding the scope and objectives of source reduction be undertaken.
2. That a source reduction bulletin titled, "General Principles of Sourse Reduction" be composed during this year, and made available.
3. That a clarification of terms used in source reduction be given further consideration in order that our vocabulary can be standardized throughout the State.
4. That a questionnaire be sent to all agencies for the purpose of getting together all available information on source reduction relative to:
   a. Personnel utilized in source reduction programs.
   b. Equipment and tools used and whether owned.
   c. Types of source reduction problems in percents.
   d. Methods applied by agency in accomplishing source reduction.
   e. Costs paid or assessed to accomplish results.

Respectfully submitted,
Robert H. Peters, Chairman

President Murray: Thank you, Howard. Those are merely recommendations to the Committee. No formal action needs to be taken.

Ways and Means Committee, Les Brumbaugh, Chairman.

REPORT OF WAYS AND MEANS COMMITTEE

L. R. BRUMBAUGH, *Chairman*

During 1956, the Ways and Means Committee held seven general meetings to develop and formulate ideas on the suggested projects as outlined in the 1956 CMCA yearbook. At the first meeting it was decided that the membership of the Committee should be enlarged to include several additional members. The entire committee consisted of the following members: Art Geib, Bob Peters, H. Greenfield, J. Kimball, Chester Robinson, and L. R. Brumbaugh.

It was further decided that the purpose and goal of this committee should be to investigate ways to streamline and improve the organization and operation of the membership agencies of the Association and to devise, suggest or recommend means for effecting such improvements. As previously suggested, the projects undertaken by this group are as follow:

For our first project, should the Association start a scrapbook? This book will contain newspaper articles, pamphlets and other publications issued by the Association. A book of this nature would serve as an historical collection for preserving documents and records. The committee definitely recommends that the Association begin a book of this nature.

On our second project, the Committee investigated the possibilities of standardizing titles of District personnel. After several general and sub-committee meetings, it was decided to divide the functions of the M.A.D. agencies into five groupings: Administrative, Technical, Supervisory, and Operational Services. From these five groupings, 19 job classifications were developed. Investigation work was undertaken on each job title, defining the duties, outline of the typical task performed, and the qualifications of each separate position. The work accomplished under this project is still in the preliminary stages, and a great deal more work is needed to complete it. Before releasing any material, the Committee definitely recommends continued study on this project for another year.

Our third project was to investigate and evaluate the proposed legislative bill entitled "Council of Mosquito Abatement Agencies," developed by the CMCA 1954 Ways and Means Committee. After a re-appraisal and revision of the original bill, this Committee strongly recommended that such proposed bill be sent to the membership of this Association. The bill was submitted to the State Department of Public Health and reviewed by the Senate Advisory Group to determine the correct legal phrasing. On November 2, the Board of Directors of the CMCA instructed its Secretary to send copies of this proposed legislation to each member for their consideration. Since the mailing of this bill, additional problems have arisen. There appears to be a misunderstanding as to the need for such a Council, and the belief by many that by-laws should have been presented with the bill. The Committee, therefore, recommends that no official action be taken at this time, or until these points can be clarified.

In summarizing the work of the 1956 Committee, the Committee wishes to make the following recommendations:

(1) That the 1957 Committee continues the project on job classifications, titles, and duties for Mosquito Abatement Personnel.

(2) The 1956 Committee feels that the importance of the project, "Council of Mosquito Abatement Agencies," jusifies a continued study by the 1957 Committee and efforts should be spent on the provisions, particularly on the development of the proposed by-laws for this bill and a more comprehensive outline of the needs and functions of such a council.

(3) The Committee recommends that the Board of Directors of the CMCA assign a committee to assume the responsibility of starting and developing a CMCA scrapbook.

It is further recommended, when considering the appointment of committee members on the Ways and Means Committee, that a nucleus of at least three of last year's members be retained.

Respectfully submitted,
1956 Ways and Means Committee

President Murray: Thank you, Les. Those recommendations are informal, are they not?

Mr. Brumbaugh: Right.

The next committee is the W. B. Herms Award, Richard Peters, Chairman.

REPORT OF
W. B. HERMS AWARD COMMITTEE

RICHARD PETERS, *Chairman*

Mr. G. Edwin Washburn
California Mosquito Control Assn. Inc.
Box 629
Turlock, California
Dear Mr. Washburn:

This will acknowledge with deep appreciation the W. B. Herms Campership check for thirty-five dollars.

This money will be used to send Dick Johnson of Troop 8, Berkeley, to Camp Wolfeboro for the First Period. It will also help sent a second boy from Troop 57 of Berkeley to Wolfeboro the Second Period.

Will you kindly express the appreciation of the Council to the members of your organization for this assistance to worthy boys of our area.

Sincerely yours,
Victor Lindblad, Scout Executive
Boy Scouts of America

Mr. Peters: That is the extent of the report, it having been appropriately put.

I did also want to convey to you for your information the fact that Professor Herms' widow, Mrs. Willie B. Herms, also passed away last year, and I just wanted to make mention for the benefit of those who did not know.

President Murray: Thank you, Dick.

That completes the standing committees. Now, before the special committees give their reports we should consider any old or new business.

Do you have any old business?

Secretary Washburn: No.

President Murray: We will move on quickly. Is there any new business to be brought up at this time?

Mr. Peters: May I?

President Murray: All right. I was trying to get through on time.

Mr. Peters: I will try to make this very brief. It concerns the matter of civil defense that Dr. Merrill presented to you in his address of yesterday morning.

The subject remains a vital one to every Californian, and it is important that mosquito abatement people be identified in the event of need for civil defense activities in vector control and decontamination functions for our own protection.

I make the appeal to you that you take steps to follow this up by reporting in to your local civil defense office and enrolling there in the medical and health services so as to assure that in the event of need you will be assigned to this activity. I think that is a duty that we in public office owe to the public of California.

The other point I would like to make concerning civil defense is that General Van Wyk, who is the person in charge of the State Civil Defense Surplus Property Program and other related activities, will be here to address this group immediately following the close of the Meeting tomorrow at noon. He has important information to bring to all of you about procurement of surplus property. So I would invite your indulgence for a short time after the closing of the Meeting tomorrow for General Van Wyk's presentation.

Thanks.

President Murray: Thank you, Dick. I am glad you made arrangements with the General, because there has been considerable misunderstanding, at least locally in Tulare County, as to who does what. I would like to get it straight from the authorities.

The special committees: Resolutions Committee, Don Grant, Chairman.

REPORT OF RESOLUTIONS COMMITTEE

C. DONALD GRANT, *Chairman*

The following resolutions have been proposed by this Committee and are herewith presented for approval by the members of the general assembly:

RESOLUTION NO. 1

WHEREAS the members of the California Mosquito Control Association are familiar with the transactions of the Board of Directors during the past conference year through attendance or the distributed copies of the minutes of such meetings

BE IT RESOLVED, that the actions taken by the Board of Directors during the past conference year, as duly recorded in the minutes, be approved by the members assembled in this business meeting of the 25th Annual Conference.

RESOLUTION NO. 2

WHEREAS the program, presentations and meeting arrangements for the 25th Annual Conference of the California Mosquito Control Association, held at the Hotel De Anza in San Jose, has afforded great interest and enjoyment to the delegates here assembled

BE IT RESOLVED, by the members in this assemblage at the annual business meeting of Jan. 22, 1957, that we hereby express our deep appreciation and thanks to those who have contributed their time and efforts in effecting the success of the program and Conference arrangements.

BE IT FURTHER RESOLVED, that the Secretary-Treasurer of this Association be hereby directed to send letters of appreciation and thanks to those persons participating and contributing to this 25th Annual Conference, and in particular to the following:

Members of the Program Committee: Robert H. Peters, Chairman, Ted G. Raley, C. Donald Grant, and Richard F. Peters (ex officio),

Members of the Local Arrangements Committee: E. Chester Robinson, Chairman, Howard R. Greenfield, Marvin C. Kramer, Dean Ecke, C. Donald Grant, and John O. Stivers.

And to James St. Germaine and staff of the Santa Clara County Health Department and Dr. Thomas F. McGowan of the San Jose City Health Department.

RESOLUTION NO. 3

BE IT RESOLVED, that this assemblage herewith acknowledges the valued friendship and services of our former colleagues, now deceased in this past year:

Mr. L. S. Haile of Corcoran M.A.D.

Mr. Earl A. Arnette of Eastside M.A.D.

Mr. Eugene J. Beumiller of Ballona Creek M.A.D.;

And that this meeting be adjourned in their memory and suitable memoriums be published in the Proceedings of this Twenty-fifth Annual Conference.

Respectfully submitted,
Resolutions Committee
Ted G. Raley
E. Chester Robinson
C. Donald Grant, Chairman

Mr. Grant: I move they be accepted by this assemblage.

(The motion, having been duly made and seconded, was put to a vote and was carried.)

President Murray: Thank you, Don, very much.

This is the most pleasant moment I have.

The Nominating Committee, Art Geib, Chairman.

REPORT OF NOMINATING COMMITTEE

ART GEIB, *Chairman*

Mr. Geib: The Nominating Committee is composed of Jack Kimball, Southern California; Dick Sperbeck, Sacramento Valley; Chet Robinson, Bay Area; and myself, San Joaquin Valley. Also C. Donald Grant.

I wish to place the nominations of the following individuals for the following offices:

President of the CMCA for 1957, Howard Greenfield.

Vice President, Robert Portman.

Secretary-Treasurer, G. Edwin Washburn.

Trustee Member, Roy Holmes.

President Murray: You have heard the nominations of the Nominating Committee.

Mr. Secretary, have any other nominations been received according to the By-Laws?

Secretary Washburn: None whatsoever.

President Murray: In view of that, I believe we are ready for the question to accept the slate of the Nominating Committee.

(The motion, having been duly made and seconded, was put to a vote and was carried.)

President Murray: Mr. Greenfield, I turn it over to you.

President-Elect Greenfield: Just like that he tells me.

President Murray: May I say one word sincerely?

I have had a lot of fun; I have had a lot of help. I appreciate all of the work that you as individuals and members have done, and I think we have advanced quite a bit and I know we are going to continue even more so.

President-Elect Greenfield: Can we give Don a big hand?

(Applause)

(Whereupon, Mr. Greenfield assumed the Chair from Mr. Murray.)

President Greenfield: I want to thank you sincerely for this honor. I hope that I can do as well as Don, but after hearing what has been presented this morning, some of the recommendations, the financial situation and so forth, I hereby resign and turn it back to Don. (Laughter)

Mr. Raley: Mr. Chairman, before adjournment may I make a comment relative to the American Meeting in Miami Beach on April 28 through May 2.

Many of you are planning to travel. I have information indicating that to increase the pleasure of your travel you can, by air travel, go by way of Mexico City to Miami Beach and return for practically the same cost of travel as you can by going, as we think of it, more directly. So if any of you are interested, please contact me at the Consolidated Mosquito Abatement District in Selma and I will send you the information that I have on that.

In relation to the American, also, I do hope that all of you members have paid your dues, and I would like to recommend to the new Board of Directors that they continue the practice that has been followed in the past few years of sending an official delegate from the California Mosquito Control Association to the American Meeting in Miami and even, of course, give consideration to defraying a part of the expenses of not only that official delegate, but others from the California Association.

President Greenfield: Thank you, Ted.

Are there any other announcements.

Mr. Robinson: Howard, we had planned around 11:00 o'clock to have our equipment demonstration. Since it is about 12:00, we probably had better have it right after lunch, or should we go down now? I think we owe it to the exhibitors to really get out and look at the equipment.

We have several interesting exhibits from the Alameda County District, and they have a generating plant there on an International pickup, and Bean Spray has their new mister out there, and also Homelite is giving a demonstration of saws right out in back of the hedge.

President Greenfield: All right. Maybe we can set it up on this basis, and you, Chet, would you inform the representatives that at 4:30 we will hope to adjourn, and from 4:30 to 5:30 have the demonstrations for this particular body here. Unfortunately we did go overtime because we were to terminate at 11:00 and have an hour and a half of demonstrations before lunch.

Mr. Stivers: I would like to call a short meeting of the San Joaquin Valley group up in this corner immediately following this.

President Greenfield: All right. That is just what I wanted to say.

We need now, of course, the election of our regional representatives so that we may have a complete board to operate with.

Would you please get your nominations in as soon as possible.

Mr. McFarland: We have just met, and we have unanimously agreed that Jack Kimball be selected as Director from Southern California.

President Greenfield: We will call for the results of the election at the beginning of the Meeting this afternoon.

Since there appears to be no further announcements to be made at this time, the Meeting is now adjourned.

(Whereupon, at 12:15 p.m. on Tuesday, January 22, 1957, a recess was taken until 1:30 p.m., this day.)

ALTERNATE SESSION

TUESDAY, JANUARY 22, 1957, 9:30 A.M.

OPERATIONAL PERSONNEL MEETING

Chairman: DEAN H. ECKE

Vector Control Specialist
Santa Clara County Health Department

Editor's Note: The following papers were presented at this Session, but the considerable discussion thereon was unrecorded and is necessarily omitted from the Proceedings.

NEW DEVELOPMENTS IN USE OF INSECTICIDES AND SPRAY EQUIPMENT

ROBERT G. TURNER, *Superintendent*
Delta Mosquito Abatement District

To us, any discussion of new insecticides is a discussion of the organic phosphates. While this group of compounds is not new to the chemist, it is relatively new to mosquito workers in California. Our first experience with this group occurred in 1952 and was brought about by our inability to effectively control the pasture mosquito with any of the chlorinated hydrocarbons. At that time, we, along with several other districts in the San Joaquin Valley, were able to secure some E.P.N. Although the price was high (about 52¢ per acre), the results were better than we had been accustomed to for some time; so, with some modification of our program, we abandoned D.D.T., Toxaphene, and all their cousins, and E.P.N. became our basic field larvicide. We early noted that this material was unsatisfactory when used as an adulticide; so, after some experimenting and careful checking with the Bureau of Chemistry and other regulatory agencies, we went to Parathion in our aerial treatment. We found this material to be highly effective, both as an adulticide and as a larvicide, and at 30¢ an acre it was immediately obvious we could save five or six thousand dollars per season if we used it for our entire program. Because there was so much more danger with Parathion than with E.P.N. we were reluctant to change over completely. However, in 1954 the decision was made for us when Du Pont informed us they would no longer formulate the E.P.N. we were using. At that time we still had several drums on hand; so we were able to begin a gradual change over, putting two of our more experienced operators on Parathion. We took pre-exposure blood tests at weekly intervals for several weeks. During all this time there was no significant drop in cholinesterase activity; so, when our E.P.N. was gone, we put all of our zones on Parathion and we have been there ever since.

I have mentioned only E.P.N. and Parathion so far in this discussion, these being the two our district has used primarily. I don't mean to imply that these are the only phosphates in use in California, nor do I intend to slight the others. In fact, some districts are using Malathion as their basic larvicide. These districts believe that this material is enough less toxic than Parathion that it compensates for the increased cost. We have only one standard of safety in handling any organic phosphate, therefore we use what we know to be the cheapest and feel reasonably sure is the most effective. To my knowledge, no other phosphate is in general use in mosquito work in California, although some experimental work has been done with others and more will be done, I'm sure.

I mentioned earlier that we have only one standard of safety in handling these materials; unfortunately this doesn't eliminate accidents, and some exposure is going to occur. There are several methods by which we may become poisoned by these insecticides. The most likely to occur is through spillage or breakage in handling the concentrate, or through saturation of the clothing by spray drift ,and the subsequent absorption through the skin. Other possibilities are by ingestion (if we smoke or eat without washing carefully), or by inhalation while handling dusts or aerosols without a respirator. However, at this stage of the game, how you became poisoned is not nearly so important as early recognition of the symptoms and what you do in the next few minutes. Let me read from *A Guide and Recommendations for the Use of Insecticides in California Mosquito Control,* published by the C.M.C.A., "Typical symptoms of organic phosphate poisoning generally include dull headache, followed by dizziness and nausea, then abdominal cramps accompanied by vomiting and diarrhea. Soon there is a feeling of constriction in the throat and chest and breathing becomes difficult. Pupils constrict to pin-points. Mental confusion follows, accompanied by twitching and excessive salivation. Soon there is a collapse, coma, convulsive seizures, and finally death." We believe the best way to stay out of trouble is to be constantly on guard against exposure. When exposure occurs, which it almost certainly will, take your man immediately to a physician who understands phosphate poisoning. We have available normal cholinestrase level counts on all of our men, established during the off season, for use in diagnosis. Using this policy, we have—to date—avoided any severe stages of poisoning.

In the field of new equipment, a number of districts have turned their attention to mist blowers, or wind wagons. This re-emphasizes the old problem of trying to find a piece of equipment that could effectively bridge the gap between small hand jobs and those large enough to make an airplane economical. We have tried and discarded booms and aerosols, primarily because these machines must be transported by a vehicle which cuts up the fields and contributes to soil compaction. This added compaction tends to defeat one of four basic philosophies: that of promoting a verticle drainage where we can; and it doesn't help our public relations either. It is doubtful if we will ever incorporate any power larviciding unit into our basic program. We do, however, recognize the necessity of specializing to some extent, and will continue to use this type of equipment where it seems to fit.

METHODS OF WEED CONTROL

GERALD LANT
Entomologist, Northern Salinas Valley Mosquito Abatement District

Weeds are plants out of place. Weed control in mosquito abatement is based on the principle of first things first.

As a background to this idea of weed control our original idea of this operation was an effort to reduce the weed growth on the edges of the ditches so that a more efficient larval inspection would be possible, and in the event of larval activity, the operators would not be encumbered by the excessive vegetation that continually hinders many of our spray operators.

In practice 2-4-D spray was applied to these ditch banks and the results were very favorable.

As the program expanded to eliminate the water-covering plants (pennywort and water cress) it was noticed that an increased flow in the ditch depressed the larval population to the point where spraying for larvae was occasional rather than routine.

Needless to say, with the combined operation of mechanical and chemical weed programming, the insecticide usage has dropped to a fraction of the former output.

In sensible control, use of weedicide can be a genuine benefit to any district's operation program. This is very evident in the public relations of the district where farmers are saved many dollars of their own. These "dollars" would have been spent for the spray control of agricultural insects that utilize wild vegetation as cover and food.

In the actual spray and treatment program the most important aspects from the operators' standpoint are: (1) What materials are for what job, (2) How safe to use, both for produce and operator safety, and (4) How do the costs compare.

For the first materials classification—broadly they can be abritrarily grouped as follows: the selectives, the generals and sterilants.

The selectives are specific in function, the final effect is that of an alteration in the hormone balance of the plant, thereby effecting slow death. The most familiar of this group is 2-4-D with its several formulates. It is exceedingly versatile because if used at the recommended dosages its killing effect is confined to the broad leaf, but the strength can be altered to include even cattails and tules in its control range.

2-4-5-T acts much the same but is more effective on woody type cover. Dalapon has reversed this selection with grass the susceptible group and broad leaf's generally unaffected. Amino triazole is a more general herbicide with pronounced leeway in usage.

It should be mentioned here that any use of hormone selectives such as the aforementioned necessitates the filing of an application with the County Agricultural Commissioner's office. He in turn will advise you on regulations governing use of hormone selectives in highly susceptible areas. Cotton, grapes, melons and tomatoes are but several of the economic plants affected by minute quantities of these sprays.

Less risky to use proximal to crops would be the "tissue-burning" weed oils: Dinitro-phenol and fortified Diesel oils. Some sterilants used in low concentrations are very effective in the "general" weedicide class.

The common complaint with the general weed killer is that in areas where erosion of land or sloughing of ditch banks are problems, general or sterilant usage eliminates the dirt holding grass roots.

The sterilants act in the ground. They enter the root structures and discourage plant growth for periods of time that vary up to four years, but in average rainfall areas one to two years duration may be expected for the recommended application rates. These include the arsenics, borates, chlorates, common salt and combinations of the above. C.M.U. is commonly used by itself or in combination with the ureas of chlorates.

Incidentally, these materials are only a handful of the many effective formulations used commonly throughout the U.S. today.

The safeness of these to the man who has to apply them is of continuous importance. First, it must be borne in mind that as with many insecticides, weedicides also have similar solvents that can cause damage to sensitive tissue (eyes, nose, etc.) if prolonged contact is maintained.

The phenolic compounds and the fortified oils are unpleasant to use because of odor and skin effect, but even in the most potent, the intense toxicity of the organic phosphates is not, to my knowledge, ever reached.

For a summation of weed control, it would be well to look at it not as single approaches but rather as several tools, that when integrated properly give good, positive results. The soil sterilants (which are a bit expensive incidentally) can be utilized to protect bridges, sheds, fuel supply areas and pump houses from damage through later weed burning.

The selectives may be applied for predetermined effects as previously noted. When the total efforts of the spraying have been achieved, the entire debris and residue may be burned off.

This coverage of the weedicide chemicals does not preclude the desirability of tillage, natural elimination (either by plant competition or grazing) or any of the other methods that are possibly available.

The costs of these materials and their application rates and characteristics are available either from the suppliers or from interested agricultural commissioners.

Now I would like to hear some questions.

PUBLIC RELATIONS
(Operator Responsibility)

HERBERT B. BROWN
Division Foreman, Alameda County Mosquito Abatement District

Public relations is not a subject that is new to operators or personnel of any mosquito abatement district as it is a part of our every day work.

To define public relations briefly—it is a process of informing the public of district activities and policies.

Each operator or employee of a mosquito abatement district is a public relations representative of his district. It is his responsibility to explain the policies, activities and reasons for activities to the people he meets in his daily rounds. In many instances we are the only

contact residents of the area have with the district and it is by our actions that the district is judged.

Building casual acquaintances into friends often revolves around an ability to talk to people on a friendly basis and with some regard for their needs and interests. In turn, these people as a result of this personal contact will often take corrective measures to eliminate their mosquito-breeding cources. Friendliness is just another form of public relations. To mention an example or two of what we feel are very good public relations, we furnish some of the schools in the area with mosquito fish for their fund raising carnivals. We ask them to distribute mosquito control pamphlets and to try to get as many fish as possible in fish ponds, tanks, troughs, etc., where they will do us the most good. We both benefit by this activity.

The pickle processing industry seems to like the southern part of Alameda County, as we have several in the area. The tanks used for processing are a real problem to control. In co-operation with the management and workers we have worked out a system for control whereby we only make an inspection about once a month. Also at the same place we use their tanks for winter storage of fish. We stock heavily in the fall and they feed and maintain proper water supply through the winter so that we have an available supply of fish in the early spring when fish are hard to obtain from normal sources.

The words you use are tools to persuade people to act or to get an idea over. Haven't you talked to Mrs. Brown about her leaking water faucet or pond lilies or lazy goldfish until you could inject an idea or suggestion that would help to control mosquitoes more effectively and still not require repetition of work?

Public relations covers a very large field of activity—inter-agency, person-to-person, industrial, farm, house-to-house, and many others. Each one of us contributes to a public relations program each and every day.

COORDINATION OF AERIAL CHEMICAL CONTROL WITH GROUND OPERATIONS

BURTON FENTEM

Chief Pilot, Merced County Mosquito Abatement District

We have found that with the amount of problem area and the limited budget that we must operate under, the only way that we can have mosquito control is through the operation of district owned aircraft.

Without coordination between operators and pilots a good job of control would not be possible. There are many factors involved in having a good coordination program. First of all this starts with the foreman. It is his responsibility to see that his operators are trained properly and to help them with any problem that they may have. I feel that a well trained operator is a very important man to the district. In the Merced district we have nine operators. The district is divided into nine zones, and an operator is responsible for one zone which is approximately 150 square miles. You can see by the size of the area that he must organize everything that he does to avoid neglecting any part of his territory.

How does the operator tie in with the airspray program? Without the operator we wouldn't have an airspray program. We know that the cheapest way for mosquito control is by airplane, however, even though the cost of application by truck is much greater, we must have the combination of truck and plane to do the job.

I would like to give to you briefly an idea of what the operator and pilot jobs consist of and how it becomes an organized team. First of all it starts with the operator. He makes his inspection and determines whether this particular source is to be airsprayed or not. If it is to be airsprayed he must fill out an airspray request form. On this form he gives pertinent information to the pilot such as the date, the name and location of the property owner, the approximate area to be treated, the larvae infestation and stages, etc. If these requests are filled out properly the pilot can determine how to schedule his work and also the type of insecticide he is to use. After the operator has completed his daily work he returns to his depot and turns his request form over to the pilot. With this information that the operator has given the pilot he can plan his work for the next day. Each pilot is responsible for approximately 500 square miles, so he must work with more than one operator. Each plane has its home base which is geographically located within the district. By having the planes and pilots stationed throughout the district eliminates much ferry time and unnecessary costs. In addition to this we have two other air strips that are equipped with loading facilities. By having fine airstrips strategically located we eliminate a lot of costly time and backtracking. At each of the five locations we have operators that use these as their home depot.

During the spray season the district has six two-way radios in operation. We have found that these radios more than pay for rent and certainly is responsible for considerable savings of time and costs to the taxpayers. At each of these five depots located within the county we have wind guages. We have found out through experience that we can successfully spray in winds up to 12 and 15 miles per hour. These are inexpensive instruments and have saved us many trips; by this I mean, if we are working in a certain area and finish up and are ready to move into the next operation zone we either call him by radio or he calls us and tells us the current condition. If the wind is blowing too strong in his area we can contact other sections of the district that may have no wind and need help. We sometimes have all of our planes working in one area. We have found that by giving an operator a ride over his territory by plane it can be covered in 30 minutes or so, which will save the operator as high as one day of his time looking for the sources.

I believe that this covers briefly our present operation in Merced County. Without coordination between air and ground personnel you can't expect a good job of mosquito control.

NOTES ON A FIELD KEY OF CALIFORNIA MOSQUITOES

EMBREE G. MEZGER
Member, CMCA Culicidology Committee

After making a review and recommendation, of and from, "The Survey and Study of the Mosquito Population Measurement Program, 1954," the Culicidology Committee of the California Mosquito Control Association found that there was a justification for the preparation of a standard California Mosquito Key or Keys to be used by personnel in the California Mosquito Control Districts. Fifteen (15) M.A.D.'s were selected to be surveyed, as to their opinions and critical comments regarding style, illustrations, and terminology in the new key to be developed. These districts represent a cross section of all the M.A.D.'s throughout California and were selected on the basis of their previously indicated desire for a fieldman's mosquito key, plus the factor that they were, or are contemplating using a key that was not entirely satisfactory to them.

Results

Two types of Mosquito Keys were submitted for their review.

Type A. U.S.P.H.S.—Pictorial Type
Specifically—Introduction to Mosquito Identification

Type B. Standard Illustrated Type—with choice between written descriptions
Specifically—A Guide to the Most Common Mosquitoes of the San Joaquin Valley

From the opinions and critical comments submitted concerning preference of keys, style, illustrations, characters, and terminology of the two types, an analysis was made by the Culicidology Committee.

A. Preference of Keys
   1. A guide to the most common mosquitoes of the San Joaquin Valley.

B. Style of Key
   1. Compactness without loss of detail
   2. Layout—clear and simple

C. Illustrations of Key
   1. Large and clear illustrations
   Illustration of all major species in California

D. Characters of Keys
   1. Emphasis on key characters
   2. Explanatory supplement to define characters
   3. Circle, underline, or arrow point key characters

E. Terminology of Key
   1. Terminology should be consistent throughout key and correct scientific terms and names
   2. Explanatory supplement to define terminology and names

F. Other Points Desired in New Key
   1. Ecology notes on species
   2. County Mosquito Distribution Chart and the anatomy drawings of the adult and larva, from the Introduction to Mosquito Identification

Conclusions

Further action by the 1957 Culicidology Committee should be taken as to the preparation and publication of such a key, or keys, under the California Mosquito Control Association.

Editor's Note:

The following paper was submitted for publication in the Proceedings although it was not presented at the Conference. The paper was prepared as a result of the action contemplated by the City of Palo Alto within the Matadero Mosquito Abatement District. During the middle of 1956, Council members questioned the necessity of paying taxes to a mosquito abatement district and to the County Health Department for services in vector control which were felt to be overlapping. The City contemplated withdrawal from the Mosquito Abatement District on the basis of their interpretation of recent legislation concerning withdrawal of annexed areas and cities from such districts. The legality of such action was never tested or established, since in December of 1956 the City Council of Palo Alto voted to remain within the Matadero Mosquito Abatement District. Perhaps some of the same reasons presented in the following submitted paper may have influenced their decision in this regard.

WHY A SPECIAL TAX TO MAINTAIN A MOSQUITO ABATEMENT DISTRICT IN NORTHERN SANTA CLARA COUNTY

GORDON W. MAPES
Superintendent, Matadero Mosquito Abatement District

In considering this question one should go back to the dim ages of the past when the Ohlone Indians (the local tribe) crouched around their smudge fires to free themselves from the vicious attacks of clouds of mosquitoes. Or again, to take up the earlier writings of the early Spanish Padres and how they described clouds of voracious mosquitoes attacking them on the shores of South San Francisco Bay. And more recently, on the San Francisco Peninsula, following the major San Francisco earthquake and fire of 1906, of how people began to migrate down the Peninsula but found the mosquito situation unbearable.

Thus began the early efforts of mosquito abatement (the first in California) on a private scale, as a result of private donations from individuals seeking to improve living conditions on the Peninsula.*

By 1915 the public demand for relief from mosquitoes in this entire region had become so great that it reached the California Legislature, and the first Mosquito Abatement Act was passed, which essentially gives to the Mosquito Abatement District Boards of Trustees the sweeping powers that they enjoy today, and which have been used throughout the State with great discretion.

The reader may well inquire why all of this tremendous commotion about mosquito abatement around San Francisco Bay? The answer lies in the existence around the entire perimeter of both North and South Bay on the marshlands (along the high tide line) of a great *Aedes* Belt. To the reader this can best be de-

(*It should be pointed out that about the same time, Herms and Gray began their great work of removing malarial mosquitoes from northern Sacramento Valley, aso on the basis of donations from private organizations)

scribed as a strip of land along the high tide line on the marshlands that is seeded with the eggs of the Salt Marsh *Aedes* or Migratory Mosquitoes. These eggs exist in the marsh ground and lie inert but viable for periods of ten years (how much longer is not known) until such time as conditions become favorable (conditions of flood, temperature and humidity) when these eggs will hatch in countless numbers over wide regions, and being migratory in character will lift into the winds and may be carried for distances up to 100 miles (as checked by entomologists).

To summarize, all residents of San Francisco Bay area actually are living astride a huge Pandora's Box extending around the entire Bay Area fringe belt, and each community faces a similar problem because of Nature's tremendous potential of these *Aedes* eggs existing in the marsh ground.

Mosquito-wise, the status of North Santa Clara County (including Palo Alto) is an *inter-dependent* one. Speaking in terms of Mosquito Control, we in each of these San Francisco Bay Communities—are our neighbors' keeper, and our neighboring Communities are our keepers. The actual picture of Mosquito Control in North Santa Clara County is a complex one, not a simple one. Contributing to the remarkable immunity (compared with earlier years) from mosquitoes in Palo Alto and North Santa Clara County are the efforts not only of the local Mosquito Abatement District, but also the similar efforts carried on by *Mosquito Abatement Districts* in San Mateo County, Alameda County, Marin County, Contra Costa County, Solano County, Napa County and Sonoma County.

It should be observed that each of these neighboring San Francisco Bay Communities (excepting San Francisco with no marsh problem) *maintain their own separate Mosquito Abatement District through the levy of a special mosquito tax for the main purpose of abating mosquitoes.* They all consider the mosquito problem in the San Francisco Bay Area so formidable and important that they reserve a special tax for the very important purpose of eliminating mosquitoes within their confines.

The awareness and deep concern of earlier administrations of the City of Palo Alto relative to the real mosquito situation confronting the San Francisco Community has been reflected in their relations with the Board of Trustees of the Matadero Mosquito Abatement District. The understanding and cooperation of these earlier Palo Alto Administrations gave rise to an arrangement with the Matadero District whereby a nominal rate of $1.00 per year rental has been charged to the District for the maintenance of the District Depot in the Palo Alto Yacht Harbor Area. The City of Palo Alto deserves high commendation in this move towards economy and effectiveness of the Tax Payers' Dollar.

It may be of interest for the reader to see what Tax Payers think about Mosquito Abatement sustained by a special tax in other parts of the State. We turn first to a community known as Pine Grove, which in some respects is one of the most remarkable communities in the United States. Although this community does not lie in the path of a great *Aedes* Belt as do the Districts in the San Francisco Bay Area, still, the Taxpayers of this community think so highly of effective mosquito abatement that in the Fiscal Year 1955-56 they have sustained a mosquito tax of .40 cents per $100 of assessed valuation! Two thousand people make up this community and their estimate of the value of effective mosquito abatement is high indeed.

Two Mosquito Abatement Districts representing 53,500 people (Los Molinos and Tulare) in 1955-56 paid a mosquito tax of 25 cents per $100 of assessed valuation. One community of 5,100 people (Clear Creek) sustained a mosquito tax of 23 cents per $100 of assessed valuation. Two communities with a combined total of 97,000 people (Shasta and Turlock) paid a mosquito tax of 18¢ in Fiscal Year 1955-56. Ten communities representing a combined total of 359,600 people paid a mosquito tax of 15 cents per $100 of assessed valuation in the Fiscal Year of 1955-56. Thus the tax graduates downward until we turn to the San Francisco Bay Area where the prevailing high assessed valuations permit a much lower tax rate.

A brief mention may well be made concerning Mosquito Control as exercised by Health Departments and Mosquito Abatement Districts. *The control activity of the Health Departments is selective while that of the Mosquito Districts is operational.* Health Departments are charged with the keeping of the public health and are concerned largely with the vectors of disease and with disease bearing mosquitoes (in this area confined largely to the *Culex tarsalis* or Dairy Mosquitoes. Mosquito Abatement Districts, on the contrary, are charged with the elimination of both disease bearing and pest mosquitoes, and are supported by a special tax for this particular purpose. This is the prevailing practise around the entire perimeter of the San Francisco Bay Area (except San Francisco). Also, it extends generally to other portions of the State.

TUESDAY AFTERNOON SESSION

JANUARY 22, 1957

The Tuesday afternoon session of the Twenty-Fifth Annual Conference of the California Mosquito Control Association, Inc., met at the De Anza Hotel, San Jose, California, and was called to order at 1:30 o'clock p.m., President Howard R. Greenfield, Salinas, California, presiding.

President Greenfield: Well, it is time to call this session to order.

The first business we have is the receiving of the names of the regional representatives. They are:

Paul Jones, Coastal Area.
Joe Willis, North Sacramento.
Jack Kimball, Southern California.
Ed Davis, San Joaquin Valley.

Those are the regional representatives, and at the end of our session tomorrow afternoon, I would like to have a half hour with the new Board of Directors to discuss such items as appointments and a few other things that we have to consider before we can get underway.

You know that at 4:30 this afternoon, upon adjournment of this session, there will be, as I understand it, another demonstration put on by the commercial representatives. For those of you who were unable to attend the demonstration from 11:00 to 12:00 today, you may

see that same thing repeated again after adjournment.

We have the pleasure this afternoon of having with us Dr. John Harville, another one of Dr. Duncan's well-known students, who is Associate Professor of Biology and Education at San Jose State. I think John has gone beyond biology in certain respects and has developed a wonderful program of educational aid, and he will today give us a chance to see what has been done here locally in Santa Clara County on the use of visual aids in pursuit of our control program.

John Harville.

Abstract of:

PUBLIC RELATIONS TECHNIQUES IN MOSQUITO ABATEMENT PROGRAMS

JOHN P. HARVILLE, Ph.D., *Associate Professor*
Biology and Science Education
San Jose State College

Effective public relations techniques in mosquito abatement programs will be considered here from two aspects. First, I shall outline certain basic premises which influence public relations aims and methods. Second I shall demonstrate selected techniques which have proved their usefulness in local public information programs.

WHY PUBLIC RELATIONS IN MOSQUITO ABATEMENT PROGRAMS?

1. *Obligation.* Since public monies are involved, the mosquito abatement agency has both legal and moral obligations to keep the public informed as to how those funds are being spent. Samuel Reck (1954) stressed this fact in an address to the New Jersey Mosquito Extermination Association. He pointed out that an enlightened, informed, supporting public encourages official recognition of, and respect for, the work of the mosquito control agency, and insures against unwarranted political interference.
2. *Necessity.* Economical mosquito abatement depends in very large measure upon public cooperation. Dorothy Nyswander, Professor of Public Health, University of California, emphasized this dependency with these words (1949):
   "A mosquito control program does assume responsibility for overall protective operations, but it differs uniquely from other broad public health measures in that its successful operation makes continuous demands on the cooperation of individual home owners, farmers, and industries."
3. *Opportunity.* Today as never before, the public is interested in scientific problems, and is ready to accept vector control as a community responsibility. Furthermore, the public is aware that this is no easy task – that there are no cheap shortcuts to mosquito abatement. This public awareness results in part from the explosion of the myth of the magic insecticide. Most of us (and this includes the informed public) are at last willing to accept the fact that mosquitoes cannot be exterminated by any economically feasible chemical blitzkrieg. We realize instead that mosquito abatement demands a long-sustained counter-offensive, in which source reduction is the major weapon.

WHAT PREMISES SHOULD GUIDE THE PUBLIC RELATIONS PROGRAM?

Excellent suggestions for development of effective public information services have been presented by Nyswander (1949), Reierson (1956), and others. These authorities emphasize the importance of administrative planning, of attention to the general principles of learning, and of continuous evaluation of effectiveness. To these suggestions, I would add two premises.

. *Every employee should accept responsibility for effective public relations.* Every employee who meets the public in any way is involved in public relations. The District Manager or Entomologist occupies a key position, but so does the secretary who answers the telephone, and is quite literally the voice of mosquito abatement. Does she recognize the sensitivity of her position in this respect? Does she try to understand every call she receives, or does she merely transcribe it, with an "I only work here" attitude that is painfully evident to the person at the other end of the line?

How about field operators? Do they reflect a high-priority interest not only in keeping the public unirritated, but also in helping to make the public better informed? Do they attempt to explain the "whys" of their field work, or is their response to questions – "Better ask the boss – I only work here."

Every employee has public relations opportunities and responsibilities, and to this extent, every employee is a teacher, working to produce a better informed public.

2. *The effective teacher* (or public relations worker) *must accept some responsibility for the learning process.* It is not enough to grind out information for public consumption. That information must be organized and delivered in a form which makes it easy to assimilate. A point of departure might be "What do the people need to know about mosquito abatement, which we can help them to learn?" Once this responsibility for the learning process is accepted, it becomes apparent that methods of presentation must be carefully chosen –that graphs, pictures, and posters become important tools of the teacher.

SELECTED TECHNIQUES FOR PUBLIC RELATIONS USE

(Demonstration and discussion)

1. TEACHING AIDS FOR THE FIELD MAN. These must be designed for his ready use in the field, where he must discuss practical problems with a few persons at a time. Such materials help him to be more effective in his explanations, and provide him with needed information to supplement his own background. Such aids include:
   a. *Life history tubes* constructed from procaine vials discarded by the dentist, and containing mosquito life cycle stages.
   b. *Picture notebooks* showing mosquito sources, biology, control measures, etc., ideally such photographs are full-page size, mounted in plastic envelopes, and appropriately captioned. Hardbacked ring-binders make convenient containers.

2. TEACHING AIDS FOR USE WITH SMALL GROUPS. Large display photographs are a most effective supplement to the slide-illustrated lecture. They need no special equipment to use, and in addition, they continue to carry they pictorial messages as long as they remain on display.
   Three special techniques are worthy of particular mention here.
   a. *Use of pictures to document reports.* In addition to the usual factual written report of a survey of mosquito problems, we may append a series of good photographs, effectively captioned, to illustrate the points developed in the report. James St. Germaine, of the Santa Clara County Vector Control Division (Santa Clara County Health Department) has used this technique with excellent results in informing local groups of the magnitude of their mosquito problems, and of the ways these problems can be solved. Photographic documentation has been particularly effective in stimulating such groups into action against their own insect breeding sources — a "do-it-yourself" kind of abatement which is much to be encouraged.
   b. *Use of the overhead projector and plastic overlays to present graphs and charts.* The overhead projector can be manipulated from the speaker's platform, and has unusual flexibility as a teaching aid. Statistical tables can be reduced to graphic form, and an ordinary grease-pencil can be used to explain or modify them in the course of the speaker's presentation.
   c. *Use of the flannel-board to explain mosquito life cycles and control.* A piece of flannel stretched over a display board, and outline pictures of mosquito life stages cut from colored construction paper, provide a speaker with effective illustrative materials for many purposes. If the backs of the pictures are roughened with sandpaper, they will stick to the flannel, and a speaker can develop a life cycle, emphasizing its points of vulnerability, and illustrating ways these can best be attacked for effective mosquito abatement.
3. PUBLIC RELATIONS THROUGH USE OF "MASS MEDIA". So much has been said and written about effective use of radio, television, and newspapers as mass media for public information that I will add nothing here, referring you instead to the excellent papers I cited earlier. However, I would like to add one mass medium which has been little use to date — that is the public school system.

In October of 1955, *California Vector Views* carried an article by Ed Smith and myself entitled "An Educational Approach to Vector Control in Santa Clara County." In this paper we described the development of a series of teaching units on vector control for use in the public schools — units produced through the cooperative efforts of the County Health Department, The County School Department, and San Jose State College.

To succeed, such an effort must be based on a concept of mutual benefit. Teaching units must develop information and attitudes which will prove helpful to the mosquito abatement agency. They must build confidence and understanding of mosquito control, and must foster desirable individual practices of source reduction. At the same time, these units must be genuine teaching aids, directly usable by the classroom teacher, regardless of any personal lack of technical background. These units must contribute to the overall educational objectives of the school; they must arouse the interest and enthusiasm of the pupils; they must advance the scientific literacy of both teachers and children.

Perhaps this mutual benefit idea can best be illustrated through an actual unit designed for second or third grade use. It is entirely self-contained, and can be used by any teacher, whether she ever heard of mosquito abatement before, or not. The unit consists of six parts:

1. A unit outline plan, which suggests ways of correlating the material on vector control with other phases of the curriculum.
2. An information outline—the facts of vector control for the teacher.
3. A list of suggested reading references and activities for the children.
4. A tape recording, which carries the "voice of vector control", inviting the children to help in the campaign against insect pests.
5. Large display pictures, mounted so that they can be manipulated by the children (complete with folding doors, which can be moved by the children, and which therefore add to the interest of the unit.
6. Pupil work sheets, designed for use by the children in conjunction with the display mounts. These they may read directly, or the teacher may read them to the class as a whole.

This example closes my case for effective public relations as an integral part of the mosquito abatement program. We have considered reasons why good public information services are important, and have emphasized certain guiding priciples for building such services. We stressed particularly two concepts: 1) Every employee is a teacher. 2) Every teacher is responsible for the learning processes of those he teaches. If we work within these concepts, we can be certain of success. Finally, we have examined a few examples of teaching materials and techniques which have proven their effectiveness as practical aids to the mosquito abatement worker. How well they will work in your district is largely up to you.

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President Greenfield: Thank you, Dr. Harville, for a very excellent presentation of some of the aspects or uses of mosquito media.

I understand also, John, that in certain respects you have just completely taken apart Ed's presentation of a later date.

Dr. Harville: That is what happens when you come early on the program. You get the first chance.

President Greenfield: We are glad you have had the opportunity to do that.

There have been a couple of questions asked on the construction of flannelboard. Dr. Harville, would you tell them a little about that?

Dr. Harville: Several people, as I went along, asked me about the flannelboard, and it is a very simple thing.

All you need is a piece of outing flannel – the cheaper the better – stretch it over a piece of plywood or a piece of cardboard or anything else, and then use ordinary construction paper, colored paper such as is used in the public schools, and if you take a piece of sandpaper and scratch the back of it, it will stick. Some people have sandpaper on the back, but that is rather unnecessary. Roughening of the back is all that is needed.

Actually a very rough outline of the figures themselves is adequate because you merely see those outlines.

President Greenfield: The next speakers on our program are Harold Gray and the panel on source reduction.

DISCUSSION OF VARIOUS APPROACHES IN SECURING MOSQUITO SOURCE REDUCTION

HAROLD F. GRAY, *Moderator*

Sanitary and Hydraulic Engineer

INTRODUCTION
by
Harold F. Gray

From long and frequently frustrating experience practically all of us are now convinced that the reduction of mosquito producing sources to their lowest practicable limits represents the most effective and the most economical basic method of mosquito abatement. It is not the only control method available, and all other methods may be used where, when and as applicable, either alone or in combination with other methods. But source reduction is a basic concept, and in addition is compatible with efficient agriculture, good general land usage and adequate community sanitation.

The engineering and entomological aspects of source reduction are sufficiently well understood to require no detailed comment here. The legal basis for enforcing source reduction has long been established under the law of public nuisance, and has been "spelled out" since the 1929 amendment to the mosquito abatement district act by the phrase 'and to prevent the recurrence thereof". But the matter of public relations concerning the adoption and implementation of a policy of mosquito source reduction by an agency leaves room for variations of policy and of techniques and procedure for obtaining public acceptance with minimum objection.

The four members of the panel will discuss this subject from four different aspects. Mr. Washburn will lead off with the educational approach; he will be followed by Mr. McFarland presenting the legal approach, which in effect puts the entire burden of cost on the property owner; Dr. Murray will then discuss the cooperative approach, in which a large part of the cost is sustained by the land owner, but with the agency furnishing certain services and possibly equipment; and finally Mr. Robinson will discuss the situation where the agency does much of the job with public funds.

One aspect of the problem will not be discussed by the panel members. That is where the agency does all of the work at the expense of the agency. If you remember the law, it states that mosquito production is a public nuisance, and abatable as such, only if it occurs on land as a results of its use or as a result of an artificial change in its natural condition. Under natural conditions an agency has no legal option except to do the work with agency funds, unless the property owner can be persuaded to contribute. That is why much of the control work on salt marshes has been done with agency funds only.

None of these approaches is necessarily exclusive of the other three, for any one or more, or all, may be used by a single agency under appropriate circumstances. The art of management in part consists of using those procedures and techniques which are best adapted to particular conditions at particular times, and consistency in principle may sometimes be purchased at too great a price in practice.

THE EDUCATIONAL APPROACH TO SOURCE REDUCTION

G. EDWIN WASHBURN, *Manager*
Turlock Mosquito Abatement District

The only nearly permanent mosquito control is source reduction. We have had many papers in the past on source reduction telling of the basic procedures used. Rather than repeat this work I will attempt to develop some of the philosophy of the educational aspects of this phase of the basic principles upon which the source reduction programs depend.

The educational approach may be divided into many categories. All of the divisions are overlapping to some extent; however, they are sufficiently distinct in themselves to need careful study to produce the maximum effectiveness.

A division of the educational approach might be:

1. Those aspects which employ mass media
2. Those aspects which employ individual contact

These two concepts confront each mosquito abatement agency embarking upon a source reduction program; namely; that of communicating to the mass population within the district as compared to the individual approach. The latter is usually accomplished by the person designated as the source reduction technician and, in fact, all members of the staff participate if the program has been properly integrated.

The word communication comes from the Latin

communis or common. It means that when we communicate, we are trying to establish a "commonness" with some one or some group. That is, we are trying to share information, an idea, or an attitude. In order that the mosquito abatement agency may present effectively to the mass population of the district its philosophy of progressive reduction of all mosquito breeding sources, it should employ all the means of communication which are available. These procedures are referred to as mass media.

Mass media are those instruments of communication which convey identical messages to large numbers of persons who are physically separated. These identical messages may be: printed, as in newspaper articles, books, pamphlets (such as brochures), comics (as employed in the brochure of the Coachella Valley Mosquito Abatement District), and magazines. They may be on film (such as the Delta Mosquito Abatement District and others have developed). The mass media may include television (as developed by the Tulare Mosquito Abatement District and recently by the Alameda County Mosquito Abatement District), radio, and recordings. The all-inclusive educational program of the Santa Clara County Health Department, Vector Control Section is an outstanding example of use of many methods. Some of the mass media are new — very new. Only the book, the magazine, and the newspaper anti-date the present century, and in this century even these have greatly increased their effectiveness and circulation. All of these means serve to gradually mold the public mind toward one common goal; in this instance the individual responsibility toward mosquito control and the awareness of all responsible persons to the always constant threat of mosquitoes as transmittors of disease, or as irksome pests, or as economic nonessentials.

Dr. Dorothy Nyswander, public health educator of the School of Public Health of the University of California, stated to this Association in 1949, "Mosquito control, so I thought, like water purification or milk pasteurization or sewage disposal, is a large-scale operation. It calls for measures which, when once established, demand a minimum of participation by the individual in protecting himself. I found I was very wrong. True enough, a mosquito control program *does* entail assumption of responsibility for the overall protective operations, but it differs uniquely from the other broad public health measures in that its successful operation makes continuous demands on the cooperation of individual home owners, farmers, and industries." It is interesting to note that others, not intimately acquainted with mosquito abatement programs, readily recognize the usefulness of obtaining a public consciousness of mosquito problems.

Any source reduction program to be effective must be organized and have a definite goal in sight: such programs should be written out in as much detail as is possible so that no one can misconstrue the meaning of all its phases nor its implications. These programs then must be properly documented for reference and for use in the public relations aspects. This is the responsibility of management. Integration of the entire source reduction program through and to all the staff members will follow in due course by staff sessions and individual consultation. If management is to function effectively it must function openly and in an orderly manner. The source reduction program must be based upon sound agricultural and engineering principles, it must be forthright and carried boldly forward, once the outline and goals have been marked. I believe that such a program must be, basically, an educational one. Since education is a continuing process and all must cooperate to develop a successful pattern of source reduction we must constantly employ all of the available resources of education; be they by mass media or by individual personal contact with the householder, rancher or industrialist. I know this approach will bring about the desired results — it has in the Turlock Mosquito Abatement District and in many other mosquito control agencies of California and elsewhere. None of us have reached our goals, and we may never do so, but we are constantly striving toward that end with all the means at our disposal.

I have discussed some of the mass media which we may employ, to the mass population, as well as to the individual, but what are some of the functions of these media?

The service functions of mass media are threefold:

1. Informational functions
2. Entertainment functions
3. Sales or advertising messages.

The source reduction programs would fall into the first or informal function and the last or sales messages. Rarely, if ever, has entertainment been employed to "put across" the idea desired. Perhaps the few television programs presented would fall into this category but I believe they have been more educational in nature than pure entertainment. The Disney film entitled "The Winged Scourge" is a good example of the use of entertainment. This area might well be explored for its possibilities.

In recent years a wide use has been made of advertising messages to sell, not goods, but ideas. The purpose of such advertising is to convince the audience of the mass media of the soundness or unsoundness of a social, political, or economic belief, sometimes but not always in a controversial context. Examples of this procedure are about us daily in the newspaper, and on the radio and television.

Selling and advertising messages employ one of the basic principles of education to put across their idea— repetition. On the air, on the screen and in the newspapers and magazines we find the same slogan or catch phrase (like 'LS - MFT'), which instantly envisions a product or a principle. Too often we write news articles, perhaps an entire series of fine ones, but we use the plan but once and expect miracles to happen. Only by repeating and repeating our message can we hope to arouse public interest. A healthy advertising budget in a mosquito abatement program could produce some notable change in public attitude toward our aims and goals. Most budgets do not contain any such item.

I firmly believe that all the planning, staff conferences, newspaper articles, or television programs are for naught unless the mosquito abatement agency is prepared with an adequately trained and experienced staff; particularly the source reduction specialist, to carry the 'message" to the individual parties. It is somewhat a travesty upon our modern methods of communication that the general public is still so totally ignorant of the basic concepts of mosquito biology, particularly as they affect mosquito abatement pro-

grams. Somewhere along the line we have not been able to obtain the attention or motivation necessary for success. All of the devices of mass media communication must be employed more effectively to inform the public body of their responsibilities if the agency hopes to achieve success. When the householder finally learns that her "Polywogs" are mosquito larvae, then progress can be achieved; i.e., when the party assumes some responsibility, we have made headway.

In any education process there are four principles of communication which *must* be fulfilled before any message can arouse its intended response; they are:

1. The message must be so designed and delivered as to gain the attention of the intended receiver.
2. The message must employ signs which refer to experience common to both sender and receiver, so as to "get-the-message-across."
3. The message must arouse personal needs in the receiver and suggest some ways to meet those needs.
4. The message must suggest a way to meet those needs which is appropriate to the group situation in which the receiver finds himself at the time when he is moved to make the desired response.

I am sure that you can easily bring to mind situations within your own experience which will illustrate each of the four principles just enumerated. The importance of fulfilling each of the four points can not be stressed too much. Some one or more of the principles have not been fulfilled when our educational approaches do not meet our goals.

It is possible and certainly within the means of mosquito abatement agencies to develop all of the mass media of communication for source reduction purposes. I believe if they were more carefully planned and more methodically carried out that the present day need of the personal contact could be lessened with the consequent larger return for funds expended. Few, if any of us, have employed mass media as is done by industry. Great strides forward in our educational approaches to the source reduction programs could be made when more careful consideration is given to these concepts.

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Mr. Gray: We will allow two questions. Please direct them to Mr. Washburn.

Does anyone have any questions?

(No response.)

All right. We will proceed to Mr. McFarland with the legal approach.

LEGAL ASPECTS OF SOURCE REDUCTION

GARDNER C. MCFARLAND, *Manager*
Southeast Mosquito Abatement District

As we all know, the proper way to handle mosquito abatement from the source reduction standpoint is the way that the other speakers have mentioned, by education, a method we all agree on. However, I think many of us forget that much of this education and much of this proper approach in getting people to do abatement voluntarily would not occur if a legal background was not present.

We observe in all walks of life, even though there is no law covering the subject, that quite a few people do things just because they want to do them right; however, the great majority will not. Many times their only excuse for not doing things is because the other fellow doesn't. So we do have to have a basic background of laws.

I would like to review certain sections of the Health and Safety Code of the State of California. I know you are all familiar with these particular sections, but I have a few comments that I think will be of some value. First, Section 2271: "Any breeding place for mosquitoes which exists by reason of any use made of the land on which it is found". . . , that Harold Gray just mentioned a moment ago, is of interest in that the statement is made that such conditions are a public nuisance.

We heard Dr. Merrill talk about a public nuisance. He said that the U. S. Public Health Service is attempting to get the concept over that all mosquitoes are public health nuisances.

Now, where can we find the definition of a public nuisance in the Health and Safety Code? In Sections 205(b) and 206. 205(b) specifically defines a health nuisance and 206 defines any nuisance.

Furthermore, there is another section in the mosquito abatement portion of the Health and Safety Code which is Section 2292, that is of value in relations with other agencies. This section says:

"Any person who obstructs, hinders or interferes with the entry upon any land mentioned in this article of any officer or employee of the district in the performance of his duty, and any person who obstructs, interferes with, molests or damages work performed by the district, is guilty of a misdemeanor."

That is very specific. A person is guilty of a misdemeanor, and this generally is thought of as occurring only on someone's private property, and not on public property.

Another section says that if a public agency of any type creates conditions that breed mosquitoes it must be abated by the agency; however, there is no penalty provision. The agency is guilty of a misdemeanor, however, as far as I can interpret, since Section 2292 states

that it is a misdemeanor to interfere with the lawful actions of a Mosquito Abatement District on private or public property.

It might be said I am reading an additional meaning into the law, but I don't think so. In cases that have been taken to court, not by mosquito abatement districts but by health departments, we find that we practice what the Assistant Attorney General said they do not advise. And we win cases.

I would now like to discuss legal aspects of other agencies. In my opinion, mosquito abatement districts do not always take advantage of other agencies' laws which might specifically cover a violation of mosquito causing nuisance better than the Health and Safety Code.

Perhaps you might have to persuade them to issue the legal notice or handle the actual persuasion, however, abatement will be the end result. I won't mention specific laws but just general observations.

First there are Federal flood control laws and provisions that Congress passed that require certain Federal Agencies to do maintenance work that is not done in many cases. Many times the particular Army engineer, or agency in the Community, may not be aware of their responsibilities. They tell you they do not have the money or funds and are not legally required to do the maintenance. If you can definitely point out to them that it is their responsibility, many times they will do the work.

We also have many state laws that are not in our Mosquito Abatement Act that may fit an abatement situation under certain circumstances. I can mention some in the Agricultural Code.

As an example, there are State dairy laws that specify requirements as to distance of waste disposal from milk houses and dairy barns. This distance is only fifty or a hundred feet, so that for further disposal you have to go to the Health and Safety Code, Sections 205 or 205(b) or 206, and then possibly to Section 4475, which pertains to sewage, floods and so forth in public places. By picking one particular point or situation in a Code and then going back to the other sections, you can many times get a workable series of laws that are tailored to fit the purpose of abatement.

Another state law you may be aware of is one we have used in a hand card form. It is Section 2737, of the Political Code of the State of California. The Los Angeles County Road Department uses these cards frequently. It says: "Whoever obstructs or injures any highway, and so forth, and diverts any water thereby is liable to a penalty of ten dollars for each day of such obstruction and must be punished as provided in Section 588 of the Penal Code."

This Section (2737) is a law that is not in our Mosquito Abatement Act but is one that can be used very effectively. Usually those who waste water in the street and highways are impressed by these cards and do better in the future. So much for state laws.

I would now like to discuss laws at the county level. Every county is different. Some counties have very few local ordinances governing situations that would help you, but some counties have a great many. Our county has quite a few ordinances as a result of population growth.

We have an ordinance entitled, "Industrial Waste Ordinance, 6130", that specifically requires permits for discharge of industrial waste, which permit must be approved by the health officer and county engineer. Mosquito abatement districts have close liaison with city and county engineers and health officers, so many times MAD's can use these particular ordinances for abatement.

Our storm drain laws sometimes help us. Certain specific provisions for proper construction of storm drains are specified by, or in, ordinances of Health Departments, Regional planning commissions, public work groups, road departments and other agencies which could include mosquito abatement districts.

We have Health Department ordinances which are very useful, yet sometimes advantage is not always taken of them. As I have said, such ordinances vary. Some health departments or some counties have ordinances for health departments that are all-inclusive. I will mention one that is included in most health department ordinances, which is also similar to Section 4475 of the Health and Safety Code. Local Health Depatment ordinances of this type are usually more specific. Your health department may have such an ordinance of which you may not be aware. Los Angeles County Ordinance 3275, Section 131, titled "Deposit of Refuse", says in part . . . "anyone who deposits cesspool effluents or slopwater or any putrid or offensive animal or vegetable matter . . .". This covers practically all water which contains organic material so is extremely useful to MAD's.

I am not covering all these various ordinances because it would be necessary to cover all ordinances in every county in the State. If you will study the county ordinances of these different departments you will find much that may be useful to you.

City laws are usually excellent because they are specific in most instances. They have specific requirements for storm drain and gutter design, and industrial, domestic and irrigation water waste disposal.

Ordinances that prohibit the dumping of trash, debris and other such substances are at times useful to MAD's. It might be asked, what would that have to do with the legal aspect of source reduction? Only this: If areas where water drains properly is blocked by vast amounts of refuse thrown from cars, water impounds with consequent mosquito breeding.

I have covered various types of laws, ordinances and regulations. Technically these legal statutes are sufficient to obtain most source reduction, however, our other speakers have pointed out or will show that better results can be obtained through the educational approach with the legal aspect used only as a last resort.

Thank you.

Mr. Gray: Well, those of you who are awake may ask some questions now.

DISCUSSION

Mr. Groft: In regards to that little yellow card, who enforces that ordinance?

Mr. McFarland: In Los Angeles County, the Road Department. In the unincorporated areas it would be the Road Department, and in the city it would be the Street Department. It could also be the Department of Highways. Any one of those agencies can enforce it. You can use a statement of the law printed on a small card, which technique is quite effective.

You may have this sample if you like.

Mr. Groft: I know what it is. I was just wondering if that goes to the local court or the district that the person happens to be in.

Mr. McFarland: It goes to the local municipal court, and is a misdemeanor violation.

Mr. Groft: In our district the judge throws them in the waste paper basket.

Mr. Gray: You will have to educate your judge.

One more question.

Mr. Carpenter (Glenburn): I take it that we can even force the County Road Department to drain the gutters?

Mr. McFarland: The Road Department uses this particular law.

Mr. Carpenter: I take it, though, that we can enforce the laws along the highway or county roads where they have gutters that are standing full of water all the time?

Mr. McFarland: Yes, if the provisions of the Health and Safety Code concerning mosquito control are violated.

Mr. Gray: All right. We will now go on.

COOPERATIVE

W. Donald Murray, *Ph.D.*

Manager-Entomologist
Delta Mosquito Abatement District

"The Cooperative Approach to Source Reduction"

The Source Reduction program of the Delta Mosquito Abatement District, while cognizant of the various available methods of obtaining corrections of mosquito sources, has placed prime emphasis on two methods, namely education and cooperative assistance. My assignment on this panel is "the cooperative approach", so I shall endeavor to explain our program and philosophy relative to this aspect of source reduction.

Cooperation is defined by Webster as "collective action for mutual profit or common benefit".

In the Delta District, the pasture mosquito, *Aedes nigromaculis*, together with the encephalitis mosquito, *Culex tarsalis*, account for about 80% or more of our total spray control efforts. These species are produced almost entirely in irrigated pasture and alfalfa, though occasionally in other cropped fields or unlevelled native land, *all privately owned.* With the house mosquito, *Culex quinquefasciatus*, we have some major sources such as dairy drains and sewer farms, plus numerous small sources. We have a few miles of natural problems in river bottoms, however, these are but a small per cent of our total effort.

While we have recognized that all problems, large and small, agricultural as well as industrial and premise, had to be given consideration in a source reduction program, our policy has been to give the utmost attention to the most important problems, which are the breeding areas in irrigated fields, mostly pastures.

In 1952 we began a concerted effort to develop a strong reduction program. An employee who knew our mosquito control problems and who was acquainted with local farming practices was transferred to this program, this was our first step. We made many personal contacts with our top mosquito producers, thinking that our problem could be greatly reduced if we could encourage them to be more careful with their water. However, we soon found that we needed to know more about the farmers' problems, technically, than we could hope to know without technical guidance.

We had always worked in close coordination with the Agricultural Extension Service, but personnel of that department were unable to allocate as much of their time to us as we felt we needed. We believed that a technically trained agriculturist, comparable to an extension specialist but in full-time employment with us, was essential, and we were fortunate to obtain such a person.

Even after we had obtained the agricultural specialist, however, we still sensed a weakness in our approach. Just telling a farmer that it was up to him to do something about his problem, or that it was up to him to go to the Extension Service for information, did not appeal to us. It was not our concept of a cooperative approach, which calls for "collective action". When a parent wants to get cooperation from his offspring, does he get best results by the command, "Go do the dishes!" or by the suggestion and appeal, "Come, let's do the dishes"? Does an educator get the best results by telling his students to get a book and read about how to overhaul an auto engine, or by overhauling an actual engine with the students? Psychologists and educators favor the cooperative, observation-discussion approach to learning over the dictatorial lecture approach and so do we or our source reduction program. Therefore, our policy indicated the need for equipment, in order that a complete solution could be made available at the lowest possible cost.

We obtained a crawler tractor with bulldozer blade, a carryall scraper, and a four-wheel motor grader. Our first use of this equipment occurred when a farmer who had just purchased an 80-acre piece of land came into our office (referred to us by the P.M.A.) and wished to set up a return flow system. Together we developed the plans and did the necessary work. We took a movie of the operations and showed it to many service clubs, schools and other groups. This one job, in one way or another, snowballed into at least a dozen other jobs in the same area in our district.

Since we began this program, we have contracted for about 100 jobs, for almost $7,000 in charges, broken down into years as follows:

Year	No. Jobs	Charges	
1953	2	$ 97.38	rented equipment
1954	25	1,872.29	
1955	25	2,004.43	
1956	45	2,987.27	

Up to July 1, 1956, we charged $4.00 per hour for the TD-9 and $3.00 per hour for the motor grader, increased on that date to $5.00 and $4.00 respectively. On these operations we at least break even in the field on the job, but the District subsidizes some of the repairs and maintenance, as well as new developments. Up to the present time we have not had a single default in payment.

In most cases when we install a return flow system, our biggest job is planning a system which we are reasonably certain will work. We run preliminary engineering surveys for which we do not charge. There are

commercial companies better equipped to lay pipe than we, and other companies better equipped to install pumps, so these jobs are contracted out by the farmer. However, there is no one better tooled to construct the reservoir and drain ditches than we, so we recommend our equipment for this purpose; although, even here, the farmer may use his own equipment or contract with someone else. We know from experience that we can depend on our job, but not always on others. Relative costs to the district on a complete return-flow system may be as low as 10% for our part of the job; so it can be seen that we are important primarily in establishing the job and tying all phases together to assure a workable unit.

As would be expected, we have encountered many interesting problems in the development of our program. I would like to cite a couple of these:

Each year we have compiled our control cost records and developed a list of our mosquito producers, the highest producers appearing at the top of the list. We have then started at the top and made contacts with the individual farmers, requesting that improvements be made. Typical responses from the top producers have been:

"I am not interested."

"I cannot afford to do anything."

"Go ahead and do what you want, I'll pay for my share of the costs."

In 1955 we determined that 50% of all our spraying expenditures were created by only 27 farmers. We have made several to many contacts with all of these top 27, and have been permitted to do "cooperative" work on 10 of them. Reports from our spray operators indicate that in no case did our source reduction project (in these instances) help to reduce their work load – a very discouraging development. What was the problem? We simply were not obtaining cooperation. It was a one-sided arrangement in which the farmer refused to participate other than financially. Recall that cooperation calls for *collective action.*

Another problem which has concerned us is the matter of non-mosquito producers requesting help. As a result of our extensive experience and our educational program, we have developed a considerable reputation as specialists in water management and drainage problems. In determining those cases on which we believe we have responsibility, there is no distinction such as black and white, since there are many shades of gray. When we have done a job which appeared justifiable, we experienced the pleasure of embarking on a truly cooperative program, the willingness and interest of the farmer uniting with our technical knowledge and/or actual construction work in such a way as to assure success. In any case, we can assume that all source reduction projects undertaken have an actual or potential preventive value.

However, if we fritter away our time on non-mosquito producers, we have just that much less time to spend on the producers. We try to be careful in our selections, but we undoubtedly do some work which will have little direct influence on mosquito production. Nevertheless, in any of the cases of this type we have a satisfied farmer to boost our program, a farmer who has better water management as a result of our work. Without the support of the large majority of farmers, we do not believe we will ever be successful in bringing pressure of one kind or another on the disinterested, heavy mosquito producer.

Our District believes that all the aspects of source reduction should be given careful consideration. Under our conditions, our policy is to minimize the use of legal weapons, or even the threat of their use. This philosophy may seem weak to some districts, but we believe our local conditions are such that, under our cooperative program in which we work together with agriculture, we shall achieve the desired ends with a greater assurance of permanent success and with less friction along the way. In addition, although we recognize that agriculture is the prime cause of our mosquito control costs, none the less we cannot, with judgment, place ourselves in the position of legally attempting to be the tail wagging the dog.

Mr. Gray: Thank You, Don.

There is only one thing I might remark on, Don, and that is that I have found quite a number of occasions that a legal approach which has held a very strenuous objection to do a job has a very educational possibility.

Are there any questions of Dr. Murray?

(No response.)

Mr. Robinson.

MOSQUITO SOURCE REDUCTION INTER-AGENCY

E. Chester Robinson
Manager
Alameda County Mosquito Abatement District

Water is California's greatest natural resource. The future agricultural and industrial growth of California depends on the conservation, proper allocation and distribution of this water Local, State and Federal governments are spending millions of dollars a year developing it.

Mosquito abatement districts in California are only one of many agencies interested in the common problem of water management, the primary concerns of other agencies being irrigation, drainage, flood control, water conservation, soil erosion, protection of roads and property from flood, seepage damage and proper farm management. Included in the area covered by every mosquito abatement district are at least two of these other agencies, so let's take them in rotation and see how cooperative enterprises are of mutual benefit.

1. *Irrigation Districts*—Most irrigation districts have heavy equipment for constructing and maintaining ditches. They are interested in agricultural problems, drainage being one of them. The East Side Mosquito Abatement District and the irrigation districts in its area have entered into a number of cooperative projects. The mosquito abatement district furnished manpower for construction; the irrigation district, the pumps, valves and structures.

2. *Drainage or Improvement Districts* – These are formed where expenditures are too large or inadvisable for an irrigation district to handle, and in areas where drainage is the main problem. They are simple to form and enjoy a reasonable rate of interest and time for payment on improvements. Have you thought of assist-

ing the farmers in helping themselves, by the use of such a district?

3. *Flood Control Districts*—Flood control districts' main objective is control of the winter run-off by constructing reservoirs, clearing and enlarging existing channels and constructing new waterways for the disposal of flood water. The mosquito abatement district, by cooperative effort can in many cases use these channels for disposal of irrigation and industrial waste water. Alameda County Flood Control and Water Conservation District and the Alameda County Mosquito Abatement District have cooperated by an interchange of equipment, plans and manpower to the advantage of both districts from an efficiency and cost factor. The Flood Control District's plans for new construction are reviewed by the Alameda County Mosquito Abatement District to ascertain if pipes, tidegates and other drainage structures are properly located to care for the Mosquito Abatement District's summer drainage.

4. *Soil Conservation Districts* – These districts construct drainage, dams and other structures to prevent water waste and soil erosion.

5. *Agricultural Stabilization Conservation Committees*—These agencies pay farmers from federal funds for constructing pipe lines, drainage ditches, for weed control and many other practices. The programs vary in each county, so see your committee and have them put the programs in which you are interested on the list for payments.

6. *County Road Departments, Railroads, and State Highway Departments*—Drainage is of primary importance to this group because of the damage to the roadbeds from impounded water adjacent to them.

7. *County Agricultural Extension Services*—Actually, these come under the educational division of this panel, but they are worth mentioning again as they are an advisory service, and can be of assistance to you.

I have not covered every agency, but only hit the high spots and given a few examples of inter-agency cooperation. Your time can be very profitably spent in personally contacting these and other groups, explaining your problems to them, and learning of theirs. Remember, they are just as interested in community betterment as you are, and sometimes two heads can solve a problem better than one!

Mr. Gray: Thank you, gentlemen of the panel.

I think that concludes it unless there are some questions to be directed, first to Mr. Robinson, and then we will give you a moment for others. Any questions?

(No response.)

I guess that covers it.

(Applause)

President Greenfield: Thank you, Harold.

There is now declared a recess until 3:35. We will start promptly with Dr. Bohart's talk.

(Short recess.)

President Greenfield: I said 3:35, and we are five minutes over now. I would like to get the Meeting adjourned this evening early enough so you will have a chance to relax and rest a bit and come back this evening to see the film on "The Rival World," PG&E's new film on water which, as I understand, is a very, very fine presentation.

I would like to make one other announcement at this moment, and for those of you who were not in the Business Meeting and are interested in civil defense procurements, General Van Wyk will be here tomorrow to speak to the group at the end of the session; and that will be, we hope, approximately at noon, so it behooves all of us to stay to hear what the procedures are and what information he can give us relative to the types of equipment available and so forth.

I notice from our general discussions and bull sessions in the lobby and elsewhere that a number of us are either anticipating going into it immediately or have already had the resolutions drawn up or are actually participating in civil defense and are merely waiting for notification of the arrival of the materials. I think General Van Wyk can certainly clear up many of the questions that are still unanswered.

Now we can start our program.

If I may, I would like to introduce at this time Dr. Bohart, who has been working with us for a good many years. Dr. Bohart is going to tell us of some of the developments in culicidology this past year.

Dr. Bohart.

Dr. Bohart: Members of the CMCA: Before I start my presentation of this subject, I would like to give you just a little background on it and the reason I am giving it at all.

About two months ago a group of CMCA members belonging to our Culicidology Committee met at Davis, at the University of California, and discussed several things that were in their minds. The outcome of that discussion was that someone should give a paper before this Meeting on the subject of biological research and its importance to control, or something to that effect.

I suggested a number of people who might give that talk and, by some mischance, they chose me.

I have written a presentation which I have titled somewhat differently from what appears in your program. I have called it "Biological Studies, Mosquito Control, and the Entomologist."

I would like to speak to you more or less off the cuff, if I may, and I will just refer to the paper occasionally, and then we will see to it that it is published, and I hope you will all read it eventually in its more formal way.

BIOLOGICAL STUDIES, MOSQUITO CONTROL, AND THE ENTOMOLOGIST

R. M. Bohart, Ph.D.

Associate Professor of Entomology
College of Agriculture, University of California
Davis, California

It is a truism to say that biological research on insects has provided the foundation upon which our control efforts have been built. Because it is a truism, this fundamental fact is often overlooked or taken for granted. It is not my intention to survey the important advances in biological research for the year 1956, although I would like to see such a presentation on future programs of the CMCA. Rather, I intend to point out some aspects of biology, mosquito control, and the entomologist. I would like to make clear that these are not my ideas alone, but have come out of discussions with members of your Culicidology Committee.

Much of our present biological information on mos-

quitoes of California has resulted from a succession of studies, each building upon and adding to what has gone before. In rice-field work, as an example, Freeborn, Herms, and Purdy were followed by Markos and Gerhardt, with many others contributing along the way to bring our knowledge to its present plateau. We have come a long way, yet entirely satisfactory control of rice-field mosquitoes has not been achieved. On salt-marsh species, results have been better. The knowledge and findings of Quayle, Herms, and Gray, to name a few, have borne fruit through drainage and reclamation so that the problem has been narrowing rapidly. A comparison of rice-field versus salt-marsh problems brings up another point. Entomologists are frequently called upon to be sanitary experts, mechanics, chemists, and politicians. It is no wonder that so little time is left to be a biologist. However, through some concentrated effort and some occasional contributions from those burdened with other duties, progress is being made. Modern thinking in mosquito control is along the lines of water control, source reduction, and public relations. These are magic words and no one can deny their importance, but we should not lose sight of the fact that the job is fundamentally an entomological one, based on a knowledge of insect biology. The outstanding success in control of the Clear Lake Gnat illustrates this principle.

On a global basis, an entomologist frequently has to vary his attack. As a theoretical example, take a man trained in mosquito control on a salt marsh. Steeped in a tradition of tide gates, he would find much of his knowledge valueless in malaria control in the eastern United States. Here he would have to become an expert in setting ditches to grade, and brush clearance. If transferred to the American tropics, he might become involved in house-to-house spray programs; on a Pacific island his attention would be directed to a clean-up program of artificial containers and tree holes. Why such diverse methods? Only a moment's reflection is needed to see that the different biologies of the mosquitoes concerned require different emphasis in control procedures. As previously stated, we have reached a plateau of knowledge with respect to the biology of rice-field mosquitoes. The same applies to irrigated pasture forms. We cannot adopt a complacent attitude, stop research, and by putting on more chemicals and improving public relations, convince ourselves that victory is well in hand. Biological research must continue at an accelerated pace.

California mosquito control has benefitted by the efforts of many organizations. In addition to the M.A.D.'s, the State Bureau of Vector Control, University of California, U.S. Department of Agriculture, and U.S. Public Health Service, have all made heavy contributions.

Here, I would like to mention briefly some of the current work of a biological nature which is being done by personnel of the above organizations. R. C. Husbands has completed three years of cooperative study on irrigation practices and mosquito production in irrigated pastures. R. E. Bellamy and E. Myers have been conducting an altitudinal light-trap study to evaluate feeding habits of Kern County mosquitoes. E. C. Loomis has completed a three-year study on overwintering habits of *Culex tarsalis*. R. K. Washino has worked for two years on the biology of *Culex stigmatosoma*. E. L. Peyton has greatly increased our knowledge of *Aedes varipalpus* (now more correctly known as A, *siessensis* Ludlow). R. E. Fontaine has carried a survey on overwintering *Anopheles* into its third year in the San Joaquin Valley in reference to the value of mosquito production in cotton fields. J. Shanafelt is developing better light-trapping methods for field sampling. R. W. Gerhardt has been working for several years on the interrelation of rice-field mosquitoes and algae. An N.I.H. grant for continuation of some phases of this project has been obtained. C. Judson and B. Rosay have been studying factors influencing egg hatching in *Aedes migromaculis* with the hope that alteration of some natural process may result in a control technique. W. C. Reeves is continuing to develop much valuable biological information in connection with his encephalitis studies. E. Mezger has been continuing a several years of study of hatching phenomena of salt-marsh mosquitoes. J. N. Belkin has been accumulating data on variation in structure and habits of *Anopheles freeborni* populations in different areas of the West. Finally, a M.A.D.-Bureau of Vector Control cooperative program has been initiated to provide a warning system on mosquito-borne encephalitis by means of a *Culex tarsalis* larval survey on a state-wide basis.

These and other projects of a biological nature attest the continuing interest in this type of investigation. However, it is too early to rest on our laurels. A. W. Lindquist in a talk before this group in 1953 listed many unsolved biological problems. Only a few of these have been investigated and much more will have to be done before we can reach that plateau of knowledge which will enable us to satisfactorily direct our control efforts.

President Greenfield: Dr. Bohart has touched upon a subject that sometimes we have all wondered about. At one time we may be source reduction specialists and then the next time we are weed control men, and other aspects are ever present, we realize that. I hope that more emphasis can be placed on the place of the entomologist in mosquito control.

Are there any questions that you might want to ask? I am sure Dr. Bohart wouldn't mind answering them.

Dr. Bohart: I would be glad to.

President Greenfield: I see some students, Doctor, that are from our local college here in attendance. I am very happy to see them, particularly in relation to that speech you just gave.

Dr. Bohart: I understand they are going to have a final tomorrow, some of them anyway.

President Greenfield: At this time I am going to take the opportunity of doing something I have been waiting for and wanting to do for a number of days now. I am going to put the bee on some of the managers to stand up and introduce their most honored guests, our Trustees.

Will all the Trustees and the managers stand up en masse, and we will start over here with the introductions and go across the room.

All Trustees and managers please stand up, and will the managers take the responsibility of seeing that each of their Trustees is introduced.

(Whereupon, all managers and Trustees stood, and the Trustees were introduced to the assemblage by their respective managers.)

President Greenfield: I think everyone recognized the situation that as the Trustees stood up, a good fifty

per cent of the audience rose. I certainly feel that they should have recognition for their service and for their attendance here at the Conference.

I am sorry that Dr. Turner, who would be considered a Trustee, is not present to receive his introduction.

Now may we have A. F. Preuss present his program. His Trustees' Meeting will be the final part of our program today.

Adolph, please.

TRUSTEES' TOWN HALL PROBLEMS AND SUGGESTIONS

A. F. Preuss, *Moderator*
President, Board of Trustees
Consolidated Mosquito Abatement District

Mr. Preuss: Thank you, Howard, for the introduction.

Members of the CMCA and Guests: First of all I would like to thank Don Murray and the members of the Board of Directors and the Program Committee of the CMCA for finding time to allot for a Trustees' Session, a very informal session so that we may discuss some of our problems and perhaps come up with some suggestions as to what we think should not be done to help us solve the many problems that we have.

We, of course, are responsible for the proper administration and operation of our respective districts. We select a manager who carries out our decisions, and when he runs into difficulty he reports back to us and then it is up to us as Board Members to make a decision as to how the particular problem should be handled.

In this respect we must be thoroughly familiar with the Health and Safety Code as it pertains to mosquito abatement and also many other phases of the law.

These problems are many, and I think this is an opportune time for us to get together to discuss these problems, and it is essential that the managers be here with us. I think they have an important job. We have to rely upon them in many instances for minor details.

Mr. Henry Dietz gave us some valuable information as far as the duties of the Trustees pertain. He brought us up to date, and I am sorry that not more of the Trustees were available. Evidently he stole some of the thunder from Mr. McFarland, but Mr. McFarland got by very nicely; but when Mr. McFarland got up to speak he stole some of my thunder, but he didn't get away with all of it.

We had intended that Mr. Gordon Winton would be with us here this afternoon. He is the legal advisor to the Merced County Mosquito Abatement District, and it was intended that perhaps if questions would arise of a legal nature, we could get his opinion. Due to the fact that he is now elected Assemblyman, he was unable to get away from his duties at Sacramento.

I have prevailed upon Mr. McFarland to come up and sit with me, and also Mr. Darrah of the Stockton area. So if you gentlemen will come up I will appreciate it. I do need a little support up here.

(Whereupon, Mr. McFarland and Mr. Darrah joined Mr. Preuss on the speaker's platform.)

Mr. Preuss: It was brought out in the discussions by Mr. Dietz that our powers are very broad. The question is: Are they too broad sometimes? Do we abuse those particular powers?

He suggested that we use discretion and negotiation before we resort to legal maneuvers if at all possible. I do not know what the proper definition of "discretion" is. It could mean, perhaps, that when you have a farmer down you should jump on him. I don't think that is the proper method of approach.

Perhaps most of the time we seem to have the upper hand. It is a matter of letting him squirm, letting him find out what he can do; and when he finds out that we are still liable to be on top there isn't much that he can do except to fall in line with what we wish for him to do. But those things can come about in a gradual manner without producing any bad effects.

It is necessary that a district manager maintain adequate records of various sources so that if and when it is called to the attention of his Board he has ample records to base his findings on.

It may be necessary not only to have records for one year, but perhaps for two or three years, and these records would be used as a guide to the Board so that they may determine their action in the future. The manager, in other words, is sort of a right hand man to the Board.

I thought Mr. Harold Gray's panel up here had the situation pretty well put when it was mentioned that mainly control work is educational cooperation and legal procedures. We like to keep legal in the background and use all the educational persuasion that we can, get all the cooperation that we can, and when it looks as though we have run against a wall, we must seek further help, and no doubt that would be legal help.

The Health and Safety Code prescribes the manner in which we can get this help. My thinking of this portion of the program is merely to have open discussion from the Trustees, and managers as well.

No doubt you have problems. Our districts are widespread, from the northern part of the State to the southern part. Perhaps your problems of the northern part will differ from the problems of the central and southern parts. You may wish to ask other districts how they have met their problems that might be similar to yours.

I would refer those questions back to the Members of the Board and also the managers to see if they have met a problem of that kind and how they overcame those difficulties.

However, there are going to be some questions pertaining to the Health and Safety Code. Therefore, I am glad to have a little support from these two gentlemen here.

We sent out a letter asking various questions in order to sort of head up what we are aiming to do. One of the questions that was mentioned was the question as to whether or not many of the districts hired legal counsel or whether they got adequate support from the county counsel. Replies indicated that help from the county counsel was always sufficient. However, it seems a few districts have maintained their own counsel.

The cooperation from county counsel has been excellent. The attendance of the Board Members at their meetings has been excellent.

I am going to start off with this by asking a question that has been in my mind for some time and it showed up in the replies that I got from several of the Board

Members. It is going to be on the legal side, and I will refer it to one of the gentlemen here. Perhaps I could ask Mr. Darrah.

I would like to know how many of the districts here maintain a petty cash to pay small bills. I would like to see your hands.

(Whereupon, some of the members of the assemblage raised their hands.)

Thank you.

Now I will ask Mr. Darrah: Is it proper and is it legal for a mosquito abatement district to maintain a petty cash account for the purpose of paying small bills? It is more convenient if a district can have a petty cash. We in the Consolidated District maintain a cash account of fifty dollars. Each month it would mean a savings of perhaps writing ten or maybe fifteen warrants. The actual expenditures some months would only be ten or fifteen dollars. I don't recall offhand that we have ever used up the fifty dollars in any one particular month.

Now, Mr. Darrah, what is your opinion? Are we doing something that is perfectly legal?

Mr. Darrah: I believe it is. You get to a point where making expenditures may be so small that it will cost more to process them than you would be using. Certainly the law is a practical thing, and I know of nothing that would prohibit you from keeping one.

Mr. McFarland: I would like to comment on that aspect of it. I think most of you are familiar with the latest audit that is being carried on by the county auditors, and one of the criticisms of our operation, among others, was the fact we did not maintain a petty cash fund and that it was keeping with the proper public policy and so forth to have it. So we are going to have to put one in even though we had not bothered with it prior to this time.

Mr. Preuss: Has anyone any questions that they would like to ask? Be sure to give your name and your district.

Secretary Washburn: Mr. Chairman, I would like to comment on this slightly. The interpretation by our private counsel for the district and by the CPA who has audited the books of the district for some eight years now is that we have no legal authority to maintain a petty cash fund. We do not maintain such under that authority by our own counsel.

Mr. Gray: I might make a remark. A number of years ago the district attorney of Alameda County ruled the Alameda County District could not maintain a petty cash fund on the ground it was not authorized in the Act and you had no authority to do it. I kept one just the same. (Laughter)

Mr. Preuss: Howard?

President Greenfield: We encountered a similar situation. It seems from just a few of the comments here that possibly it is more of a policy that has developed within the county structure or governmental structure itself instead of a question of legal interpretation. I am not certain on that, but it just seems that in our county the district attorney felt that, as a matter of policy, unless certain controls were instituted, petty cash funds in the county structure were not recommended and were looked upon with great disfavor. He did not say they were illegal; just that they were looked on with great disfavor and asked that all special districts and similar agencies discontinue the use of their petty cash funds.

In the meantime, our auditor ran against that ruling and immediately said, "Well, that's fine. We'll throw it into a revolving fund and everything's legal." (Laughter)

Mr. Preuss: Before we get too deep in this, Howard, whenever time is up, will you let me know?

President Greenfield: All right.

Mr. Preuss: I would like to mention that whatever we are saying here is being recorded and will come out in the proceedings, and I am hopeful that perhaps the next Board of Directors, and perhaps the Legislative Committee, might review some of the things that are problems and the things that we are mentioning here. It is possible that they may want to come up with some changes in the Health and Safety Code for clarification purposes.

Secretary Washburn: I would like to make a comment on this. In relation to county counsel rulings and so on, I presume you all know there are some fifty-eight counties in the State of California and there are some fifty-eight county counsels; in normal rulings of county counsel, as I have run across them, there are fifty-eight separate opinions, and each county counsel is authority unto himself. The final authority, of course, rests with the Attorney General of the State of California. But each counsel may have separate rulings so we may have to operate separately.

Mr. McFeely (Oak Park, Illinois): Mr. Chairman, I have been a Trustee for thirty years and spent about three million dollars, and I think such a ruling would be nonsense, and if it were to come up where I am an official, I would ignore it.

Mr. Vannote: I would like to raise the question of whether this matter is one for the attorney to decide or whether it is an auditing problem. In our county the approval is not a legal matter, but a matter of audit.

Mr. Preuss: We will have that in the proceedings, and I am hopeful that one of the committees may pick it up and follow through, and it may come out with a better understanding as to our position in regard to the petty cash fund.

So much for that.

Now, let us hear from some of the Board Members as to what your particular problem may be that you are not sure of yourself as to what to do, and perhaps we may get some information from some who have had a similar problem.

Would anyone care to start off? If not, I will pick out some of the information that was given to me in the letters as to what some of the districts would like to have discussed at this time.

We have one letter here and it mentions: "I would like to have a legal opinion as to the meaning of paragraphs (h) and (i) of Section 2270 of the Public Health and Safety Code."

Mr. McFarland.

Mr. McFarland: I will read them so you are familiar with them.

"Section 2270: The district board may"—and then the various powers of the districts, what they can do—

> "(h) Borrow money in any fiscal year and repay it in the same or in the next ensuing fiscal year. The amount borrowed in any fiscal year is not to exceed

$0.15 in each $100 of assessed valuation of property in the district.

"(i) Issue warrants payable at the time stated therein to evidence the obligation to repay money borrowed or any other obligation incurred by the district, warrants so issued to draw interest at a rate fixed by the board not to exceed 5 per cent per year, payable annually or semi-annually as the board may prescribe."

Mr. Preuss: It seems to me that as far as borrowing money, the purpose of this perhaps would be to ask for a transfer from the general fund of the county a sufficient amount of money which would tide a mosquito district over during what we call the 'dry period" from July until such a time that the tax rate is established.

Of course, this money would not be made available, I don't believe, until after the tax rate is established. Perhaps that is what this individual is referring to. I think many districts will apply to the Board of Supervisors for transfer of money from the general county fund to their mosquito abatement district to use that money until their own tax money becomes available.

Is that clear to all of you, or do any of you have a particular question that yould like to ask?

Mr. Murray: I think that the remarks of Mr. Dietz yesterday should be given consideration on that, that there is jealousy by the other county agencies of the county government relative to all of the special districts and there is a growing tendence to require special districts to take care of themselves.

In our case we have never been able to obtain any money from the county. They say, "It is your business; run it."

I think that some of the districts are finding themselves pressed. They have been able to get by in the past, but it is getting tighter, and that situation may continue until all districts are unable to borrow from the county funds.

More power to you if you can get it.

Mr. Preuss: Don, have you built up enough of a kitty to carry you over during the dry period?

Mr. Murray: We had to.

Mr. Preuss: Then borrowing isn't a particular problem as far as your district is concerned now. You are over the hump.

Mr. Murray: Yes.

Mr. Preuss: How about some other district. Are they still confronted with it?

Mr. Guerts (Salt Lake City, Utah): Our Utah law provides that monies or revenues derived, for example, in 1956, are used for 1957 operations. We don't have any problem on ours. Our revenues on taxes are received in the year. We start 1957 with an adequate fund to carry out our program.

Mr. Darrah: Mr. Moderator, may I call your attention to the fact that this is merely an authority to borrow which the mosquito abatement district wouldn't otherwise have, and it implies no compulsion at all on the county or anyone else to lend the money.

Mr. Preuss: That is a very good point. It just merely gives us the power to borrow. If you can't get it from the county, you will have to look for some other source.

The next paragraph, (i), refers to issuing warrants payable at the time stated therein and so forth and the amount of interest. Where you borrow such money from the county general fund, I don't think it is any particular problem. I believe that is available without interest; but if you do borrow it from other sources, the chances are that interest is going to be involved, and I think that paragraph (i) specifies the amount of interest that you may pay.

Mr. Gray: I think I can clarify that last section.

If some of you remember the days of the early Roosevelt times, when we were all broke, the cities and counties issued what they called "anticipation warrants," and they bore three to five per cent interest. There was no money in their fund to pay those things, and you had to wait in getting your money until they told you that warrant number so and so would be paid, and then you presented it and you got your money. You had to wait until tax money could get paid in.

I remember back in 1928, I think it was, or 1929 — I have forgotten — the City of Oakland got in a tax jam for some reason or other, and they had no money, and they issued warrants with four per cent interest, if I remember correctly. I think I had to wait about three months before I got my fees out of it.

But that is the way they had to do in the past. If you are broke, you can still issue warrants which have the effect of borrowed money and carry an interest rate. You have to wait until taxes are paid in; then you are paid in the order of issuance.

Mr. Preuss: When the Fresno District was organized, of course there were no funds available. The deal was made with one of the local banks to pick up the warrants and hold them until such a time as the county funds were available.

Another question here: "Why should mosquito abatement districts that receive subvention funds and are thoroughly audited by the State Controller's office be subjected to an additional audit for which they have to pay by the terms of Section 26909 of the Government's Code?"

Is anyone familiar with that particular Code?

Mr. Darrah: He answers his own question. The state of subvention in the program contemplates a certain amount of auditing. This section requires each mosquito abatement district to make audits. As long as it remains that way there is no problem. You just have to do it.

Mr. Preuss: Has anyone any questions they would like to ask in regard to that?

Mr. McFarland: I would like to comment on that. This audit that we are having to pay for now is involved in that section, and mosquito abatement districts, as districts go, probably are well handled and their audits will show they have done a good job, but there are some districts that keep no records and some of them have no reason for existence.

I might give an example of one of the districts in Los Angeles County that was formed. It was a water district, and later the city took over all the facilities of this water district, purchased them, and it was no longer the district's business to supply water to the district, and yet it was already formed and never dissolved. There was a board of trustees set up to receive twenty-five dollars a meeting and they met once a week regularly for about eight years and received their twenty-five dollars, which was picked upon this audit, so there was a good reason for that.

Mr. Carpenter: I would like to ask one question that may have been answered before and I missed it.

Are we allowed to build up a reserve?

Secretary Washburn: Eighty-five per cent of your budget, yes.

Mr. Preuss: The question is: Are we allowed to build up a reserve.

Mr. Darrah: Yes, but you better follow the language of the Code quite carefully and do it within the Code section.

Secretary Washburn: Mr. Chairman, the answer to that is not "may we." Maybe legally we are entitled to, but doing it is something else. That will be within your own finances.

Mr. Preuss: I think with some districts, and perhaps most districts, it is being done. The money is put in under some other particular heading.

Mr. Darrah: "Section 2313:

> The District Board may establish and maintain a cash-basis fund for the purpose of defraying district expenses between the beginning of a fiscal year and the time of distribution of tax receipts in a fiscal year. Such cash-basis fund shall not exceed 60 per cent of the estimated expenditures for a fiscal year."

Mr. Preuss: I believe that is the answer.

Mr. Cavanaugh (Indio River): What happens to the fund if we go over sixty per cent.

Mr. Darrah: That is illegal. Legally you can't do it.

Mr. Cavanaugh: What can happen?

Mr. Darrah: It should go back into the general fund. You shouldn't do it. The auditor will probably take it away from you .

Mr. Gray: Maybe the difference is with the county, because for years we ran a cash-basis fund according to law and that remained in the district's fund.

Mr. Darrah: His problem was what if you ran over sixty per cent provided in the Code. That was his question. I am only talking about the excess of sixty per cent.

Mr. Gray: Oh. That is illegal.

Mr. McFarland: In addition, Section 2314 allows an emergency fund not to exceed twenty-five per cent of the estimated expenditures, so that would be an additional amount if it were so designated.

Mr. Johnson (Northern San Joaquin): I question that sixty per cent, because we were called on the carpet two years ago because we had too much reserve and we had a little over twenty-five per cent of our budget and we had to cut it down. In the extra portion, our district last year in San Joaquin County, we were allowed to increase it, but certainly not this year. We had about a twenty-five thousand dollar surplus, and we had to cut it down to a little less than twenty.

Mr. Portman: I would like to ask this in connection with this question: Whose power supersedes that of the Board as given to them by law? In other words, who compels the Board of Trustees to reduce their fund and under what basis? Was it a legal basis for such matter?

Mr. Preuss: Who advised you in that respect?

Mr. Johnson: The county auditor.

Mr. Preuss: You may have a point there to study.

Mr. Darrah: If you are in the area where it is within the discretion of the Board of Supervisors to allow you to spend the amount that you budget, then, obviously that can curtail the amount you can build up as a surplus, and they have that power over such districts.

There is another section that provides – I have forgotten the exact limitations – but you can spend up to a certain amount. But if it is within the lower bracket the Supervisors have no power to curtail your expenditures up to the full amount authorized in the Health and Safety Code.

Mr. Preuss: The next problem here: "In most coverages the Code provides more than ample provisions for our operations. Yet our one criticism might be that it does not lend aid to a preventive program such as the State Highway Division and certain of our cities submitting drainage plans to us prior to final adoption. Normally such programs are inaugurated without our knowledge and without their consideration of the mosquito problem involved. This frequently results in the creation of more mosquito potential and extra cost in either corrective or abatement work."

I think perhaps in a case like that it may be necessary for the Board or the manager to do a little contact work with the agencies within his district.

Someone here – I think it was Don Murray – mentioned that he got wonderful cooperation from the Federal Government on some of their projects.

Are there any comments on that?

Mr. McFarland: Whether you could get away with it or not I don't know, but you could certainly use that provision of the powers of the Board. I think it is Section 270. That section requires a public agency to pay for anything that they create.

Mr. Preuss: Another point we would like to hear from other Trustees on is their use of county ordinances prohibiting breeding and/or disposal of waste water on the surface of the ground and the penalties provided.

I believe it was mentioned in Harold Gray's panel here that many counties do have ordinances regulating the waste and the disposal of it, and I am just wondering if anyone has any particular gripe on that as to whether or not that ordinance has adequate provisions in it or has teeth in it.

Mr. Brumbaugh: In our county we have had three ordinances passed in the last couple of years. One is for leveling land. They now have to get a permit from the county engineer. We think it would be excellent in reducing some of the water problems.

Also they have another ordinance prohibiting putting water on county roads because we have been having a lot of trouble with our road system in our area. They employed one man, and he is now patrolling the road where water is going on the road, trying to stop unnecessary waste of water.

It has been working out very well, and we hope to utilize it to the best of our advantage.

Mr. Preuss: Any suggestions on that? If not we will go ahead with the next suggestion.

It is suggested here that Section 2272, which at present reads: "The nuisance may be abated in any action or proceeding, or by any remedy, provided by law" should have the word "may" changed to the word "shall."

I would like to hear from our gentlemen up here on that.

Mr. Darrah: As a matter of use, "may" implies a discretion on the part of mosquito abatement Trustees in

determining whether or not they want to resort to abatement.

Now, you have all been talking about public relations and your indisposition to invoke these rather severe provisions of the law. If you were required to abate every public nuisance in your county, you would have taxpayers on your back who would make you go out and abate those nuisances that are really private rather than indulging and educating and cooperating with farmers as you now prefer to do.

Mr. Preuss: Well put. Are there any comments on that?

(No response.)

There is another suggestion here that another section be added, perhaps calling it 2281(a). Section 2281 now states:

"At the hearing the district board shall redetermine whether or not the owner shall abate the nuisance and prevent its recurrence, or shall specify a time within which the work shall be completed."

It was suggested that perhaps Section 2281(a) be added, stating: If the owner fails to abate the nuisance within the time specified in the notice or at the hearing, he is guilty of a misdemeanor.

Now, we know it can be or is a nuisance and the creation of a nuisance, no doubt, is a misdemeanor.

What is your thinking? Should "misdemeanor" be spelled out in our Health and Safety Code for clarification purposes? Do you gentlemen think it is essential?

Mr. McFarland: My personal opinion is that if it is already covered in the law, why confuse the issue by trying to be doubly safe, so to speak. I think that is a constant criticism of public bodies that they already have the legal power necessary, and then attempts are made to even dot the "i's" closer, and actually they get just the reverse.

Mr Preuss: Any questions or suggestions?

(No response.)

We will take one more. Our time is almost up.

It is suggested that Section 2283 be changed. It now reads:

"The cost of abatement shall be repaid to the district by the owner."

And it is suggested to read as follows:

"The cost of abatement shall be repaid to the district by the owner within 30 days following receipt of a statement of cost incurred by the district during the previous months."

Is it essential that we put a time limit in there or leave that up to the discretion of the Board?

Mr. Culp: To give you an example of what you might run into there, I had a leaky pipeline on my ranch, and I called a fellow up in the pipeline company three different times to fix it, and they never did get it fixed. There I was paying for a job to be done. It wasn't being done, and I still had to do that, so when you make a fast, hard rule of something like that, I think you are opening yourself to criticism.

Mr. Preuss: Any comments?

(No response.)

I appreciate having this opportunity of heading this panel. I think we have had some worthwhile discussions here that will go down in the proceedings, and it may be that next year some of these various committees might pick up some of these for discussion and find out if we want to follow through on any of them.

If there is nothing else, I will turn the Meeting back to Howard.

(Applause)

President Greenfield: Thank you.

Mr. De Nevi (Stockton): I would like to ask a question if I may.

I was interested in the remarks made by the President of the Board of Trustees. For my clarification, did you state that there are districts that do not have their own private counsel, but in lieu of their own private counsel go to the DA?

If that is true, I would be curious to know how many districts have their private counsel or, in dire need, go to the county counsel?

Do I make myself clear?

Mr. Preuss: Yes.

I think in most instances you will find that the first course is to go to county counsel. I think there are a few districts that would prefer to have their own legal counsel merely be at the meeting to sit in with them and keep them advised.

Would some of the Trustees here like to comment on that as to the reasons they have hired legal counsel of their own? Is it just for convenience, or is it that you couldn't get satisfaction from the county counsel?

Secretary Washburn: Mr. Chairman, I am not a Board Member by a long shot. There is reason behind why some of the districts have private counsel. County counsels of any county are not, by law, required to service any special district. They are required to serve schools in certain other groups; but if the county counsel sees fit and has time and the personnel to handle the problem of the individual district, which is his own decision, and if he is willing to do it, fine and dandy. Otherwise you will have to seek private counsel.

Mr. Preuss: Does that answer your question?

Mr. De Nevi: Yes, it does, but I was curious if you had at your fingertips information on how many districts had?

Mr. Preuss: No, I didn't compile that information. I am sorry.

Mr. Hauret (Ballona Creek): The county counsel will render opinions, but they will not enter into litigation. So if a district is thinking in terms of litigation against property owners, for example, he would have to go to his own private legal counsel and not the county counsel.

Mr. Raley: I think that might be clarified, too. You have your district attorney's office to fall back on in that case, so even there it is not necessary to get private counsel.

Mr. Gray: If you wanted to foreclose a lien you would have to get your own counsel to do it.

Mr. Preuss: That is it, Howard. Thank you.

President Greenfield: Thank you.

Gentlemen, we are at that time now when we may just start to contemplate adjournment for this evening. However, before we do, there are a number of announcements here that I have been asked to make.

General Van Wyk will be here tomorrow noon. He will tell us how to procure, we hope, surplus equipment through civil defense needs or participation.

Beginning at 8:00 o'clock this evening in this room there will be an informal showing of some of the new

entertainment films in color. We will see "Water," which is the Pacific Gas & Electric film; "The Rival World" by Shell Oil Company. We also have one on source reduction from that outstanding district, the Delta MAD, and "Yosemite," which has been done by the United Air Lines. I am sure that all four of those films will certainly be worth seeing.

Are there any further announcements to be made?

Mr. Kramer (Castro Valley): Howard, there is equipment scheduled for outside demonstration.

President Greenfield: Thank you for reminding me. I have it written here and wanted to mention it.

We are a half hour overtime. I hope, however, that the exhibitors will still be willing to demonstrate their equipment.

You are at your leisure now. The equipment demonstration will be down below, and we will adjourn at this time.

(Whereupon, at 5:00 p.m. on Tuesday, January 22, 1957, an adjournment was taken until 9:00 a.m. Wednesday, January 23, 1957.)

WEDNESDAY MORNING SESSION

January 23, 1957

The closing session of the Twenty-Fifth Annual Conference of the California Mosquito Control Association, Inc., convened at the De Anza Hotel, San Jose, California, and was called to order at 9:20 o'clock a.m., President Howard R. Greenfield, Salinas, California, presiding.

President Greenfield: I hope that you all enjoyed your movies last night, those who were able to attend the session. I have heard a number of comments on the pictures, Tommy, and so far I have talked to no one who did not enjoy them. So thanks to you, Tom, for your efforts on providing some entertainment for last evening.

While they are setting up the projector I might make a few announcements. First, the Board will meet following the session this morning. They will meet for a luncheon down in the restaurant in the back room, if we can make the arrangements for the room.

We have the announcement that General Van Wyk will present an informative little discussion on procurement of surplus equipment for civil defense activities as terminating the formal program.

Are there any other announcements, Ed, that have come to you at this time?

Secretary Washburn: None.

President Greenfield: Is Bob Portman here? He is probably still eating. It is customary for our Vice President to assume the responsibility for the program on the last day. We won't disturb Bob until he gets his eggs down, so I will proceed with getting our program underway.

Our first panel this morning is going to be conducted by Art Geib. As you will note from your program, the title is Mosquito Control Insecticides—Where Do We Go From Here.

Art, if you would assemble your panel and take your place on the podium we will get underway.

MOSQUITO CONTROL INSECTICIDES – WHERE DO WE GO FROM HERE?

PANEL

ARTHUR F. GEIB, *Chairman*
Manager, Kern Mosquito Abatement District

MIR S. MULLA, PH.D.
University of California
Riverside, California

GAINES W. EDDY
U.S. Department of Agriculture
Corvallis, Oregon

CHARLES PURSING, PH.D.
Director, Agriculture Research Laboratory
Stauffer Chemical Company

LEWIS W. ISAAK
Associate Vector Control Specialist
Bureau of Vector Control
Department of Public Health

Mr. Geib: I would like to keep this symposium as informal as is possible, gentlemen. I hope we may stimulate a few questions and comments from the floor.

This subject of Insecticides and Their Use in Mosquito Control is one that we have discussed at each and every Meeting, or we have, at least, for the past ten Meetings. Apparently it seems necessary to do so inasmuch as it is a rather important phase of mosquito control activities in California.

We can hope, perhaps, that the day may come when insecticides won't play as important a part in our activities as they do now. However, such a possibility seems to be in the distant future. It certainly is not with us now.

Before going any further, I would like to introduce to you the members of this panel.

On my left is Lew Isaaks, Bureau of Vector Control, State Department of Public Health. As you know he has been screening new insecticides for mosquito control purposes.

Dr. Charles Pursing, Director of the Experimental Laboratory, Stauffer Chemical Company.

Mr. Gaines Eddy, U.S. Department of Agriculture, Corvallis, Oregon, Laboratory.

Dr. Mir Mulla, University of California, Riverside.

As Howard pointed out, this theme was chosen in an attempt to show on this panel the present status of insecticide use, and to focus attention to the insecticide situation as it exists here in California in our mosquito control problems.

It might be wise to very briefly go back to 1945 or 1946 when we first started using DDT. The history of that, I think, is pretty well known. Many of the mosquito species in parts of the state developed resistance to DDT and subsequently to most others of the chlorinated hydrocarbons. With this development it was necessary to resort to the use of phosphate insecticides in lieu of the chlorinates. We were fortunate that we were able to have other alternate materials which we found in this family.

We have now been utilizing malathion and parathion as larvicides for at least four years. I believe EPN was used earlier than that.

There are those of us engaged in this work who are a little bit optimistic; there are those of us who are not particularly concerned; and there are those of us who are a bit pessimistic about where we go from here in this insecticide field. I am thinking particularly of what might happen in our mosquito control work if this summer or any time thereafter we developed a fair degree of resistance to the phosphates that we are now using.

Without any further mention of the potential prospect of the development of resistance to phosphates, I will call on Dr. Mulla to tell us his viewpoint concerning resistance and the use of insecticides in mosquito control.

Dr. Mulla.

Dr. Mulla: Mr. Chairman, Members of the Panel, Gentlemen: Dr. Metcalf unfortunately was unable to attend this meeting here today, despite his great interest in the activities of this group. He asked me if I would deliver his talk to this assemblage. As some of you may know, Dr. Metcalf has been recently chosen president-elect of the Entomological Society of America, the largest national organization in any one single branch of the biological sciences. His duties and responsibilities, in addition to those in administration and research, have increased materially.

This last Sunday our Riverside campus was the scene of mobile TV units and cameras, and Dr. Metcalf was busy preparing entomological material for the show called "The Wide, Wide World." Probably some of you watched it this last Sunday. We didn't, because we were just struggling through the rain storms, on our way to San Jose.

Before I deliver Dr. Metcalf's talk on larvicides, I would like to take this opportunity of saying a few words about the research on *Hippelates* eye gnats, a problem in which I am sure some of you are interested, because several of you during the course of these meetings asked me to say something about the eye gnat problem in southern California.

Last year the Coachella Valley Mosquito Abatement District extended a grant to the Department of Entomology at Riverside for undertaking research on the biology and control of *Hippelates* eye gnats. Dr. Barnes and myself of that department have been engaged in research on eye gnats since that time. The facilities of our department from analytical and toxicological laboratories to machine shops are utilized in furthering overall research on the eye gnats.

Not much has been said about the eye gnats before the CMCA Meetings for the last two or three years, and many of you may have forgotten that they still constitute a menace in certain districts.

The *Hippelates* eye gnats are, or are becoming, a problem in several southern California communities. A great deal of research on the biology, control, and attractants is needed before any appreciable reduction of populations is expected.

Now, coming to the problem of mosquito larvicides and resistance to insecticides, it can be said that resistance to insecticides is not a new phenomenon, but its occurrence has been much more frequent since the advent of organic insecticides. The names of five or ten pest arthropods which develop resistance to some sort of pesticides are added each year to the list.

As you remember, Dr. Simmons, in his presentation two days ago, cited and named thirteen or foruteen species of mosquitoes that have become resistant to chlorinated hydrocarbons throughout the world. It is the occurence of this phenomenon that forced WHO and the Health Division of the International Cooperation Administration, and local governmental agencies, to speed up malaria eradication programs before the problem of resistance becomes widespread in mosquitoes.

Now, in Riverside, in the past six years the Department of Entomology has evaluated the toxicity of approximately four thousand new organic compounds to *Culex quinquefasciatus*. These materials represent preselected compounds which have in general shown some sort of insecticidal properties and have been obtained from industrial sources throughout the United States and Europe.

Of the four thousand selected compounds, 248, or 6.2 per cent killed larvae at one part per million. At 0.1 parts per million only 66, or 1.6 per cent, were effective. At 0.01 parts per million only 7, or 0.17 per cent, killed the larvae. Two compounds, or 0.05 per cent, wer toxic at 0.001 parts per million.

This illustrates the difficulty in finding new material with high larvicidal activities.

Since resistance already exists to the broad group of chlorinated hydrocarbon compounds, the breakdown into chemical groups is also of interest.

I have charted this pretty quickly on the blackboard here, and some of you in the rear may not be able to see it, but I will go over this chart.

Here in the left column the toxicants are charted at one part per million, 0.1 P.P.M., 0.01 P.P.M., and 0.001 p.p.m.; and under the other columns the number of compounds are given which are active at the indicated dosages against the larvae.

Organic phosphorus compounds, as you know, at one part per million include the largest number—99—as compared to the chlorinated hydrocarbons—44. Of the other types of compounds, there were only 25 of them that killed the larvae at one part per million.

At 0.1 p.p.m. there were 59 of the organic phosphorus compounds and seven of the chlorinated hydrocarbons, and there were none of the other groups. At 0.01 p.p.m. there were only four organic phosphates and three of the chlorinated and at 0.001 p.p.m. there were only two of the organic phosphate compounds and none of the chlorinated hydrocarbons.

None of these compounds are manufactured on any large or industrial scale. These are only experimental compounds, the chemical nature of which is not publicly known.

This clearly indicates that the organic phosphorous compounds are preponderant and most active. Should resistance develop to this class of material as to the chlorinated hydrocarbons, there would be few, if any, highly active larvicides to fall back on. Therefore, it is highly important to establish:

1. New groups of highly active larvicides from compounds which have widely different modes of action from phosphorus compounds and the various chlorinated hydrocarbons;

2. The cross resistance of the hydrocarbon resistant species to phosphorus compounds and other new types;

3. Whether any resistance to organic phosphorous compounds is general throughout the group and specific for certain compounds;

4. The practicality of alternate treatments with compounds of differing mode of action in preventing the development of resistance, the practicality of use for field mosquito control of some of the more promising of the new compounds which have been screened.

This can tell us that the next hope that we have for effective larvicides will be in the group of organic phosphorus compounds. But our knowledge of the nature of resistance whether of a general type or specific is very limited. In other words, further studies are needed to determine the nature of resistance and cross resistance in these different classes of compounds and then find out what is the effective way to manipulate these different classes of compounds to avoid the development of resistance.

I think that is all I have as far as the resistance goes, and I am sure you will hear from the other members of the panel on the occurrence of resistance in mosquitoes against some of the organic phosphorous compounds. Let us have our fingers crossed.

Mr. Geib: Thank you, Dr. Mulla. I would like to suggest that when a speaker finishes, if there are any questions, why, it might be better to ask them at that time rather than to attempt to go through the entire panel first.

Is there anyone who would care to ask questions at this time?

DISCUSSION

Dr. Murray: What larvae did you use in testing there?

Dr. Mulla: You mean what species?

Dr. Murray: Yes.

Dr. Mulla: Culex quinquefasciatus.

Dr. Murray: So far as you know, non-resistant?

Dr. Mulla: Yes, this is a non-resistant strain.

Mr. Gjullin (Corvallis, Oregon): Have any of those been field tested yet?

Dr. Mulla: No, none of those compounds have been field tested, and we see an urgent need for field tests and trials to further evaluate these compounds under field conditions.

Dr. Murray: One other question I would like to ask you is where would parathion and dieldrin fit in that picture of parts per million? I mean compounds we know.

Dr. Mulla: I don't know about dieldrin, but parathion will range in the .01 parts per million, I think.

Mr. Geib: No further questions? If not, we will ask Mr. Gaines Eddy to report on viewpoints from the USDA at Corvallis, Orgeon, with respect to the problems that we are confronted with and the work that they are doing, the avenues of investigation that they may be following.

Mr. Eddy.

Mr. Eddy: Thank you, Art.

Members of the California Mosquito Control Association: On the program you will note that Dr. A. W. Lindquist is listed instead of myself. He unfortunately had to leave a little early and did not have a formal paper written out. So last night I jotted down a few points that will give you some idea of the trend in which we are thinking.

I would first like to go back and give to you an overall picture which is similar to what was more or less indicated in Dr. Lindquist's previous talk. That is the control of mosquitoes not from insecticides alone, but rather from "an attack on all fronts."

Mosquito control is to me and to a lot of us like building a highway, a house, or a railroad. You need lots of different tools; all of them good and all of them sharp. The investigation of materials as insecticides represents just one phase of our work. A portion of this we might classify as mosquito larvicides.

Dr. Lindquist yesterday mentioned that the group at our Orlando, Florida, laboratory is screening in the neighborhood of a thousand new materials each year, some coming from industry, some from our own insecticide research groups.

A lot of you are familiar with our Mr. Gjullin's work an adulticides here. We have done quite a bit in our own laboratory on the effective materials against adults. Another phase of our work has been strictly on repellents, although a lot of them are actually insecticides.

But another phase, a No. 3 phase we might say, has been our research that has been underway now for several months on attractants. To me, attractants offer one of the greatest possibilities of insect control, regardless of whether it is mosquitoes or not. Even populations have been wiped out by their use. When I speak of attractants I am thinking more of chemical attractants. We were discussing last night, for instance, that we have several potent insecticides at the present. I believe that in themselves, these would be fine for control or as additives to attractants, provided we had materials that were sufficiently attractive in the first place. So that phase is being attacked.

Although our biological studies have not been too extensive, we have more planned this year. We did some in Oregon last year, and hope that we can do a little more in the future.

There is another phase which Dr. Mulla mentioned that we are also investigating. Not only is our group involved, but research groups all over the country. This phase might be classified as studies on the "mechanism of resistance." Herein lies probably the clue, if we could find it, to the answer one the best use of insecticides for overcoming resistance. If someone would come up with the answer on that, on just how and why insects develop resistance, then the solution might be a very simple and easy one.

This year we have run through C^{14} labeled allethrin and P^{32} labeled Bayer L 13/59 (Dipterex) in house flies, and this coming year we will be working with a labeled material involving DDT-resistant *tarsalis* with the hope of throwing some light on the mechanism of resistance from that standpoint. The studies are mostly on the mode of action, absorption, metabolism, and general excretion of the materials in the insect itself.

Another phase in our attack on mosquitoes has been our work on sterilization through the use of gamma rays. In Florida they have worked with *quadrimaculatus,* using cobalt 60 source. Although that work does not look too promising so far, it does not mean at all that it might not work on *tarsalis,* or even some other species of mosquitoes. Although it might not be exactly practical in California, it certainly might have a place

in certain parts of the world. Certainly it needs a little further investigation from that end.

We know that that type of attack can work because some of you know that our organization at least is "bragging" that they have eradicated the screw-worm from the island of Curacao. You might say bragging when you use the word eradication, because that is a big term, a very big one. Eradication was accomplished through the release of sterilized males, or males sterilized by gamma rays.

Another phase we are getting into is research on the use of growth regulators or inhibitors; in other words, work with hormones and similar materials. There have been published accounts, as you all know, that certain materials would prevent the growth of the insects when applied in the larval stage or in the pupa stage by preventing their transformation into adults. That phase is now under scrutiny.

Getting back now to the place of insecticides, what is available today? Well, that deepnds on where you sit. As everybody knows, in the more northern areas they are still getting along fine with some of the chlorinated insecticides, but in the deep South, in Florida, they are not doing so well, as all of you know. In Oregon, for instance, my old stomping grounds, we are doing fine with DDT, except in one or two little places. I don't think I need to say anything about California. I think everyone knows what the situation is here.

But I like to look at the resistance problem from an optimistic side. I don't think the research at Riverside or any place else has indicated in the laboratory or the field that very high resistance to mosquitoes has developed in the case of parathion, although this could happen. I hold the view that there are probably lots of compounds, organic phosphorus compounds, to which *tarsalis* may have little ability to develop resistance. There are lots of new materials. I think, of course, that if we concluded that all these were exactly alike from the standpoint of resistance development, it would certainly be a very hazardous conclusion.

You can take the insecticide pyrethrum. You know that resistance of mosquitoes to this material even way back when they used it for many, many years as a mosquito larvicide, didn't develop too much, as far as I know, in comparison to what has happened today with other materials.

The chlorinated insecticides are really characteristic in themselves. I still think we have much hope in lots of the phosphorus group or in several unrelated materials, as was pointed out by a previous speaker.

One group that some of you heard Dr. Lindquist talk about that looks rather promising was the chrysanthemumic acid derivatives. I am not a chemist but, as I recall, the structure of that group is similar to pyrethrins; and resistance to those types should not develop as quickly. We know also, in another phase of the problem, that in regard to the use of additives or materials that synergize or boost up the activity, that the chrysanthemumic acid group is susceptible. A lot of you know, too, that quite a number of phosphorous compounds are also susceptible to synergism. It may be that the use of these materials in combination with some of the phosphorous compounds will actually prevent development of resistance. Also, some of you heard Dr. Simmons mention that in some of their field work with combinations of phosphorus plus chlorinated hydrocarbons that they had better control than with those materials individually.

The use of combinations of materials, especially in the phosphorus or chrysanthemumic acid group, would, I think, give us an entirely different complex of physiological actions, the type of modes of action that might be entirely different from those of the chlorinated insecticides. So I think there is probably hope from this standpoint.

The hundreds of new compounds being synthesized and investigated all over the world leads me to the optimistic attitude that as an entomologist I think that the resistant problem certainly is not going to get out of hand. I believe there was a note or two sounded already that indicated that we may be going back to the use of pyrethrum larvicides in some areas.

I would like to leave one thought as far as our group is concerned. We are striving to go forward—not backward—and we hope that we can get there. I would hate to admit, being an entomologist, that I would have to go backward instead of forward. So I think with all these different modes of attack, that is, an "attack on all fronts," including the insecticides, that we can go forward instead of backward. I sort of hope, Art, that such will come to pass anyway.

That is about all I have.

Mr. Geib: Thank you. I think we might have made a mistake. It seems to me it would have been more appropriate to have you last on the panel where you were most encouraging, as far as I am concerned. I am very happy to hear some of the comments you have been making.

I suspect that there are others in the group who feel the same as I do; also that perhaps you have stimulated a few questions. Is there anyone who would like to ask Mr. Eddy any questions at this time?

DISCUSSION

Question: Is there any place where resistance to organic phosphates has been recorded?

Mr. Isaak: Yes, very much so. In many locations in California we have it. There is one location that has been recorded for malathion, and just this past season.

Mr. Geib: Any further questions?

(No resonse.)

I think we are fortunate in having Dr. Charles Pursing here to approach this problem from the viewpoint of the commercial man; to point out to us some of the problems that are involved in development and production of insecticides.

Dr. Pursing: You caught me unaware, I thought I was going to be cleanup man on this panel.

Fellows, I must confess that I don't know one mosquito from the other and, furthermore, I don't know an awful lot about mosquito control. But I would like to talk about pest control, because I believe that your business is very closely tied in with the entire problem of insect control, and I would rather stick to that subject.

This panel question—Where do we go from here?—five or ten years ago would have been a really wonderful opening for a joke, but I don't see any of you fellows laughing and I don't feel like telling a joke because I think we are all very much concerned about where we are going.

Actually, fellows, I can't speak for industry because there is really no one opinion in this industry. I have talked to many industry people, and they all have different ideas. So I can only talk about what I think myself, and frankly I am an optimist.

I have been in pesticide research twenty years and I would have to be an optimist to stay with it that long, and I am very optimistic about the future of mosquito control and pest control in general. In my opinion we are going to make greater strides in the next ten years than we have in the last. Our contribution as an industry, naturally, is going to be from the development of new insecticides.

We all have our problems, as Art Geib has indicated, and as a member of a profit making organization I have my problems, and any industry man has his problems. The most important problem is simply trying to show a profit because we might as well face it—industry isn't in business for the advancement of science. They are trying to make money, and there is nothing wrong with that in our society because we are in a free enterprise economy.

Our problem is related simply to high costs of development and the length of life of the materials which we develop.

First, the high costs of development have been a subject for conversation for many years. There has been much said about industry's cost in developing new materials. It may be interesting for you to know that I was one of the first to have given a talk on this subject that received national publicity. I gave such a talk in 1951 before the Pest Control Officials' Association in Washington, D. C.

Now, at that time I made a real study of how much it cost to develop a new material by asking practically every leader in industry about it. I figured every angle, even attorneys' fees to protect the compounds with patents, and I came up with the figure of 250 thousand dollars as representing the average cost of putting a new insecticide on the market.

Some of the fellows in the audience thought, "Well, this guy's giving us a line. He's trying to exaggerate."

Actually, I was very seriously criticized by a lot of the people in industry because they considered that the figure was too low. However, I did tell the pest control officials at that time that one company had spent a million and a half dollars developing a compound before they sold a pound of a certain new pesticide and another company had spent four hundred thousand dollars.

You all know what has happened to prices since 1951. They certainly have gone up. Personnel costs have gone up. My salary has gone up a little; but not very much. My expense account has gone up more than my salarly, actually. (Laughter) And the costs of equipment has tremendously increased in the last five years. That, of course, is contributing much to our high costs.

Another important factor is the regulation, which we admit is necessary, in Washington. That is, the requirements of the Food and Drug Administration and Pesticide Regulation Officials. They make it a little tough these days to sell materials. And we have the Miller Amendment now, which is the law, and it is a very good law, but it is new.

We don't have any criticism of the officials. The only criticism I have heard is that they are doing their job maybe too well, and we certainly cannot criticize them for that because we would be doing the same thing if we were in the Food and Drug Administration, but it has increased the costs of developing new materials.

The life expectancy of a new pesticide could be discussed much better by others on the panel. The incidence of resistance, I think, is increasing, which is a big factor limiting the life expectancy of a new pesticide.

Also there is this matter of competition. We bring a material out on the market and before long somebody has a better one and then our material is out of business. We would like to get our money back, in other words.

Another thing industry faces right now is this tight money policy of the government. You may not realize it, but it does affect our research and development budgets. Our companies are taking a very close look at all of our expenditures, including research and development.

Another factor is the present financial condition of the chemical industry. Any of you who play the stock market know that chemical stocks are off and earnings are off in the chemical industry. I don't care what company it is, their earnings are down. That has been another factor, and it has been a little tough to get money out of management for research.

But, gentlemen, in spite of this we are expanding in our pest control research; there is no doubt about it. The best evidence is, and you fellows know, that there are more new materials coming out today than ever before. This surely indicates that there is an acceleration in the development of pesticides.

We have seen several notices in the papers lately of increased expenditures of industry for pesticide research. One company is spending a million dollars in California for agricultural chemical research facilities, and several companies in the East are spending more than that. I can say that our own pesticide research budget has been increased substantially this year over last year, so we are not really too discouraged by high costs and life expectancy of these materials because there is still a good possibility of making good profits. In my opinion, the leaders of industry look on pest control as a sound investment, and I believe they will for some time. It will take greater adversities than we have had in the last ten years to change their opinion.

Another encouraging factor is European research. You all must know that most of our pesticide developments in the new organics have come out of the laboratories of Europe.

I recently visited practically every large pesticide research laboratory in Europe, and I know why that has come about because it is absolutely tremendous, the work that they are doing. It is absolutely tremendous the work that is being done, particularly in Germany, in the development of new materials, and we look forward to many materials coming in from Europe to bail us out in case we don't have enough of our own.

I haven't gotten around to saying where do we go from here and I was going to say a little bit about fundamental research.

With regard to fundamental research in biology, we are all for it. We are supporting it financially in the universities, and we think that it is the ultimate answer to our problems. Maybe twenty-five or fifty years from now it will pay off.

What I am most interested in and concerned about—and I think you are too – is what is going to happen next year and what will happen in 1959 and 1960. In my opinion we will proceed in the next few years just like we have in the past; come out with a lot of new chemicals, test them, and send them to university people like Dr. Mulla, to the USDA folks and to you people in mosquito control work for evaluation and development.

There are probably other ways that we can control insects, but I am interested primarily in chemicals. In my opinion, we should not all work on the same group of compounds. Somebody comes out with DDT, which is a chlorinated hydrocarbon, and everybody synthesizes chlorinated hydrocarbons like mad and comes out with hundreds of chlorinated hydrocarbons, and then insects become resistant to them and we are in trouble.

Somebody comes out with organic phosphates; everybody works like mad on organic phosphates. Then we get resistance to this group across the board, and where are we? I think we ought to be studying other compounds, and that is what we are trying to do in our laboratory. There must be other groups of compounds that have pesticide possibilities and we are looking for those. I think that the institutional research workers are doing the same thing.

Another thing, I hope that we don't throw away some of these materials that are not too spectacular. Many of our investigators today are looking too diligently for the spectacular. They want those compounds that kill 100% at .00%, but maybe there are some compounds that are good at .01%. We must develop some of these others in order to have a stock pile when resistance develops.

I did want to say something about prices of new pesticides. When we bring out a new material you fellows think we are robbers because the price is so high. I would like to defend industry a little on that score. Industries try to get some of their money back on their new materials, even before they get into big production, and I haven't been able to sell my management on losing money on new materials. They don't really see the point, especially when a new material may last only two or three years.

As you know, first we make a compound in a glass vessel at the laboratory and then go out into a pilot plant and make, say, maybe a thousand pounds a week or a thousand pound a day. Some of those pilot plants cost as high as one hundred fifty to two hundred thousand dollars. In our business that is a research expenditure, and industry usually amortizes it over a three year period, so the customer is paying for very high cost equipment.

I just want to make a little plea not to be too critical of industry for charging too much for new materials.

Now, a little bit about this matter of competition. Ordinarily you think competition would reduce the cost of materials, but actually it doesn't always work out this way, because you have so many materials coming out now that maybe none of them will ever reach big volume because of competition from the others. The only reason we have low DDT prices today is because industry produces millions of pounds per year. The only way you get low cost in chemicals is through high volume production and if there are so many materials all will be produced in pilot plants, and that means they will all be higher cost materials. We, of course, as a company hope that we find the one that is going to put everybody else out of business, and then we will reduce our costs.

I will repeat that I am optimistic, and the reason I am optimistic is because fellows like you have created an interest in the public for pest control. We don't want to go back to the time when we didn't have mosquito control or when we didn't have house fly control and had to have wormy apples. I believe the public is willing to pay for it now, and I am confident that our investigators will come up with satisfactory controls and the public will buy them.

Thanks very much.

Mr. Geib: Thank you, Dr. Pursing.

Are there any questions that anyone would care to ask Dr. Pursing?

(No response.)

There are a couple I would like to ask at this time, and perhaps one of them might be directed to him or other members of the panel.

DISCUSSION

Mr. Geib: You speak of everyone working like mad on one family of compounds. I think we have all seen that, and I wonder what the situation is today concerning the development of new materials. Are we in that race right now? Is there much going on in the way of investigation of newer materials not in the phosphate group?

Would you care to answer that?

Dr. Pursing: The only ones I know about are the ones that we are working on, and we are working on all groups. Actually in a synthesis program and a development program in a large organization like ours we have a group of chemists that synthesize compounds that are tested for weed killers and tested for a number of industrial uses, and we test all of them, so we get a broad spectrum of compounds right across the board. Therefore, we have an opportunity to pick up compounds from other groups.

Mr. Eddy: Art, I would like to mention that in our group as put on the board over there, three of those five materials were not phosphorus compounds, as you might have noticed. In fact, during the past several years our group has screened hundreds, literally thousands, of materials and in fact almost any esters that appear under acids in the groups are all up and down the line, thousands and thousands of them, and many of those have not been evaluated, and they fall in the class Dr. Pursing mentioned, of materials that are not spectacular but materials that might well be picked off the shelf at some later date. In fact, they are coming out so rapidly and being prepared not only by industry, but even our own organization, to a point where we neither have the funds nor the personnel to get in the field or accept the spectacular type.

We have many thousands of them that might be well picked off at some later date if need be; so if we get a few more people to field test and a little more money, we can go back almost any day and pick off something; at least get you out of the hole for the moment.

Mr. Geib: Mir, would you care to make a comment with regard to that?

Dr. Mulla: I am not too familiar as to what compounds are screened. I talked about that by using the

blackboard, and I said I don't know the nature of those compounds, as to what they are. Of course they are organic phosphates and there are some other compounds, but, as you can see, there is not much hope for mosquitoes in these other groups. But this doesn't mean we should not look forward or keep investigating these other classes of compounds. Gaines mentioned these chrysanthemumic acids. I don't know how expensive they are, but I assume the cost per acre would be quite high as compared with organic phosphates. I don't know; probably Dr. Pursing would know.

Mr. Ecke (Santa Clara County): I would like to ask how much evaluation is given to a new insecticide before it is turned loose to your advertisers. It is pretty easy to get testimony from a farmer or someone that a certain insecticide is good because it is spectacular, but how much actual research is going into evaluation and who does that research?

Mr. Geib: Would you care to answer that?

Dr. Pursing: Well, are you talking about our advertisers?

Mr. Ecke: I am speaking speaking generally.

Dr. Pursing: I was hoping you were. (Laughter)

Well, I think that the people in my position in industry would prefer that we didn't have very much advertising until it was pretty well proved out. I thing they do a good job, but every once in a while some compound gets loose and management may take a fling on it. They may want to promote it. I know of compounds that have been promoted by presidents of large corporations against the advise of the research department, so there are a few that get away.

Mr. Eddy: I might add just a word. Several of the companies that a lot of us know do have their own screening programs, and they are becoming more and more extensive in their efforts, and when they turn that compound loose even to our Federal or State organizations they know pretty well where it stands. They have a backlog of research. They have the regular screening with different insects involved.

I know we have recently gotten several materials which they have given us, brand new materials just out. They came about through their screening program.

Dr. Pursing: I can speak for our company, and I visited practically every lab in the country, and they have the general group of insects which they feel will cover the common species, and I don't think that a compound is sent out as a rule unless it looks exceptionally good. We never send a compound to anybody unless we think it really has a lot of possibilities because we don't want to swamp people like Mir over here with these materials because there are really thousands of them coming out.

Mr. Geib: I am curious about one thing, Dr. Pursing. Could you give us an estimate as to the time lag or period of time that is required to develop a material from the time it looks promising until it is really commercially available?

Dr. Pursing: Well, the formula in industry is seven years. That is what they figure; seven years from the time it is in the test tube until it is out being sold. I think it can be speeded up. I think we can do it faster than that. Of course it depends on the material, but it is at least five years.

Mr. Geib: That takes a lot of time.

Dr. Pursing, you mentioned what you were doing there at your laboratories. Would you care to elaborate on that a little at this time?

Dr. Pursing: I would like to invite any or all of you to come out and see our laboratory. It is not very far from here.

Mr. Geib: You had better tell them the address.

Dr. Pursing: It is on Fremont Road. I can't remember the address. (Laughter) Anyway, you go out Fremont Road until you almost get to Grant Road. It is at Fremont Road and Stevens Creek, where Stevens Creek crosses Fremont Road. If any of you come out we would really seriously like to show you around there.

Out there we have two departments. Really we have a biology department and we have an agronomy department, and we receive compounds from three synthesis laboratories. We don't do any of our organic synthesis at our laboratory; it is merely biological.

We have a lab in New York and one in Richmond, California, and one in Los Angeles. They send up these materials, and we screen them on insects or weeds or practically any use that might have an agricultural benefit. Our job is to evaluate, and we have houseflies. I can't remember all the species we have, but we think we have a representative group of insects. We are not screening on mosquitoes now, but we used to screen on mosquitoes.

Our modus operandi, you might say, is to take up these materials and then send them to a place like Citrus Experimental Station or Berkeley or Corvallis; someplace where we have a grant and support research there, we have a grant in aid.

They will take these compounds that show some promise in our tests and will screen them on specific pests that are in their area. We send a lot of materials down to Riverside, and I don't think any of us are in that really high group, but I hope that some of them may have been in what Mir has been talking about.

Our lab out here is not very large compared to what you would see in Europe. I visited the Bayer Laboratories in Europe, and it is absolutely stupendous. You just can't imagine how wonderful their labs are; and I visited the labs here. We don't have anything to compare with what you would see in Europe, even some of the companies that you have never heard of like BASF and Ludwigshaven. I had never heard of the companies and I visited them, and they apologized for how they only started two years ago on research in pest control. After profuse apologies they showed me one of the most beautiful setups I have seen in my life. It was a lot better than we have here, frankly.

If I had known I was going to say anything about our lab I would have been able to give it a better plug and could have brought you a movie, but maybe some other time.

Mr. Geib: We appreciate what you have done now. Dr. Pursing again is with the Stauffer Chemical Company.

Most of you are familiar with Lew Isaak and his work in screening and investigation of insecticides for mosquito control purposes, primarily as larvicides. He has been doing that work for a number of years with the Bureau of Vector Control, State Health Department, out of their Fresno laboratory or field station. Lew is prepared to discuss some of the materials that he has been working with this past season, and he may go back

a little bit further than that. I believe he also has a few slides that he will show.

Mr. Isaak: I will discuss some other things before showing the slides so you can leave the projector over there.

This part of the discussion will be divided into three different parts; the first two have to do with aerosoling and resistance done in cooperation with C. M. Gjullin of the USDA; not only in cooperation with him, but under his direction. The third part will be involved with screening of new insecticides.

I might add here at this time that all three are going to be relatively short.

As most of you may recall, last year at this time, due to the heavy rains in the valley here and the record snow pack in the mountains, we had every reason to anticipate an extremely heavy *tarsalis* population in the central valley. To avert a possible encephalitis epidemic, especially in areas outside district control, it was within the province of the BVC operations to prevent adult *tarsalis* from reaching a dangerous level by utilizing what materials and equipment were readily available.

Although much aerosoling has been completed in the San Joaquin Valley during the past eight or nine years, there is very little factual information as to just how effective these aerosols are.

The insecticide we chose for aerosoling was malathion, and the equipment used were Todd Insecticide Applicators and venturi exhaust generators. Locations selected as test areas were in Fresno County where venturis were available through the Consolidated Mosquito Abatement District.

All arrangements were made for these tests, and we waited for the onslaught of *tarsalis* which, fortunately, never materialized. A cool dry spring and rapid seepage of excess surface water prevented *tarsalis* from ever reaching what might be considered a dangerous level. We felt, however, that obtaining factual information as to the effectiveness of the combination of malathion and diesel oil in aerosols would be of value, so we continued as planned.

Our first test was completed in Farmington, in San Joaquin County, a community of about two hundred, extending over an area of several square blocks. The aerosoling radius was between one quarter and one half mile around the center of the town and was completed with a five per cent solution of malathion in diesel oil applied at twenty gallons an hour, and the machines moved at about three miles per hour.

Operations were begun at 4:30 in the morning and were completed about 7:00 a.m. The temperature was in the fifties and the relative humidity from sixty to eighty-five.

The smoke settled beautifully in and around the buildings, the trees, and it appeared that if ever this particular combination of malathion and diesel oil was to work, this was the ideal situation. And yet results were very disappointing.

Two methods of count were utilized for determining results: New Jersey type light traps and aspirator collections of adults. On the basis of building collections, there was a reduction of fifty-four per cent of *tarsalis* and a sixty-two per cent reduction of *stigmatosoma* females. By light trap collections there was a thirty-three per cent reduction of *tarsalis* and no evident reduction in *Culex stigmatosoma*. A reduction of twenty-four per cent occurred in the *tarsalis* population in the check area. So on the basis of Abbott's formulation which accounts for natural mortality, the actual control was reduced from thirty-three per cent to twelve per cent.

It should be added, however, that in the opinion of C. M. Gjullin, who made the calculations, that the number of females collected in the test area was so small as to hardly consider this as a reliable index; that is, from the test area. A greater reduction of males than females occurred in both species in the test area.

Another test made in Farmington at a later date under like conditions netted a fourteen per cent reduction of *tarsalis* and five per cent of *stigmatosoma* females on the basis of building collections, while an increase in both *tarsalis* and *stigmatosoma* females occurred in the light traps after the aerosol application.

Through the cooperation of the San Joaquin Mosquito Abatement District, larviciding control measures were reduced in the Farmington area for a short period before aerosoling in order to allow the population to build up for the test. These breeding sites, which continued to produce during the post aerosol period, and the poor performance of one of the machines during this latter test may have contributed to the low percentage of control that was obtained. That was fourteen per cent on *tarsalis* and five per cent on *stigmatosoma*.

Oddly enough, the opinion of the population in that area was that the aerosoling did a fine job of cleaning out the mosquitoes. (Laughter)

We conducted two tests in Riverdale, Fresno County, with venturi exhaust generators and, after taking the count, we decided it was a waste of time. We could find no reduction in anything.

Malathion deposition and distribution in and on buildings and other objects in these two localities is now being determined by the Bureau of Adult Health. That is, we tacked strips of filter paper in the buildings, outside the buildings, on telephone posts and so on, just before aerosoling and collected them after the smoke disappeared. This information will be available in a future publication, but preliminary information indicates an extremely low deposition of malathion with these aerosol applications. So much for aerosoling.

Earlier in the season *tarsalis* larvae were collected from the Fresno area as there was really little else to do while waiting for the emergency to develop. After completing a few tests we decided that something was wrong with our stock solutions, so we threw them out and mixed up some more and started testing all over again. We found that it wasn't the stock solutions that were giving us the trouble, but actually the mosquitoes were showing far more resistance than we had ever thought possible.

The amount required for fifty and ninety per cent kill of fourth instar *tarsalis* was twenty-one and thirty-three times greater respectively than that required for an equal kill of larvae taken from outside the district. Moreover, these tests indicated that *tarsalis* are not resistant to parathion in this area, althought none has been used for larviciding in the Fresno area.

If the larvae were resistant, what about the adults? *Tarsalis* adults reared from larvae collected from the area were also checked for resistance. Acetone solutions of malathion were evaporated in petri dishes

Toxicity ranges of some new insecticides in comparison with malathion using colony-reared *Culex quinquefasciatus* fourth instar larvae.

	Parts Per Million														Approximate P.P.M.			
															LD_{50}	LD_{90}	LD_{50}	LD_{90}
	1.	.5	.3	.2	.15	.1	.08	.07	.06	.05	.04	.03	.02	.015				
	1-1 mil	1-2	1-3.3	1-5	1-6.7	1-10	1-12.5	1-14.2	1-16.7	1-20	1-25	1-33	1-50	1-67				
Thimet	-----	-----	-----	-----	-----	-----	-----	100	99	92	-----	83	59	43	1-57	1-21	.018	.048
Guthion	-----	-----	-----	-----	-----	-----	-----	-----	100	87	-----	61	31	-----	1-37	1-19	.027	.052
DDVP	-----	-----	-----	-----	-----	100	92	79	-----	38	15	-----	-----	-----	1-17	1-13	.059	.077
ET-14	-----	-----	-----	-----	-----	99	70	-----	65	42	-----	-----	-----	-----	1-17	1-11	.059	.091
Phosdrin	-----	-----	-----	100	-----	96	66	58	27	-----	-----	-----	-----	-----	1-14	1-8	.071	.13
Thiodan	-----	-----	100	99	-----	81	-----	45	-----	18	-----	-----	-----	-----	1-13	1-7	.077	.14
Malathion	-----	-----	100	85	58	30	-----	-----	-----	-----	-----	-----	-----	-----	1-8	1-4.5	.13	.22
Trithion	-----	100	-----	90	68	48	-----	-----	-----	-----	-----	-----	-----	-----	1-10	1-4	.1	.25
1240	92	73	36	17	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1-3	1-1	.33	1.

NOTE: Two hundred larvae were utilized to check each dilution in ten separate glass containers. All tests were run at room temperature which varied between 68-70° F.

and allowed to dry for twenty-four hours before using. From ten to fifteen females were exposed in each dish for ninety minutes at eighty degrees Fahrenheit, then transferred to clean cages, and mortality was determined after twenty-four hours. The amount of malathion residue required for an estimated LD 50 and LD 90 was ninety-three and one hundred times greater, respectively, than for the females collected from the untreated areas.

Resistance tests of larvae and adults were completed in the Kern district also, but we found that no resistance was evident in either *Culex tarsalis* or*Aedes nigromaculis* to parathion or malathion, even though phosphates have been used exclusively in that district for the past five years.

Now a little something about new insecticides.

All testing was completed with colony-reared fourth instar *Culex quinquefasciatus* larvae, the same, I belive, as Dr. Mulla has at Riverside. Two hundred larvae were utilized to check each dilution in ten separate glass containers. All tests were run at room temperature which varied between sixty-eight and seventy degrees Fahrenheit.

Now may we have the first slide, please.

This is guthion, one of the Bayer new materials. You see here that it isn't as spectacular as parathion, and yet it is a very good larvicide. This one exhibits one hundred per cent kill up to a .06 p.p.m. Actually it is about ten times less effective than parathion in laboratory screenings.

Let's have the next slide, please.

This is a field testing. As I said, parathion looked like it was about ten times more effective in laboratories than in field testing.

We completed eight blocks of seventy-five thousandths pounds per acre. In every case we got one hundred per cent kill in that variety of species. Even down at fifty thousandths pounds per acre we got ninety-nine per cent kill, and I think there were one or two places out of those where I found one or two larvae, so you see it is very effective.

Unfortunately it is still quite expensive. Even though you can use it at about one-fifth as much as malathion, it will cost just about the same right now.

May we have the next slide, please.

This is Dow's ET 14, which is a pretty good material also; one to ten rating, or .01 part per million exhibited nine per cent kill. The toxicity is very low, something around twenty-five hundred milligrams per kilogram, which is even less toxic than malathion.

Thimet is American Cyanamid's new compound. It looks pretty good. I expected to field test it this year, but made the mistake of placing it on the loading platform there in Fresno expecting to take it out in the field. The sun got pretty hot, the bottle was full, and it exploded.

It has a very distinctive and persistent odor, so persistent and so distinctive that Earl Mortenson got a shotgun out and was going to kill the skunk under the building. (Laughter)

Next slide, please.

This is Shell Oil's 2046, a little bit less toxic to mosquito larvae. Mammalian toxicity is quite high. I haven't field checked it yet.

May I have the next slide.

Thiodan is one out of Germany also, I believe, and it is distributed here by Niagara. This is a very interesting compound in that it is almost as effective on pupae as it is on larvae. This is very unusual. With this unique quality, Thiodan may play a very important part in mosquito control in the future. If oil can't be used in certain places and a pupicide is needed; something like this material might come in very handy. Toxicity, I believe, runs between 90 and 177 parts or milligrams per kilogram so it would be fairly safe to use.

Here are these materials in comparison on the basis of an LD 90. This is grouping these materials rather loosely, but it places them in a definite category. Guthion with thimet are in one category, and then the next one is thiodan, ET 14 phosdrin, and Public Health Service DDVP are all pretty much the same. I put malathion in there just as a comparison. Dr. Pursing's 1303 would compare pretty well with malathion. He could probably give us a little bit on the mammalian toxity of that material.

Do you happen to have that?

Dr. Pursing: Well, it is very low on dermal and about twenty-five milligrams per kilogram on oral; twelve hundred milligrams per kilogram on dermal and twenty-five on oral.

Mr. Isaak: Thimet, the second of the group, is almost as toxic, or I should say as toxic, as parathion orally. Dermally it is much less; about ten times less.

The last one is Niagara's 1240. It is another one that is less spectacular, but it could develop into something a little better later on, depending on price and availability.

I don't have any lab information on 4124. I believe I gave it last year. It looked very good in the laboratory, one of the best ones we have tested, and yet in the field it apparently hydrolyzes much too rapidly for our methods of control.

DDVP also looks pretty good, and in field testing, on clear pasture water, it looks good at around fifteen hundredths, two tenths, a quarter of a pound per acre, but over at the Hanford Sewer Farm where the water was clear, but apparently heavily polluted with organic matter, it fell down quite badly. We got only about eighty per cent control at four tenths of a pound per acre with DDVP in that field.

That just about takes care of what I have to say, Art.

Mr. Geib: Thank you, Lew. The last comment there I think perhaps is one that needs a little bit of emphasis, and that is that those materials which have looked good in the lab don't necessarily prove to be satisfactory after you have taken them into the field. Lew has encountered that on numerous occasions, and I am sure others have also.

Are there any questions that you would like to ask now?

DISCUSSION

Mr. Buehler (Eugene, Oregon): When you made your tests with aerosol, was that in an area that was resistant to malathion, or was that an area where malathion hadn't been used before?

Mr. Isaak: Malathion had been used very little in the San Joaquin Valley district.

Maybe Leon Hall could give us more of a picture on that than I can.

Mr. Hall (Stockton): In the San Joaquin, that year was the first year that had seen any use of malathion in the field. In that particular area it was definitely limited. DDT had been used prior to that.

Another point on those tests that might be well to bring out is the fact that when they were made the adult populations had dropped considerably from a very high count to quite a low count; also that in a winery right in town, in a small town, which had been locked up and was supposedly not in use, we found a short time later that it was completely loaded with *stigmatosoma* larvae in the pits around the outside.

The people were elated over the results and it looked pretty good in the paper account. And I think there may be something to the fact that has been mentioned that maybe the mosquitoes themselves do not bite for a period of time after they have been affected by the insecticide, even though they may live.

They were quite sincere, and of course, it served for good public relations. Those problems kind of cleared up. We hope there is not going to be more tests in that area until we further evaluate the conditions.

Mr. Geib: Any other questions?

Dr. Mulla: I have one question to address to Mr. Eddy, Sir. You said that you do not believe that there will be development of resistance to parathion. That is a pretty broad statement, in my opinion, and we know of instances of other insects resistant to parathion; more than one, more than two, more than three instances. I would like to know what evidence you have and on what basis this statement was made.

Mr. Eddy: As I recall, I think maybe you got the wrong impression or I left the wrong one. I was only quoting from your own word and the evidence as to all the number of generations that had been run through down at the Riverside laboratory on parathion. In our own work, say, on EPN, like in using DDT, we could develop resistance rather rapidly in other insects or *tarsalis*, but the evidence shows at least that development of resistance would be less quickly established than with DDT; but that it would not develop with parathion or any other insecticide, repellant, or anything you had, would be hazardous certainly to conclude.

I am sorry I left that impression. I said that on the evidence Riverside had, they didn't prove it in the laboratory. It hasn't been proven either in the laboratory or in the field, but that it might not start tomorrow. It might well do so.

Dr. Mulla: I got the wrong impression. I am sorry.

Mr. Eddy: I am sorry I left that impression.

Dr. Mulla: I think some of the other people got the same kind of impression. I wanted to clarify the situation.

Mr. Isaak's evidence showed that he has gotten a strong resistance to malathion, which is again phosphate and pretty closely related to parathion.

Mr. Eddy: I was familiar with that work.

I might mention one thing on that while I am on the floor in connection with Shell Oil 2046 which, in a lot of areas, you would not be using that material where fish are concerned. But this past year we had an occasion to use some of these materials on irrigation work that would get back into the streams where trout were. Of course, that is snow water that is running around forty-five or forty-six degrees, but that material in our preliminary tests indicated that we could kill the fish quicker than we could kill *tarsalis*.

Mr. Grant: For several years I have been wondering about where and why the term "resistance" was utilized in preference to "tolerance levels." "Tolerance levels" has been used for so many years in bacteriology and many places that it is probably a little more expressive in some ways of the actual situation.

After having worked for a few years in bacteriology and to come back after the war to find resistance meaning practically the same thing, well, it fooled me. Normally, I had thought of resistance as being to diseases by plants and animals and so forth more than with the physiological breakdown and tolerance in referring to insecticides in entomological work.

Mr. Geib: Does anyone care to answer that?

Mr. Isaak: I think most people will agree with you on that, Don but when we want to do anything about it, it takes an extra big step. I think it is a better term and a clearer term.

Mr. Geib: We might take time for one more question if anyone has anything.

Mr. Owings (Durham): We are highly criticized on the actual getting rid of mosquitoes around the residential district. That seems to be the big payoff. I would be interested in finding out what a person could do around a residence to actually show the taxpayer that he is getting his money's worth.

Mr. Geib: Lew, perhaps you would be in a good position. (Laughter)

Mr. De Nevi: May I answer that? From a practical standpoint I don't know whether I can answer that correctly. But in our district, through the good graces of our manager, he saw fit to buy a used discarded tricycle, motorcycle; and very periodically, not only in our town, the City of Stockton and other towns in our area, we run around spraying sewers and so forth. They see the equipment around, and they know they are getting service, and I think that has a good public effect from the taxpayers' standpoint.

Mr. Geib: That is a common practice in many communities throughout California where mosquito control is carried on. Many districts carry on a continuing inspection and larviciding service in urban areas which takes care of the immediate production of mosquitoes in the community—in and about the homes and buildings.

But that doesn't necessarily answer the problem of migrating mosquitoes coming from beyond the urban area and moving into the city, so what to do about those, I think is a moot question, particularly in light of the evidence that Mr. Isaak presented. Aerosols were not too effective, at least in the two tests which were conducted this past season.

I don't know whether or not we have summarized and found out where we go from here in this panel at all. I personally feel that there are still those three types of individuals in this group; those who are a little pessimistic about what the immediate prospects for effective new insecticides may be; those who are not particularly concerned; and those who are optimistic.

I would like to express my gratitude and thanks to the members of this panel for their participation here today.

Thank you.

(Applause)

President Greenfield: Thank you, Mr. Geib, and members of the panel.

We have a fifteen-minute coffee break. I am sure you can be back here by 11:00 o'clock.

(Short recess.)

President Greenfield: I would like to remark at this time that I want to thank the Utah contingent here for their appearance at the Conference.

Where is Bob Vannote? Bob, we certainly appreciate your attendance here.

Where is Otto McFeely? Oh, yes. Otto, we are very happy to see you again this year in attendance at the Conference.

Mr. McFeely: I am very happy to be here.

President Greenfield: I hope I haven't missed anyone. Of course, you know Milt Buehler from Oregon.

At this time I would like to turn the rest of the program over to our Vice President, Bob Portman.

Bob, will you come up and initiate the proceedings?

(Applause)

Vice President Portman: At this time I would like to ask Dick Peters to come up here and introduce our next speaker.

Mr. Peters: Mr. Vice President and Members of the CMCA: I mentioned to you yesterday in the Business Meeting that we would be privileged to have with us today someone who can dispel the uncertainties pertaining to surplus property in the civil defense program.

We have with us today General Van Wyk, who is the Chief of the Division of Supplies and Transportation for the California Disaster Office at Sacramento. General Van Wyk has been very nice to accommodate us despite a very complicated daily schedule by arranging to come here. We ask your indulgence in fitting him into the program at this time.

General Van Wyk, will you address the group and subject yourself to the questioning which undoubtedly will follow.

PROCUREMENT OF SURPLUS EQUIPMENT FOR CIVIL DEFENSE

General Harry Van Wyk
Chief, Division of Supplies and Transportation
California Disaster Office
Sacramento, California

General Van Wyk: Thank you very much.

I think I can tell you in a very short time how you may be able to benefit from the new program on surplus property so far as civil defense is concerned. We have had several inquiries, and apparently there is some misunderstanding on the part of all of us on just how this works.

Congressed passed last year, as you know, an amendment to Public Law 655 which makes accredited civil defense organizations eligible to receive surplus Federal property in the same manner that schools and medical facilities heretofore have been privileged to participate in this program.

There are a few restrictions which have been added to the civil defense aspect of the law, and one is that surplus property may be donated to only official civil defense organizations. In California that means property must be donated either to the State, a county or an incorporated city. The California Disaster Law provides that only counties and cities may become accredited by the Disaster Council after they have complied with certain rules and regulations.

That provision automatically prohibits the donation of surplus property to a mosquito abatement district or a fire district or a school district or any other similar legal entities. It does not, however, prohibit such legal entities as yours from benefiting from the program insofar as civil defense missions are concerned.

If your organization is officially affiliated with an accredited civil defense organization, then that organization may apply for surplus property to turn over to you in the performance of your civil defense mission.

The law is designed to assist every group that is working in civil defense to more efficiently and properly perform its civil defense mission. It isn't designed to permit states or counties or cities or districts or any other group to acquire surplus property for their day to day operations. There is nothing in the law, however, which prohibits the use of acquired surplus property in day to day work, provided such use doesn't interfere with its civil defense essential mission.

If an agency acquires surplus property for a civil defense mission and it can be used in its day to day work without interfering with that ultimate use, there is no objection on the part of the State or the Federal Government. The State policy is that the best way to determine whether or not property is needed is to analyze the civil defense mission, determine what it takes to do that job, balance against that total requirement what you have, and what you don't have is what you need, and you are entitled to ask for it. There is no assurance you will get it because we don't know just what is available.

The surplus property program is tremendous. Over the past several years the Federal Government has declared over two billion dollars worth of property surplus to Federal needs, not all of which, of course, is suitable for your needs or anybody else's needs.

A large part of that dollar value includes war equipment – battleships and heavy bombers and what not – which nobody can use. But last year over two hundred million dollars of surplus property was acquired by schools and hospitals. Many of the things which they use, we can use, and a lot of things which they couldn't use we can use.

A lot of people say, "Well, where can I find out what is available?"

The State Surplus Agency has three warehouses which stockpile things which the State Surplus Property Officer has felt would be usable by schools and hospitals and, now, civil defense. The proper approach is not to go there and see what he has. The proper approach is to analyze your requirements, find out what you need that you don't have and ask for it. Normally what you need will not be immediately available.

The State Surplus Property Officer takes your stated requirements and his field men, in going all over the western part of the United States, and Alaska and Hawaii visiting surplus Federal stocks, look for what you want. When it is found, you are notified, given an opportunity to inspect it, and if it is something that

you need, which will fill your requirements, it is donated to you.

There is a small service and handling charge which amounts to about ten per cent of the fair value as determined by the State Surplus Property Officer, and that fair value is roughly half what the Government paid for it.

Everything that is donated is usable. Not all of it is new. A lot of it is new, but it is all usable. There is no junk there. No one has to accept anything that doesn't meet his needs. The service and handling charge amounts to about ten per cent of the fair value, includes delivery costs.

I am sure that there are many questions in the minds of some of you. Perhaps we could clarify the matter if you would ask questions.

DISCUSSION

Mr. Peters: General, at present there are three stations, are there not, in California through which procurement may be sought; Oakland, Sacramento and Los Angeles.

General Van Wyk: There are three. One is in Oakland, one in Sacramento and one in Los Angeles. The acquisition by these groups, however, in practically all cases would be through a county civil defense organization.

As I understand, your agencies work with the counties in some cases, and in other cases they extend beyond county boundaries. If you aren't affiliated with any one county and are interested in this program, your approach is through the state organization.

As you know – or you may not know – the State is divided into three regions: The southern part of the State with headquarters in Los Angeles is our Region One; our Region Two with headquarters in Berkeley covers the coastal counties from Kern County up to the border; and our Region Three with headquarters in Chico covers the rest of the State from Kern County up to the border.

I believe that your closest association and the assignment missions can best be done through the county organizations. Every county in the State is officially accredited by the California Disaster Office and may become eligible for surplus property. They would have to acquire the property and turn it over to you, as custodian. Title would have to remain with the county.

Mr. Whitten (Visalia): What is the status of this equipment when it is acquired by the district? Is it owned by the district?

General Van Wyk: Title goes to the county. The Federal Government donates it to the State. We in turn pass it on to the county because the county is accredited to our organization, but you wouldn't be.

Mr. Whitten: What would be the civil defense requirements of the district? In other words, how often would that equipment be available for other work except in a national emergency; I mean on a day to day basis, or I mean for anything other than that?

General Van Wyk: Well, as I pointed out, if you acquired a piece of equipment for performance of an assigned civil defense mission and its use in day to day operations would not interfere with its availability when an emergency arose, there would be no objection to its being used day by day.

Mr. Whitten: What about maintenance of this equipment? I mean does it have to be maintained in a certain operable condition?

General Van Wyk: The county, in acquiring it, must certify that it will maintain and account for it as with any other publicly owned property.

Mr. Brumbaugh: After you have made application how long do you have to wait before you will be able to receive some of this surplus property?

General Van Wyk: That depends a lot on what you are asking for. There is presently available certain types of equipment and supplies, some automotive equipment, hand tools, small tools, that can be picked up and taken home.

As I have tried to indicate, the State Surplus Property Officer has not acquired a lot of heavy equipment for schools and hospitals because there has been no requirement for it. We now have a big requirement for it.

The answer is: At no time can you walk in and take everything home with you. There are trucks and generators and shop tools and things like that in the warehouses today, but not tremendous amounts. Things which will turn over fairly rapidly are selected. Warehousing costs are high so slow moving items are not stockpiled.

It depends on what you are looking for as to how long it is going to take you to get it.

Mr. Brumbaugh: The reason I brought that up, sir, is that we applied for quite a bit of material, and that has been approximately six or seven weeks ago, and we understand there is perhaps red tape and other things occurring, and we are just trying to get the ball rolling.

General Van Wyk: To whom did you apply?

Mr. Brumbaugh: San Joaquin County, Ed Trau, civil defense.

General Van Wyk: I would check with Ed. I haven't seen his order form. We have delegated to our regional coordinators authority to approve these things. One of the requirements before we will grant approval is that the civil defense coordinator – in this case Ed Trau – must present a plan for the county in which he shows how your organization is affiliated with the county civil defense organization, what your assigned job is and how the equipment fits into that assigned mission.

I suspect that the reason you haven't gotten anything is because he hasn't complied with those requirements. I don't recall having Ed Trau's civil defense plan, so I think your question should be sent to Ed.

Mr. Murray: Do certain types of equipment depreciate so that eventually they are written off?

General Van Wyk: Yes. Again that depends on the type of equipment. There are some things which are considered expendable, and as they are used or worn out through use, you drop them. But we couldn't write a single hard and fast rule.

The State Surplus Property Officer has some restrictions which are imposed by the law. Anything that has a government acquisition cost of twenty-five hundred dollars has more strings on than does lesser valued things. But ultimately it can be wiped off.

Vice President Portman: To clarify, supposing a mosquito abatement district applied for and obtained equipment through the regular channels and had it on hand and was keeping and maintaining it. Other than

in a case of an emergency, is this equipment subject to recall at any time?

General Van Wyk: Yes. It is subject to recall for use in a disaster in some other area. For instance, if you had it in your county and there was a disaster in the southern part of the State, under the Mutual Aid Program Butte County is committed to supply available equipment.

Vice President Portman: That would be in case of disaster?

General Van Wyk: Yes.

Vice President Portman: The reason I asked that question was in this respect: If we obtain a piece of equipment and put it in operation where we have a day to day use, we may not have a replacement for that piece of equipment, and if somebody called on the phone and we got an order to furnish that piece of equipment for a few days other than in case of disaster—

General Van Wyk: It would only be to assist in a disaster in some other area.

Mr. Smith: I would like to know if we acquired a piece of equipment, who would pay for the handling of it; civil defense or our district?

General Van Wyk: Well, that would be something that you would have to work out with the civil defense organization with which you are affiliated. The State has no money. Now, if you were affiliated with a county and the county felt that the work you could do warranted county funds, fine. Otherwise you would pay for it. I should think you would have to have a pretty good understanding with the county: "Well, I paid for it. The title rests with you, but I am going to use it."

And that would have to be an understanding worked out between the officials of the two organizations.

Mr. Murray: How official does the arrangement have to be between the district and the county? Is a simple resolution by a board of trustees sufficient?

General Van Wyk: I don't think it would necessarily have to be a resolution; an understanding, whether it is formal or informal. We must have evidence that the district is affiliated with an accredited civil defense organization, and if it so states in their plan we don't interfere.

Mr. Brumbaugh: If you obtained a helicopter and you had it for perhaps two or three years and you discovered the maintenance cost was too high, is it permissible then to turn that piece of equipment in for another type of aircraft or, say, a tractor or some type on the open market?

General Van Wyk: You are getting into something I haven't explored too deeply. I know the State Surplus Property Officer is required to enter into the disposition of certain pieces of property that are donated. On others he doesn't care what you do with it after one year's time. On aircraft there are special regulations, and I am not too familiar with them.

Mr. Farrell, the State Service Officer, is in the process of publishing a bulletin which will clarify that, and it will be sent to all civil defense organizations.

Mr. Fields (Coquille, Oregon): On clarification of that, that falls into the category of twenty-five hundred dollars or more acquisition cost to the government. In the two-year period the title then rests with the county, and the county then can dispose as they see fit.

General Van Wyk: Rules are different, I think, for civil defense than schools and hospitals. If civil defense acquires a piece of property, keeps it for two years and then sells it, they can keep the money. Schools and hospitals have to turn the proceeds back to the Federal Government.

Mr. Kilber (Portland, Oregon): In our case we have a plane that works a little differently in that it is a Douglas A24. When we acquired that there was a stipulation that that plane, when we had no further use for it, must be returned to the government or proof given that it was completely demolished.

General Van Wyk: Did you acquire it through the surplus property?

Mr. Kilber: Well, yes.

General Van Wyk: Through the civil defense surplus?

Mr. Kilber: No, it wasn't civil defense, but it was through surplus property.

General Van Wyk: Was that through the Department of Agriculture?

Mr. Fields: Health Department.

General Van Wyk: Oh, I see.

Mr. Fields: That is Public Health, which holds for hospitals, schools and public health departments that when you no longer have use for it, it has to be turned back in. But through your civil defense, in the two year period the county then gains actual title and that is the property of the county at that time.

Mr. Whitten: Can the equipment acquired be adapted to a particular use? In other words, can you add or subtract from the physical part of the equipment, such as adding a tank or something to a vehicle for hauling diesel oil?

General Van Wyk: As long as you don't interfere with the purpose or interfere with its assigned mission. If it is acquired for spraying, say, and you want to add a tank, you are just improving it. As long as you don't alter it so it can't be used for the purpose for which it is acquired, you can do just about what you want.

General Van Wyk: If there are no other questions, thank you very much. I hope that we can be of help to you. Our only purpose for being in business is to try to help. If you have questions and you don't get the proper answer through your county, call on us and we will see if we can help you.

Thank you very much.

(Applause)

Mr. Peters: One last thing. Everybody must enroll through the local civil defense office, and that remains to be done. Don't forget that.

Vice President Portman: Thank you very much, General Van Wyk. I know you have given us information here which a lot of us have been in doubt about, and perhaps it will lead us on the road to future clarification in the use and participation in civil defense. They also call it "Disaster" now, I understand.

General Van Wyk: I hope we can get all of you to enroll in the disaster organization. We need you.

Thank you.

Vice President Portman: Now we come to a part of the program which I think we can say is quite interesting and intriguing. It taxes our ingenuity and makes us wonder; and it also many times frustrates us.

I would just like to point out a couple of highlights from the past which come to me at this time.

I believe it was somewhere in about 1946 when we had a CMCA group up at the Sutter-Yuba Mosquito

Abatement District to see that piece of equipment which nobody before had known anything about, the so called Raley's Plumbers Nightmare (vehicle, aerosol venturi). We watched an old surplus building all filled with smoke (aerosol), and we were quite impressed with it. Since that time, various districts, state and other organizations have conceived and put into being any number of pieces of different equipment; and each year each district undoubtedly, as it goes along, automatically reviews what equipment it has, sees new things and gets new ideas.

We have the pleasure of having some of that later and new equipment information presented to us, so I am going to call on Les Brumbaugh to come up here and take over.

MOSQUITO EQUIPMENT CONTROL PANEL

LESTER R. BRUMBAUGH, *Chairman*
Manager, San Joaquin Mosquito Abatement District

T. G. RALEY
Manager, Consolidated Mosquito Abatement District

THOMAS D. MULHERN
Associate Vector Control Specialist
Bureau of Vector Control
Department of Public Health

HOWARD R. GREENFIELD
Manager-Entomologist
Northern Salinas Valley Mosquito Abatement District

Mr. Brumbaugh: Thank you Bob Portman.

Members of the Association and guests: If you will notice the time, it happens to be 11:30 A.M. and according to the program, this meeting should adjourn by 12:00 noon. Undoubtedly, we will have to rush in order to cover this Equipment Program in such a short period. To do this, I will dispense with my part of the program in order to allow the other speakers their alloted time.

Before introducing our panel, there are a few items that perhaps should be discussed. There should be no question that equipment problems can make or break any mosquito control program. Just imagine what you would do if planes, machines, or tools were not available. Again, there should be no question that equipment and selection of equipment is a matter of great importance to all of us. When you consider the cost, the depreciation, and manpower necessary to operate such equipment, it would be safe to estimate that over 70% of our expenditures are made in this category. In California alone, this might have amounted to two million dollars spent during last year.

Since the annual equipment costs require such a sizeable portion of each agency's money and time, perhaps we should mention briefly just what we expect from equipment. A machine that is versatile and easy to operate, comfortable for the operator, and one that disperses materials uniformly over the area to be treated. Any machine or tool meeting these requirements should be what we are looking for. However, we must remember one point; no machine is any better than the operator, or we could say, no chemical is better than the applicator.

Since equipment is such a broad field, we have divided this subject into three categories: 1. Hand, power and aerosol units. 2. Heavy equipment. 3. Engineering and miscellaneous types of equipment.

Ted Raley will cover hand, power and aerosol units. This is really a big field. Ted is going to use slides since it is often said that "One picture is worth a million words." Gentlemen, I would like to have you meet Ted Raley, Manager of the Consolidated Mosquito Abatement District.

Mr. Raley: This is such a very broad subject we couldn't pretend to go into too much detail, and yet we do hope by the use of pictures to introduce the types of equipment in use in California and in turn ask for your comments on modifications that you have made of the particular type that we will show as we go along.

(Whereupon, Mr. Raley showed slides and described them.)

DISCUSSION

Mr. Raley: Are there any comments on new equipment in any other districts? Has anyone anything new and different to offer that we should drop by and look at in your district?

Mr. Grant: I have a question. I am wondering whether the district has used forced air jets on their mist blower?

Mr. Raley: Any of those who have worked with this machine, how far have your progressed?

Mr. Mulhern: I think the Merced District is probably the one that has worked in that field, and they have used the air atomizing nozzles in connection with the interchange on a couple of units, and they get very good results with that. The efficient operation involves a relatively tremendous volume of air, which is difficult to produce and therefore makes the machine pretty large and fairly costly so that it hasn't been used any more.

Mr. Grant: Do they use the supplementary air force for the initial atomization?

Mr. Mulhern: They use it for atomization in the operation of the spray nozzles.

Mr. Grant: Do you know anything about the relative volume of material which is put forth by such blowers?

Mr. Stivers: One gallon per minute on our own blowers.

Mr. Raley: Any other questions?

Dr. Mulla: I would like to mention about the broadcaster that was developed within the last five or six months in the University of California in cooperation with the Coachella Valley Mosquito Abatement District. We modified a broadcaster considerably, and the manufacturer accepted all the modifications and incorporated it in his standard piece of equipment. This broadcaster is used now by the district for gnats, larvicides, and granulated insecticides.

Any one of you that may be interested in distributing granulated insecticides might have a look at this piece of equipment that is manufactured right here in Los Banos by the Anderson Farm Equipment Company; or any one of you who may come down south can come to the district and have a look at the operation of this piece of equipment.

It gives a pretty wide swath, depending on your granules and on the speed of the motion. You can get a swath from thirteen feet to twenty feet. You use different granular measures.

Mr. Robinson: Is that operated by hand?

Dr. Mulla: It sucks air in and throws out the granules just with the air stream. You get a very uniform deposit.

Mr. Raley: I am sure many of us will be very interested. What is the name of the company?

Dr. Mulla: Anderson Equipment.

Mr. Raley: In Los Banos?

Dr. Mulla: Los Banos.

Mr. Brumbaugh: There is another that is available to put on the market. This broadcaster may be attached to the front of a jeep, and by means of a small, battery operated electric motor, will throw out the granulated material about thirty-five or forty feet.

Mr. Raley: Any other new equipment that you have been using?

Mr. Robinson: Ted, I would like to mention the two units we have out in back. One is mounted on a jeep, where the pump is on a clutch in front, and the other, an International with power takeoff for the pump from underneath. This gets away from the auxiliary motor. It works out very well.

Mr. Raley: I will close this with just the reminder that many commercial firms have exhibited at this Conference, and I am sure that all of you will take time to see the material that they have brought and, in turn, keep them in mind when you have needs in the fields that they do represent. I think these exhibitors are very important to the lifeblood of our Conference.

(Applause)

Mr. Brumbaugh: Thank you, Ted. Those comments were very enlightening.

We are going to move along very quickly and now call upon Tommy Mulhern to discuss equipment and measurements.

Tommy Mulhern.

Mr. Mulhern: I took a great deal of liberty with the title that appears on your program by agreement with our Chairman, because I thought that I could put forth a point of view by so doing that would be more valuable than that which was indicated by the original title.

Some of you saw the very excellent and entertaining film on water last night. That was produced by Pacific Gas & Electric Company, and in that there is a very fine sequence that shows the extent of effort and cost that a big commercial concern which is mostly interested in making money will go to in carrying out measurement procedure and in using some interesting measurement equipment from the standpoint of measuring the depth and the moisture contents of the snow in the mountains.

Now, this is an activity in big business; but we all, incidentally, happen to benefit substantially from those precipitation measurements which they are making. We have also at the present time been compiling some information about the extent of mosquito control over the country, and it is a far cry from the mosquito control of twenty-five years ago, and it has become what I think we could begin to call big business.

Within these United States we have records now from 187 agencies which are spending an annual budget of about twelve and a half million dollars and employing something on the order of thirty-five hundred men. I think that is big business.

Within our local program we have seen a great many improvements, not only in equipment, but in techniques. If we trace back those developments which have resulted in these improvements, we find that somewhere along the line there have been some measurements done which have indicated a need for improvement, and in the course of the improvement there is a step by step measurement always demanded. So although we very frequently think when we speak of measurements in mosquito control, we think of a light trap or someone out with a dipper taking some larvae.

As we look broadly at the field we find that measurement is something which exists in every phase of what we do, and how well and how precisely our measurements are conducted may very well determine how rapidly we will progress. Even before a program is formed there exists the need for measurements, the demand for a program, and this is something which is normally done by very crude equipment or very crude means

The demand will usually be represented by complaints of people who are being annoyed. People will go to a governing board or perhaps a citizens' organization and say, "We have trouble. We want to have something done about it."

Eventually this comes to the attention of some public agency who has a responsibility in this field, and that agency, or agencies, must attempt to gauge and measure that demand. Perhaps they come to the conclusion that this demand is a legitimate one, that the agency should find out just how great this problem is.

So they go into a survey – called a survey, but it is nothing more than a measurement technique. We use some mechanical devices in surveys of course. We also use some of these old tools, the mosquito dipper and the collection station; we use some other things, too.

We have to get into some engineering tools at this stage of the game if we are going to set down the results of these surveys so that we can predicate a control program. We will normally have to use some maps. There are some very nice maps available. I suppose the geological survey, perhaps, are probably the most widely used maps for this purpose. You can get them on convenient scales for any part of the country.

We have even had some instances where in coastal areas the U. S. Coastal and Geodetic Survey maps serve as very good base maps, because a lot of the areas that we are particularly interested in are represented on those maps.

Air maps, of course, give us very closely detailed data on the area interested in. The one thing which becomes important there is that we have to reduce all of these maps so we have some convenient scale to work with.

Not only mosquito people, but a good many other public agencies are interested in the details of topography and have found that the 1660 foot to the inch scale is used in following crop control limitations, which is used in California and our own section survey system, is a very convenient scale. It is large enough so that

the maps can have a detail we are interested in upon them and small enough so that we can easily scale the maps back and forth.

A tool which I see occasionally but not very often in mosquito districts which very much facilitates the transfer of measurements from one map to another is a proportional divider where you measure at one scale with one inch and you measure at a different scale with corresponding distance with the other end. This is a tool, I think, which should be in every district, from the standpoint of the mosquito larval survey.

The important thing in the new program – and it is also important in the old program – is to reduce the information to a standarized system so that year to year, program to program, area to area, we can compare this. This is a field where we need additional information which will allow us to sharpen our techniques. We have done the work; we need more.

When we get into the matter of the adult, from the standpoint of adult mosquito surveys, we have a lot of equipment being used. We get to the light trap in this field, and even the light trap which was devised as a standardized piece of equipment itself has had to be standardized, and we have had to devise and develop measurement equipment and measurement means to measure the effectiveness of this measurement instrument as standardization of standards.

In this connection I would refer to some very fine work that Mr. Ed Loomis of our organization has been doing in working up standardized wind tunnel type supplementary equipment which allows him to measure more precisely the mechanical performance of light traps than had been possible to do in the past. This was a measurement mainly of air-moving equipment.

We have one of our districts in the San Joaquin Valley that has recently equipped all of its bordering bases with a very convenient type of anemometer which allows them to determine what the wind velocity is at their headquarters, offices and their field stations, so that the manager or the airplane pilot, or whoever is about to go out and conduct an airplane spray program, can tell how fast the wind is blowing. He knows whether he can go out that morning and spray or whether he is going to have to hold off and maybe spray the next day.

This is a very cheap, small instrument. I believe it came from Sears-Roebuck at a price of about fifteen or twenty dollars. You put the effective element on the roof, and the gauge is on your office wall. This I recommend very heartily to mosquito people who have to do airplane spraying.

The other means of air measurement which we use are the anemometer and the velometer. The velometer is a tool which isn't too familiar to mosquito people, but it is a measuring device which has a very high range and which records the air velocity directly on a dial when you hold a little wand up in the air. It differs, of course, very decidedly from the anemometer in that the anemometer records actually an average wind velocity over a predetermined length of time, whereas the velometer measures the air velocity at any one instant.

I have here a number of items. I am going to try to pass some of them.

On engineering measurements, I think the engineering equipment is so well known that it requires very little attention here. I would only mention in this connection one very convenient reflective leveling instrument which is fairly recent and has wide distribution. It has the leveling bubble included and you see your straight line at the same time. It is light and small and, therefore, very convenient for mosquito abatement leveling work and therefore very advantageous. It does no better job than the older, more cumbersome but equally accurate instruments.

We have been talking about insecticides today, and we are putting a tremendous effort into insecticides. It has been our experience that although the chemistry has been very well done on developing many of these formulations, very often the operation falls down because of equipment, which may be mechanically very fine, has some lack of proper adjustment in its use so that the spray or mist which is delivered is not sufficient for the job to be done, and here is a place where we have a continuing need for a lot of calibration, a lot of measurement of what is coming out of our spray machines.

I had one mosquito manager show me machinery which was being used in his district, and although this machinery has initially been very carefully worked up and the man has been very carefully trained in its operation, some of the men, in order to do a more complete job of mosquito control, had, without authorization, modified some of these machines. So instead of putting out one gallon to the acre they were putting out eight gallons to the acre.

They weren't using phosphates, thank goodness.

So this type of measurement needs to be done very frequently.

Calibration. The particle size measurements are passed by very often because if we used some of the techniques we get into a very difficult time-consuming operation. But we have available a very simple means of getting an indication of what spray machines are putting out in the form of commercially available test papers which you lay out at predetermined distances. You add an additional chemical to the spray tank, and you get a permanent record indicating the size of the droplets and the distribution so that you can get this sufficiently accurate operational determination in just a few minutes.

It is a permanent record. It can be shown to the operator, and in many cases he will get from the use of this little bit of equipment an indication of why he is having troubles.

If we think in terms of source reduction for mosquito control, we immediately come into some more needs for measurement. We have to get some measurements of the land use. You had a demonstration here by John Harville. He showed what happened when land used in an agricultural situation was measured by the people who know how to measure the relative value. He was able to show the farmer that by spending a little more money, he got back a great deal more return, so that he was justified in spending the additional money which, incidentally, produced a situation which helped the mosquito control in that area.

In some of our most successful mosquito abatement programs here in California, managers have repeatedly

shown me that by measuring the effort which is being required to control mosquitoes on individual farms they can then present this data to the farmer. And the farmer, when he is shown that it is costing ten dollars an acre, let us say, to control mosquitoes on his property, and his taxes on that same property amount to a dollar an acre, or twenty cents an acre, it is a rather easy thing to convince him that he has an obligation to the district to do something about it.

This involves equipment in the form of records and detail forms which allow the compilation of this information so that it will readily be understandable.

I have here some items on shop emergency equipment. There are a number of them. I am going to pass them. We will have the record here, but the point again is that to successfully operate equipment, whether it be ordinary trucks or jeeps or spray equipment, you must provide your shop man with sufficiently good measurement equipment so that he can tell for sure, not just by opinion, whether or not that equipment is in adjustment so that it can do the job for which it was designed.

The last item that I have on this outline is an item which would call for measurement of the benefits of our programs, and I, for sure, cannot recommend here any easy-to-use equipment to do this. Here is a field where I think all of us can maybe contribute to providing the information which will allow us to more surely inform the people of the things which we are so certain of; that our work is progressing and that it is very well founded and that it is producing the results.

Thank you.

Mr. Brumbaugh: Thank you, Tom, for covering the measuring devices and in bringing out the different parts which we should know a little something about.

Our last speaker is going to cover heavy equipment, and that will be by none other than our good President, Howard Greenfield.

CONSTRUCTION EQUIPMENT USED IN SOURCE REDUCTION PROGRAMS

HOWARD R. GREENFIELD, *Manager-Entomologist*
Northern Salinas Valley Mosquito Abatement District

Historically, the use of heavy construction equipment had always figured prominently in the planning and operational programs conducted by mosquito control personnel. However, to one, such as myself, who had entered the field of mosquito control at approximately the same time as D.D.T., the use of earth moving equipment by abatement districts to control mosquitoes was truly a historical and absolescent theory. Certainly, chemical control would, if properly used, eliminate many species of insects considered to be pest or disease vectors.

In 1949, while attending my first Conference of California Mosquito Control Districts, which also included the American Mosquito Control Association in joint session, I had the opportunity and pleasure to meet and listen to men such as William B. Herms, Harold Gray, H. D. Peters, and many others of equal stature. Much to my amazement, however, I suddenly came to the realization that these men were questioning the miraculous powers of the chlorinated hydrocarbons to give adequate control, and were suggesting the return to the practices of those fundamental sanitation maxims as laid down by Sir Ronald Ross* in 1910. These postulates now are being incorporated into the Source Reduction Programs in many of the California Mosquito Abatement Districts.

I must state that I was reluctant to admit, in 1949, that these men were right, that chemical control, as such, was only a useful tool—an additional tool to be used in conjunction with other tools that had proven to be successful in controlling mosquitoes. Certainly, I believe we can all agree that, in the years that have passed since that Conference in 1949, we, in mosquito control in California, have seen more and more emphasis being placed on the integration of basic sanitation laws (source elimination) with our chemical control programs.

Now, if I may, I would like to present a few color slides which I hope will indicate to what extent construction equipment is being used by many of our local agencies. I might mention the fact that not all of the Districts own the equipment they use. Some of the Districts contract for the services required; some work on a co-operative basis, with the landowner paying part of the costs; some Districts only act as co-ordinating agencies, but all of the agencies use construction tools in one manner or another to effect their source reduction programs.

First Group: draglines, back-hoes (crawlers and floating dredger-type)

Second Group: tractors

Third Group: motor graders, pull graders, and ditching equipment

Fourth Group: scrapers, carry-alls, dump trucks, skip-loaders

Fifth Group: hauling equipment

Sixth Group: miscellaneous equipment

Seventh Group: typical projects for source reduction

These slides have been donated through a number of districts; Kern, Merced County, through Tommy Mulhern's extensive slide file, and through other mosquito abatement districts. I want to thank you gentlemen for the use of these slides.

We briefly mentioned our costs only on some of the heavier types of equipment. I have found in checking through with the various districts in the cost records which are kept that the heavy excavator type of equipment will run somewhere in the neighborhood of seven to eight dollars for operational charges as an hourly cost.

The scrapers and tractors that you will see in the second group of pictures will usually run between four and six dollars for an hourly charge.

(Whereupon, slides were shown and described by President Greenfield.)

President Greenfield: That is all I have to present. I want to thank you.

(Applause)

DISCUSSION

Mr. Buehler: I don't know whether you fellows down here have run into it or not, but there is a machine

*Ross, Ronald, The Prevention of Malaria. New York, E. P. Dutton & Co., 1910, p. 295.

which is called a Grade-All, that seems to me to be a very versatile piece of equipment. It is hydraulically operated, and it cleans the ditches very nicely, and I wondered if any of you had ever used it.

President Greenfield: Yes, the Grade-All has been used. In fact, its use is becoming increasingly important to many construction companies. To my knowledge the districts have not been able to avail themselves of its service because of its high cost. I understood that last year they ran somewhere in the neighborhood of twenty-six thousand dollars.

We must consider initial cost. A drag line at best will run between fifteen and nineteen thousand dollars.

Mr. Buehler: I didnt' know what they cost, but it cost us less to rent one than it did a drag line, and the job that it did was better than you could have done with a drag line if you put men in there with shovels to hand-clean it, and it distributed the spoils and everything. It was perfect.

President Greenfield: The Grade-All is a precision machine and can do many functions that no other piece of equipment yet designed has been able to do. It will even take the footings to such a tolerance that a contractor no longer needs to form them out of timber and so forth. It is a very excellent piece of equipment.

Are there any other questions that I can answer?

Mr. Robinson: I just want to make an annoucement. I have some extra Essex power sprayers if anyone is interested in buying any.

Mr. Mulhern: Howard, for the benefit of anyone who has worked in source reduction, would you like to comment on that new book entitled, "Moving The Earth"?

President Greenfield: Yes. I was just introduced to a book that seems to have a great many of the answers that I have sought for a number of years. It is called "Moving The Earth."

Tommy, do you know the name of the author?

Mr. Mulhern: I don't recall the name of the author or the publisher, but if you will read the last issue of the California Vector Views you will see a little note in it about this new book. If you don't have the California Vector Views and would like to get it, just notify the California State Department of Public Health.

President Greenfield: I can assure you that anyone embarking upon a source reduction program should add this particular book to his library. It is an excellent book. It has many of the pieces of equipment that we have seen here today; also some of the many important forms of equipment that we have not seen here in California.

Are there any further questions? If not I will turn the meeting back to Les Brumbaugh.

Mr. Brumbaugh: Let's give Howard a hand.

(Applause)

Thank you, Howard. I didn't realize there was so much heavy equipment.

I would like to thank Ted Raley, Tommy Mulhern and Howard Greenfield for participating in the panel on equipment. I wish to thank you for sitting and listening so patiently.

I see it is 12:30, so I will turn the meeting back to Bob Portman.

Vice President Portman: I would like to remind a few of you individuals that immediately after the adjournment of this Conference there will be a meeting of the Board of Directors in the back end of the coffee shop down below, that little hole in the corner there.

We would like to thank the Santa Clara Health Department for the use of equipment and personnel and the San Jose City Health Department who made their personnel and facilities available to us.

One thing which I have been impressed with at this Conference is our attendance. I have been impressed with the numbers in attendance at each session and how they sit and do not run away. We haven't had anybody out back there to take your dollars like a Rotary or a Lions Club, but we have lost only a few in attendance.

The other thing that is very important is the number of Board of Trustee members who have been here. I was really surprised to see how many there were, and I know that some of them have sat hour after hour in these chairs, and I hope that they have got something in return.

We have, as usual, a lot of individuals who have come here from varying distances, from other parts of the United States and other parts of the world. That is always very pleasing. Sometimes we brag out here in California, but I sincerely believe that in California we do have something to offer to other areas that are interested in mosquito control.

I would like to state that I feel that the attendance has been excellent throughout the Conference, and I know that it attests to the sincere interest of the personnel in California who are engaged in mosquito abatement.

Now, unless there are further announcements or other business to come up, we will adjourn.

Thank you.

(Whereupon, at 12:45 o'clock p.m., Wednesday, January 23, 1957, the Twenty-Fifth Annual Conference of the California Mosquito Control Association, Inc., adjourned.)

PROCEEDINGS AND PAPERS OF THE ANNUAL CONFERENCES OF THE CALIFORNIA MOSQUITO CONTROL ASSOCIATION

AUTHOR-TITLE INDEX

(Volumes 1-24, 1930-1956)

FOREWORD

The writing of a history of the California Mosquito Control Association is a task yet to be undertaken. In the absence of such a reference certain comments are believed desirable here in order to orient readers wishing to use the index which follows.

The first "Conference of Superintendents and Trustees of Mosquito Abatement Districts in California" was held December 16, 1930 at Agriculture Hall, University of California, Berkeley, at the invitation of Professor William B. Herms, Head of the Division of Entomology and Parasitology. The first five meetings were similarly held under the auspices of the University of California.

The mimeographed proceedings of the first eleven meetings (1930-1940) appeared under the title, "Conference of Mosquito Abatement Officials in California." Beginning in 1941 the publication was designated "Proceedings and Papers of the .....Annual Conference of the California Mosquito Control Association." The Association became incorporated April 23, 1951. The Proceedings have appeared in printed form since 1948.

Conferences were not held in 1942 and 1943 due to circumstances of World War II. Two conferences (14th and 15th) were held in 1946, and similarly two (21st and 22nd) were held in 1953. The 1949 conference (17th) and the 1955 conference (23rd) were held jointly with the American Mosquito Control Association, and the Proceedings for those years include the papers from both the California and American Associations.

It has been necessary to exercise some editorial judgment in assembling the index. Business transactions, committee reports, informal remarks of welcome, etc., have not been included. Panel discussions and symposia have been conducted in a variety of ways throughout the years. In some cases these are represented by a series of formal papers, only interrelated in the most general way; in other cases discussions have been very informal, with individual identity with a given subject made somewhat obscure. In assembling the index an effort has been made to associate authors and titles or authors and discussion subjects with primary consideration for the function served by the Proceedings as a part of the literature of science.

Indexed items preceded by an asterisk (*) refer to a secretary's account of the paper delivered.

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