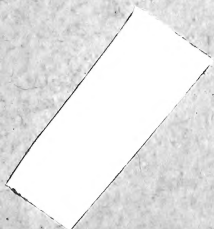


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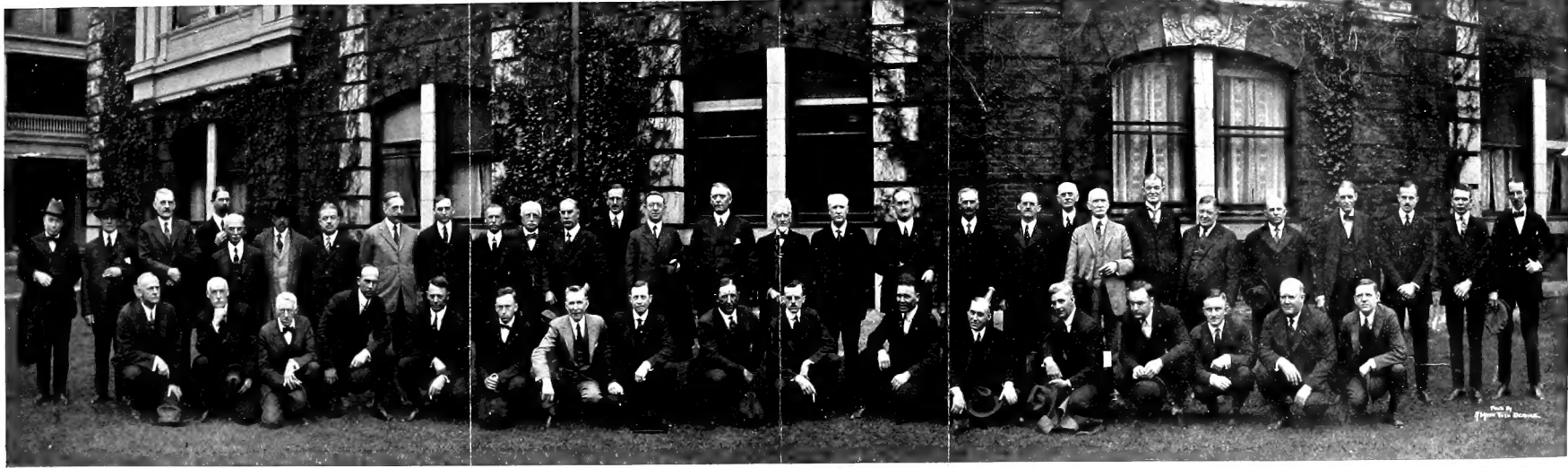




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PROCEEDINGS

OF THE

EIGHTH ANNUAL MEETING

OF THE

New Jersey
Mosquito Extermination
Association

HELD AT

ATLANTIC CITY, NEW JERSEY

APRIL 28 AND 29, 1921

SOMERVILLE, N. J.

THE UNIONIST-GAZETTE ASSOCIATION

1922



ACTIVE MOSQUITO EXTERMINATION COMMISSIONS OF NEW JERSEY

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PROCEEDINGS
OF THE
Eighth Annual Meeting
OF THE
New Jersey Mosquito Extermination Association
HELD AT
Atlantic City, N. J., April 28-29, 1921

THURSDAY EVENING SESSION.

(The meeting was called to order at 8.45 P. M. by President Rider).

PRESIDENT RIDER: The meeting will come to order. We have taken Atlantic City again by storm if not with a storm, as last year. The Mayor sends us his regrets that he is not here to welcome us, but he has sent a gentleman, Mr. Joseph A. McNamee, to extend a welcome to us to Atlantic City.

MR. JOSEPH A. MCNAMEE: Mr. President and gentlemen of the Mosquito Convention: It is a great honor and privilege to welcome you to Atlantic City on behalf of the Mayor and the citizens of the city and to commend you for the splendid work you are doing. It is because of this great work that Atlantic City has attained the eminence that it has today. We are proud of our resort. I have heard expressions of pride tonight and, with the consent of my good friend City Clerk Hand, of our neighboring residential section, Ventnor City, I am going to take the opportunity to paraphrase them. Mr. Hand had a British friend who had traveled all over the country, going from California to the Atlantic and from the Gulf to the Lakes. On being asked which city in all of his travels in this country impressed him the most, he replied, after studying a little, "Atlantic City." "Why," he was asked. "Because," he replied, "while I find Atlantic City the quietest city I have visited, I also find it has an awfully strong undercurrent." (Laughter).

I think that it is this undercurrent which has gone far to make our city famous and to make it successful.

In a comparatively few years our city has been transformed from a barren desert, from a bleak wilderness, to a magnificent resort city, containing some of the finest hotels in the world with a capacity of entertaining all who come. Atlantic City has never been overcrowded, notwithstanding there is no limitation, no restriction; all who come here can be entertained according to their wishes. As we speak in billions since the war, I do not think I exaggerate in saying that the ratables of Atlantic City today are worth at least a quarter of a billion of dollars. Divide this amount by the number of years, say fifty, in which this great development has come, I think you will admit it is a marvelous growth. And I think also that the New Jersey Mosquito Extermination Association has had much to do with Atlantic City's growth and prosperity. Some years ago, with the mosquito as a pest, many people refused to come to the shore and many came who were driven away. So I think you have been a great blessing in aiding our prosperity, to say nothing of improving the public health. It is rather gratifying to feel that our own county has had much to do with the methods employed. I refer especially to the Reiley ditcher. Some day I hope to see the name of Reiley as famous in mosquito work as Morse is in telegraph work. (Applause).

It occurs to me that the names I see here deserve to be emblazoned on the temples of fame—Rider, Meyers, Manchee, Headlee, Camp, Howell, Jackson, Darnall, Brinkerhoff, Engle, Hudson and the numerous names on the back of the program and it would not surprise me to see posterity determine that this Association had rendered such great service to the state that they should be remembered in a substantial and suitable form for the edification of all future generations. It is hard to measure the great good you have done. And after you have reached the seat of the disease in the Mullica River and have eradicated the germ, then, surprising as it will be to the world, New Jersey will be mosquitoless as well as drinkless.

You know that your work does not always receive the encouragement it should. I know that like all the great men, doing great things, that you meet with apathy, that you meet with discouragement; that you feel the people are not sympathetic and that they ought to support you more. So they should. But all great men, all great problems, find the same difficulty, find the same apathy. And at heart the people are with you; for people have a habit of letting somebody else do it. You find the same apathy extending to all

great problems. Had you been in this room the other day and heard the complaints of the leaders of industry of the country, you would have found that they all referred in a very emphatic manner to the lack of sympathy of the people, the apathy of the people.

You will have to do the work and get your credit, reward and glory in spite of the apathy. On reading the papers the last few days I find that the hospitals all over the country suffer the same way. On Tuesday I was in Philadelphia and went through one of the greatest hospitals in the country, Jefferson. And one of the questions I asked particularly was, "How much sympathy and support do you get from the public?" The answer was, "Little or none." Nevertheless, that does not deter them from carrying on their great work and doing all they can to make it a success. You will have to do the same thing until you triumph, and you are going to triumph.

Atlantic City is with you, Atlantic County is with you, the Board of Freeholders are always ready to respond generously to your requests; and when you finally triumph and when you bring about this great result, a mosquitoless state, you will get your reward for all the work you have done.

I wish you success in your convention; I hope you may find a few Mr. Reileys here in Atlantic County to help you out, and I hope that your stay here may be pleasant and you will go away feeling that Atlantic City is the place to come again for your next convention. (Applause).

PRESIDENT RIDER: I think we all appreciate the words extended to us by the Mayor through Mr. McNamee. I don't know how it is with Dr. Darnall and the rest of us people who have been workers in this enterprise, for so many years, but the Vice-President and the President feel, as the saying seems to come to me, "Some men are born great, some achieve greatness, as in Dr. Darnall's case, for instance, others have greatness thrust upon them," like the Vice-President and myself.

We are very glad to have these words of welcome and we appreciate them very highly and thank the Mayor for them.

We will now proceed to the appointment of three committees:—

Committee on Nominations—William E. Darnall, of Atlantic; Lewis Brown, of Bergen; William Porter, of Cape May; Ralph Hunt, of Essex; H. H. Brinkerhoff, of Hudson; William Warn, of Monmouth; Robert F. Engle, of Ocean; Walter Hudson, of Passaic; W. R. Randolph, of Union.

Committee on Resolutions—Frank Brouwer, of Ocean; Joseph Nixon, of Passaic; R. G. Savoye, of Union.

Committee on Audit—A. H. Cornish, of Essex; Charles J. Larky, of Hudson.

Those are the committees, gentlemen.

Now, gentlemen, the program as arranged for this meeting starts out with an address by the President. I will ask the Vice-President to take the chair while the President delivers his eulogy.

President's Address

Ladies and Gentlemen: Since our last meeting, all the elements of full citizenship have been passed to the ladies, and if we pull together, our combined powers should be at least doubled.

If I was to suggest any particular keynote for this, our eighth annual meeting, it would be "Keep Hammering."

Approaching Philadelphia by ferry from Camden, a few days since, we saw workmen engaged in binding together with heavy iron cablechain, a group of buffer piling. The end of the chain was dropped down to the desired position for anchorage, so low that each one of the workmen, one to hold the spike and one to wield the sledge, supported himself by one hand, leaving the other free to perform the operation. For safety, each had another to hold a leg.

The colored man drove the spike home without missing a blow.

Now that our working force is doubled, and then some, it is up to the ladies to say what part they will take in the operation:

Hold the spike, wield the sledge, or (I hesitate, but I'll say) pull the leg?

MY IMPRESSIONS OF ANTI-MOSQUITO WORK

I am wondering if the doctor, in assigning me this topic knew that I was born fighting mosquitoes?

It is said that first impressions are most lasting. That men of accumulated years delight to tell what good boys they were, and recite early experiences. Also that with memory less retentive, they become repeaters.

"When a child in my cradle, in the wilds of Western Michigan, I was kidnapped and carried away by Indians. After looking me over, they concluded that I was not worth keeping, and returned me to my mother."

I have always respected their judgment.

Really, I did not pull this off to secure your attention to my tale. Rather as an object lesson in anti-mosquito work.

As an entrant on the field of human industry, the first duty I recall having been assigned me, was to build, with chips, smudges in an iron kettle, before our log cabin door, that the family might enjoy somewhat of comfort by day and restful sleep by night.

Tallow dips, the only method of lighting by night, were tabooed.

The cause for the pioneers troubles and annoyance could have been found in a nearby rain barrel, a neglected gutter or a stagnant pool.

But pioneers could scarcely be blamed. They had limited access to books.

Possibly they may have seen such as were said to have been read by a professional friend.

When I endeavored to interest him in mosquito work, he said: "You can never destroy mosquitoes. They breed in all grass and shrubbery."

But, I said, the first six days of his existence, he is an aquatic insect, and can only live in water.

He assured me that he was right, for he had seen it in the books.

I did not question his veracity. If such books are really in print, they should be barred from the mails and shelves, as other licentious matter.

You will be interested to know that he has since become an ardent advocate of the work, and supports annually by his vote, liberal appropriations to the cause.

As for the schools at that early period, they were occupied principally with the three Rs.

Economics, hygiene, sanitation, and other subjects, knowledge of which make life enjoyable or miserable, as the case may be, had not yet found their way into school books.

And here is where the "Hammering" comes in for the makers of copy-books and the more modern typewriter instruction books.

IN CONCLUSION

We are to be congratulated on the world interest being taken in the extermination of insects generally.

The first step in Americanization is delousing the immigrant.

From personal observation, I would say, return some of them for their first lesson.

The mosquito propaganda should be the follow-up course.

And do you know, in a community of which I have intimate knowledge, where mosquitoes have been eliminated, the advanced alien shows greater appreciation and a better understanding of the work, than the average native.

I have been surprised at the intelligent discussions I have overheard on the subject.

At the Italian home, the mosquito inspector is a welcome visitor.

Quite in contrast with many natives who greet him or her, with a frown or worse, a salutation like this, "you are wasting the public money, and increasing our taxes. We are not interested in species. They all bite."

We need a hundred percent efficiency.

My impression is, that it is not so much money that we need for digging ditches and supplying oil, as educational propaganda.

When all communities learn, as some have, the economic value, say nothing of the comfort enjoyed as a result of the work, they will all want it done, and the money will come willingly and freely.

Bank deposits are the best barometer of municipal progress. In the town where I live, one of our principal suburbs to Atlantic City, they have increased from \$200,000 to two and one-half millions, since mosquitoes were eliminated.

Possibly the messages we have sent out to the public have been too scientific, have reached only the cultured, and passed over the heads of the masses.

Our friend Gaskell has given us the slogan for New Jersey "The Mosquito must go." How soon shall we be able to respond "He's a goner?"

PRESIDENT RIDER: Opportunity will now be given if any one wants to criticise Dr. Headlee for the scoring he gave our good old friend Noah and his qualification for entomology. Hearing none I will take pleasure at this time in introducing a gentleman who is one of my first acquaintances in connection with mosquito work—in fact, I think I knew him somewhat before that, but he is a man who has always encouraged me to struggle along in the work and gave me great encouragement personally and I know he has been of great service to this organization. It gives me pleasure at this time to introduce Dr. Hunt, who will now address us. (Applause).

DR. RALPH H. HUNT: Mr. President and gentlemen: It gives me pleasure to meet with you once more. The last four years I have missed, largely because of being in the service of the government, and in the last year I was so busy trying to pick up the loose

ends which had become scattered in twenty-six months that I did not feel I could afford the time to come down to Atlantic City. I regretted exceedingly not being here last year, the only time when I have been within reach of Atlantic City that I have not come to these meetings.

In meeting you gentlemen here tonight I see most of the old faces here, all of you looking younger, all of you looking more earnest in the work. I miss one or two faces whom we have lost since the first meeting of our association, and I am sure we all miss them. It is unnecessary to mention names, but when a good man leaves the game it is hard to fill his place, especially if he happens to be a pioneer. I refer especially to Mr. Delaney, of Hudson, whom we all respected and whom we always felt had his heart and earnest endeavors in the work, and who accomplished a great deal.

Dr. Headlee asked me to read a paper tonight on the title which appears in the program. I was very loath to take up any of your time but inasmuch as I happened to have served as your President for the two beginning years of this association, I suppose that was the reason why he asked me to write this paper. The title is, "Review of New Jersey's Anti-Mosquito Work and a Forecast of Its Future."

DR. RALPH HUNT: Perhaps it is as well to make this paper, so far as the past is concerned, a one of personal narrative. I can remember as a boy of always having a fondness for the outdoor life, always loving the trees, flowers and birds and this love led to knowledge as I became older. Biology soon had a charm for me and I usually knew where the wild flowers grew, where the birds built their nests, and where to find the different variety of trees.

The control of public health and the abating of nuisances in general, affecting the health and comfort of peoples, is, of course, a part of my profession.

These two factors, I suppose, directed my attention to the mosquito problem. It, perhaps, is well here to give a reason for attacking the mosquito problem in New Jersey.

The literature from early colonial time down to recent years is filled with references calling attention to the baneful influence of the mosquito. Not only has it rendered the lives of citizens intolerable at certain seasons of the year, but it has hindered industrial development and depreciated property values computed in millions.

Thousands of acres of good arable land lie fallow because of the presence of this pest. Many places, attractive otherwise for human habitation or industrial purposes, are rendered uninhabitable. Men

and beasts of burden are unable to live in comfort and perform their labors.

I first learned of the attempt to control local breeding while a member of the East Orange Board of Health. The work had been started some few years (I think in 1903) in South Orange, largely through the appeal of Mr. Spencer Miller. At this time, the work was growing slowly, and to the late Professor John B. Smith of the State Experiment Station, was due to the scientific standing of the movement.

Little was known of the life history of the different varieties of mosquitoes from which the state was suffering. I lay stress upon the work of Professor Smith, for it was he who delved into the life habits of the mosquito and made control a possibility. I can well remember Professor Smith, stout, thick set, a beard which covered his face, legs which scarcely raised him above the meadow grass, a little blue soldier hat with a vizor like that of a pullman conductor. I can see him wading through the marsh, with a net in one hand and a bottle of wrigglers in the other. Always smiling, always optimistic. He could not see the difficult tasks which have often beset our path since then. His optimism carried opposition before it and was a large factor in the success of the movement.

The next concerted movement in the state was the formation of the North Jersey Mosquito Extermination League whose membership consisted largely of members of the local Boards of Health of Northern New Jersey. This was an enthusiastic body of workers, and served to accentuate and make the movement permanent. Our meetings were held in the rooms of the Board of Trade in Newark, and often the mosquitoes were a pest during the meetings. This society grew in membership and finally was instrumental in securing the passage of the present county mosquito commission act, under which our Commissions of today are working.

It will thus be seen that the work of mosquito control was sporadic until 1912, when the present county commission law was placed upon the statute books. This law gave a non-partisan personnel, and an appropriation based upon ratables. It made the giving of funds mandatory upon the county boards of freeholders, after the budget had been approved by the Director of the State Experiment Station.

The county unit was adopted because it seemed to offer a large enough unit for effective work. When one is dealing with a pest, the range of flight of which varies from a few hundred yards to

thirty miles, the reason for a large working unit is evident. If any change were to be made, we all feel that the control unit should be larger. For example, the Newark Bay Marsh containing 29,000 acres of salt marsh lies within five adjoining counties, each capable of feeding a brood of mosquitoes into the other.

It is easy to understand that if one of the counties fails in its work, the beneficial effects of conscientious work in the adjoining counties would be more or less nullified. Our own opinion has always been that more effective work could be done were the whole area in question placed under one responsible head. There are many practical reasons why this has not been done up to the present time. Right here comes a phase of the work which to some extent has overcome the above difficulty. I refer to the part in the work taken by the State Experiment Station. Throughout all these years, there has been placed by the state, a certain amount of funds to be expended under the direction of the State Experiment Station. This has given cohesion to the work and has brought about a result which could never be obtained through a county unit. Doctor Lipman, the Director of the State Experiment Station, has always taken an active interest in the work. He has placed the work during all these years in the hands of Doctor Thomas J. Headlee, the secretary of this society. His work has been always alive, always inspiring, a tireless worker with a mind well trained for the work.

This Station, under Doctor Headlee's guidance has always maintained a field force which is at the service of the county commissions. To me this work of the State Experiment Station has seemed to be, as it were a steadying influence of our work in mosquito control.

The educational work alone of the State Experiment Station has made possible the extension of the work. It has been a function among others to aid in the establishing of new county commissions. It has also been possible through this work to extend work in communities where there were not enough ratables to carry on the work.

Perhaps the work of all the counties may be best exemplified by referring to the work of the Essex County Commission with which I am most familiar.

The aim of our commission has always been extermination where possible, and control where for many reasons it was not possible to prevent breeding permanently.

I shall not forget my first acquaintance with the salt marsh, it seemed a terra incognita, a new sort of country, in those days, teem-

ing with bird and rodent life. There were snipe, mud hens and occasionally a flock of duck and always in season yellow legs. Muskrats were there in abundance and all gave one the appearance of a land unknown to man. Many portions of the marsh were inaccessible and man seldom entered these fastnesses. One could scarcely believe that so much wilderness and isolation could exist so near a large city. I almost felt as if I were on an exploring expedition. It seemed an endless task to ever drain it. As for mosquitoes, they were breeding everywhere.

I well recall the optimism of Professor Smith and his coadjutors, "In a few years' time all would be cleaned up and a mosquitoless county would result." A fair dream, but alas! for all concerned, we have been working faithfully these many years, and yet remains much to do.

At first it seemed that ditches with good outlets and connections would solve the problem. The tide would flush while on the rise and drainage would be taken care of on the ebb. Again new difficulties arose, many portions of the meadows were too low to drain, at other times a heavy rainfall for a number of days together with an east wind would increase the upland flow and decrease the tide fall in the ditches, so that they could not drain and thus even with our ditches, ideal conditions for breeding would be present.

Gradually it dawned upon our minds that some change must be made. I remember well the day Mr. Brooks invited a few of us to visit a diked-in project in the Bergen County marsh, near Rutherford. To see, was to act, and we immediately began the building of dikes and installation of tide gates. Today as a kind of evolution in control work, we are using the ditches, dikes and tide gates. Nearly all of our salt marsh is diked and tide gated. The ditch, combined with dike and tide gates, seems to solve the salt marsh drainage problem.

Of one thing we are sure and that is that standing water on the marsh is always a menace, and sooner or later will breed.

You all know of the varied implements brought into use in this work. The old ditch cutting machine, the hand spade, the dredges, and in these later days, the development of a ditch cleaning machine.

I well remember the enthusiasm of our friend Spencer Miller when he viewed the seven or eight miles of dikes we had installed on our meadows. They were really substantial too, five feet at the base, three feet high and two feet at the top. He said, "Doctor, we will have to replace them with concrete dikes." Of course, the

concrete dikes by this time would be on their way to China, yet our sod dikes still stand.

Industrial developments, railroad spurs, street building, sewer and water pipe installation are continually interfering with our drainage, necessitating always watchful care.

As to the upland work, methods have also undergone an evolution. House to house inspection has been found less and less important, this is due to two causes; one, people have been educated to care for their own premises and secondly it has long been a belief of the writer that when local condition has been fairly well cared for, a severe infestation of mosquitoes always indicates a large area of breeding, probably located at a distance. In dealing with severe infestations of mosquitoes, it is our belief that preventive work must be done at a distance from the point of nuisance, commensurate with the flight of the infesting mosquito.

During these later years, there has developed a fine spirit of co-operation between mosquito commissions and property owners. It is a fixed rule of our commission to insist upon property owners bearing at least a part of the expense of draining or filling their own property.

As for figures, I do not think it the place to tire you with statistics. I would simply refer all to the carefully compiled circular No. 111, New Jersey Agricultural Experiment Station, entitled "The Mosquito Must Go."

The results thus far have been most excellent, and I feel sure that none would wish the work to stop. None would wish to return to the old days, when mosquitoes had to be taken with the food we eat and the air we breathe. To me personally the change has been marvelous.

It is characteristic of the human race to forget the unpleasant things of the past, the present is the big thing, and a small flight of mosquitoes today lasting for a week seems almost to excite as much comment and even more than did the continued whole-season pest in the old days.

I can see nothing other than better and better results as time goes on. This is not a foolish optimism, but a sane feeling born of actual experience and observation for the past ten years.

The longer or shorter time which will be required will depend largely upon the available funds on hand. If smaller amounts of money are used, it will take longer, and if larger expenditures are made the results will be more speedy.

All the machinery for such work either exists or can be called into play. What is needed is larger means to prosecute this work. It is certainly against all reason and experience to expect one county with three or four times the area of salt marsh to do as good work as the county with smaller area with a larger appropriation.

I will appeal to all counties to earnestly strive to obtain sufficient funds to control their salt marsh.

Personally I have favored a state appropriation to be expended under the direction of the State Experiment Station, in counties where enough appropriation is not forthcoming to meet the needs. This especially when the mosquito broods are a nuisance in other counties outside the breeding area.

In closing, it is fitting to say a word about the work of the association. Formed in 1913, its first annual meeting was held in this city in 1914. It has been a very forceful factor in prosecuting the work in the state. Its chief value I believe has been in giving an opportunity for the different commissions to get together once a year and compare notes and methods. Its publicity campaign has served to keep up the interest of the public in the work. It is a going concern, and we are proud of it.

PRESIDENT RIDER: I am sure we all have enjoyed this paper by our friend Dr. Hunt. What is your pleasure concerning it? I understood that it was to be received with thanks and be printed in the minutes.

I am requested to announce that the committee on nominations will meet at the close of this session in the committee room adjoining.

I now have the pleasure of introducing to you another gentleman who will tell us "The Mosquito Extermination Project, How Its Completion May Be Expedited," and which we will all be glad to know, because we are all in the expedition of this mosquito. Mr. Howell.

MR. REID HOWELL: Mr. Chairman, ladies and gentlemen: I feel very much tempted to comment to some extent upon the address by the President and by Dr. Hunt, but owing to the hour I will confine myself in a formal way to the paper that I have to read here, as in the program, "The Mosquito Extermination Project, How Its Completion May Be Expedited."

This is a five-fold project:

- (1) Combatting mosquito invasion.
- (2) Eliminating mosquitoes.
- (3) Finding their local breeding places.

- (4) Creating an efficient mosquito fighting machine.
- (5) Gold digging for funds!

Contemporaneously with the work of Ashford, Gorgas and Reed, through the inspiring enthusiasm of the late Dr. John B. Smith and a few inspired men of Essex County, this project was launched in New Jersey and received the recognition of our law makers in the passage of the law of 1906, whereby Dr. Smith was enabled to carry on his experiment: In 1912 the Legislature enacted the mandatory law under which operations, as at present, through county commissions, are conducted. Year by year since then the work of ditching, filling, levelling and oiling has been successfully prosecuted;—ditch by ditch, acre by acre, pond by pond, meadow by meadow, thousands of acres of water from stagnation brought into activity and circulation; the devising of new methods for the care or construction of basins at the corners of the avenues, the airing out of the waste places of the swamps and fetching their miasma and pestilential flies into the exterminating light and sparkle of running brooks or down to the wash of the sea tides as they ebb and flow in this eternal endeavor to be of service to the races of the earth, the work has gone on with discernible results in the comfort and health of our people and the increase in ratables in many localities.

In considering this project:

The history of extermination and control work in Porto Rico, Cuba and Panama—and the great benefits that these historic events brought to the people of the earth and the splendid lesson they have taught humanity might profitably be reviewed, but time will not permit.

No statistics are necessary to show what already has been accomplished or how truly scientific is the method of procedure. The consideration of this project also unrolls before us a map of the State. New Jersey has an area of 7,576 square miles—length 167 $\frac{3}{8}$ miles; width 59 to 32 miles. The southern half . . . sloping . . . to the Atlantic and the Delaware . . . has tidal marshes to the extent of nearly 278,365 acres mostly still infested by mosquitoes.

Cuba—730 miles long; width, average 80 miles; area 43,319 square miles—mosquitoes under control. Porto Rico, mosquitoes under control. Panama, mosquitoes under control.

New Jersey's cities, and suburban towns and seashore resorts and its agricultural areas—limited, restricted and circumscribed—as they seem to be are all involved in this project. A glance at the map will

show you the reason that the abandoned farms and hundreds of thousands of acres of undeveloped farm lands are reasonably due to mosquito infestation.

Notwithstanding all our industrial growth and all the state's attraction for the home seeker and the holiday maker, yet here before us are sections, great areas, that are stagnant, and others that are retrograde, and still other thousands of acres of marsh lands the ultimate great worth of which for future trucking and dairying can only be conjectured.

By article 2 of the constitution of this association the mosquito project is set up in this way: "The purpose of this association shall be the advancement of the cause of mosquito extermination in New Jersey"—to the end that the state may be recovered from the damage inflicted upon it by its only enemy.

So the project stands; invoking the co-ordinating effort of all enterprise—individual, family, municipal, county and State—all are challenged to complete the work. And what a task unfinished remains for the labor of tired hands and the eternal vigilance of generations to follow up. Now how may its completion be expedited?

Successful as we have been in the past, difficulties still remain to forestall or dominate influences that otherwise should serve our purpose. What we need is money. What we must have is money. The public is crying for reduction of taxes. Some of our citizens put it down as a fad we are engaged in. We have not succeeded in making the average citizen believe in our work with this result that, while we must have more money, we cannot even have a tag day or take up a collection. We have no women's organizations in the affected districts, nor interested women's auxiliary of this state association. Hit and miss methods of publicity still continue. We must interest more men of public spirit in affected districts—real estate operators, and public officials, and society clubs. Then this will bring us nearer to an active participating interest on the part of the public.

Tax Boards should increase ratables, and railroads and the War Department with their great engineering facilities, should be called upon to loan us their assistance, also the engineering and road departments of the counties.

A new Naval Academy might be asked of the Federal Government to be located in Little Egg Harbor and Barnegat Bay with a great Federal Training Camp over on the uplands out from Barnegat to Chatsworth on the Jersey Plains. And the Commerce and

Navigation Board asked to hurry along its Inland waterway from the Highlands to Cape May.

All this would help a little.

Experience teaches that the struggling upward trend of progress is the fruitage of patient plodding. Our progress is more or less round and round in a circle but always in an upward spiral. Our problems are all perpetual.

Our difficulties are not overcome by separate or single achievements. Primitive men still have to lasso those wild horses, still have to educate them to bit and saddle, still have to remember the perils of horsemanship.

With the advance progress we have made since the launching of the first canoe, yet shipwreck and perils of the sea cry out for precautionary measures—so with all our inventive enterprises; the aeroplane, the ventilating of tunnels, the fireproofing of buildings, safety appliances in transportation, railroad or motor vehicle—yet the new situation is set about with new difficulties, and we all carry accident insurance.

Our work was scoffed at in former times, is yet, and even attempts to thwart it are made by those who should know better. Editorial note and comment and news items adverse to our program repeatedly appeared and while it was thought a good work was being accomplished in dredging the meadows, yet so much of the county appropriations went into this sink hole that the habitable portions of the county received practically no relief from the mosquitoes bred in the small pools, open ditches and marshy places of the uplands.

But we kept at it. We pegged away with such funds as we had, ditching meadows and swamps, filling pools, setting up apparatus to oil breeding places and incidentally educating the public to help itself by the elimination of incubators in back yards, rain barrels and tin cans.

Years ago the subject of the New Jersey Mosquito was a rich theme for paragraph writers, cartoonists, and self-styled humorists.

Today the mosquito work isn't news. They've always been fighting mosquitoes. The subject is casually talked about as one talks about the weather. But there is nothing unusual in this, it's the way of the world—things common place and trite.

Even our conventions receive but scant attention.

All great movements are subject to abuse. John F. Stevens, one time Chief Engineer of the Isthmian Canal Commission, wrote as follows:

"One of our handicaps in securing skilled laborers was the insidious and disloyal attitude displayed by some of our home newspapers and magazines in depicting to their readers the terrible health and living conditions alleged to prevail on the Isthmus, long after the zone had become a safer and healthier place of residence than the very cities in which some of these papers were published. The words of irresponsible letter-writers were taken in direct contradiction of the facts, and screeds were eagerly scattered broadcast, poisoning the public mind, all probably for the sake of sensationalism."

On Sunday, July 11, 1915, the Brooklyn Daily Eagle over a half page illustrated story has this caption:

"To Banish Mosquitoes? Almost too Good to be True."

"Henry B. Maurer, Secretary of the Kings County Anti-Mosquito Association, hand uplifted, does solemnly swear that the sanguineous galaxy of Solicitous Free Lancers will disappear from off the face of Flatbush. But you know promises have been made before, so do not send your mosquito screens to poor relatives in New Jersey and don't destroy your mosquito-proof helmets till the Coroner has inquested."

In Heston's Hand Book, published in 1885, Atlantic City is described this way:

"Call it a sand patch, a desolation, a swamp, a mosquito territory, where you cannot build a city—or if you could, not one would go there."

In 1855, land in Atlantic City sold at \$17.50 per acre. Today it is necessary to make reservations per night at \$17.50 and up, and find your own breakfast!

Josh Billings in his Farmer's Almanac 1870-1879, makes game of the Musketeers. "There is millyums of them caught every year, but not with a hook, this makes the market for them unsteady, the supply always exceeding the demand."

* * * * *

"I am satisfied that there war'nt nothing made in vain, but I can't keep thinking how mighty close the Muskeeters came to it."

It is encouraging to note that to make a mosquito the butt of a joke is becoming a lost art.

Our only way out of this dilemma of more or less continued ridicule and unbelief must come through a Publicity Board, and this to be effective must have a broad minded head and be adequately financed.

Educational work? Yes. But fundamentally the goal to reach

for is a universal and popular outcry and disapproval of all hands, and all methods, and all legislation which permits longer the continued presence of the mosquito in the state; to arouse the people to the fact that to endure mosquitoes is not to be civilized.

A campaign which will breathe into the minds of the people that the mosquito is an outlaw; a campaign that will persist incessantly in personal interviews on the subject with notable people of the State, the heads of big interests, and big institutions, and from heads of all our educational leaders, whom the people will hear gladly and for whom the newspapers will find a place for what these people have to say.

Our taxpayers do not know to what extent their property ratables are depreciated, or kept below values. They should be informed.

More men get into the legislature each year who know less about these matters than those of the legislators who have a smattering of intelligence of what is going on. And we can say this advisedly.

In our work-a-day world of activity, it is pardonable if men possessed of the laudable aspiration to sit in legislative halls, have failed in their education to learn about the breeding ability and the all around pestiverousness and objectionableness of the mosquito, or to what extent any parcel of real estate is undervalued because of their presence.

Greater publicity is needed for reasons which are threefold:

(1) To prevent an indifferent public from objecting to the tax burden.

(2) To prevent boards of freeholders from trying to escape from the tax burden.

(3) To prevent the legislature from striking the mandatory feature from the present law giving county appropriations for mosquito control work.

We should have one class of literature for the legislators and other State officials and for the Freeholders and all other officials of the twenty-one counties, and another class of literature for the taxpayer.

The story of the work of Dr. Baily K. Ashford, who cleaned up Porto Rico and the story of Dr. William Crawford Gorgas and his activity in connection with mosquito control work in Cuba and Panama should be revamped, rewritten and reread to a new generation of unbelievers in order to overcome their prejudice, which may be found on any street corner against our work. A serious skepticism of the scientific control of the mosquito still does exist.

Gorgas himself went into the work of ridding Havana of yellow fever with a skepticism that he afterward admitted. As late as 1902 he stated that he had doubted the conclusion of Dr. Walter Reed that yellow fever was caused only by mosquitoes. But his own work proved a cure for his own skepticism; and when Charles E. Magoon became Governor of the Canal Zone, he told Colonel Gorgas that he wanted him to understand that all the resources of the Canal Commission were behind him. With this inspiring assurance, Colonel Gorgas set about his task; and from the day of its completion, he has stood out as the world's most famous master of tropical sanitation.

Yes, this is a story that should be retold to our people again and again.

What we need in New Jersey is a Governor with the hardihood to give to our county commissions, the resources of the state to hurry up this work to completion. Any careful analysis of the figures of expenditures however must show that the work is expensive. But this should not detract from the fact that it will be successful, and that it will be worth far more to this state than it will cost. It will remove from our state an evil that exists. It will arrest the attention of our great metropolitan district to the advantage of settlement here. It will invite industry to locate along the lines of our transcontinental railways with factory towns everywhere; and our abandoned pine lands will awaken to a new birth of activity and prosperity, and a new value will be set upon the ratables of the state to the extent of an increase estimated at \$500,000,000.00, perhaps more. With this result in prospect, surely New Jersey should have sufficient local pride to clean up her own door yard.

We must have the people think of the mosquito as an unnecessary nuisance and demand its extinction. Every child should be educated to have an interest in its own comfort and its own health, and that wherever it discovers a tin can with water in it, it should turn it upside down.

A more friendly intimacy must be established and held effectively between this association and the personal members of the board of freeholders, as they come and go, to secure their negative co-operation at least, in that they may not move for a revision of the mandatory features of the law; and the same intimacy should exist with all members of the legislature, as also with the newspapers and magazine editors, the public conveyors of good and of evil report.

The eyes of the state must more effectively be focused upon this

big enterprise. We must bring repeatedly to the people of New Jersey the lesson that the mosquito trouble may be controlled and held in check.

The wonderful liberality with which the United States provided for health purposes at the time of building the Panama Canal reveals to us how discouraging is our outlook, and how utterly inadequate are our present financial resources for hurrying forward the completion of this work in New Jersey. In the Canal region \$4,000,000.00 went for sanitation proper. Now, when we remember that the area of that part of the Canal Zone under active sanitary control amounts to only 1200 acres, it will be understood how inadequate are our budgets for prosecuting mosquito control work over marsh lands alone totalling hundreds of thousands of acres.

The pretty well established inference or conclusion most of us carry in our minds that the entire Canal Zone was cleaned up and converted from an untamed jungle into a place fit for the residence of men "is erroneous." As a matter of fact, except for the 1200 acres in the settlements along the canal and the few little clearings made by the negroes for their tiny yam patches, all of the 278,000 acres of the Canal Zone area lie outside of the sanitary district.

Go on ditching of course. As some one has said "so treat the salt marshes that the breeding of mosquitoes on them will be prevented;—so open up the salt marsh with ditching that all water upon it will rise and fall with the tide and afford easy access for the killifish, the mosquitoes' greatest natural enemy, to reach and destroy the larva."

Expedite the work by hurrying this ditching to completion. But how hurry most effectively? By more legislation? Yes.

Through the legislature the State Board of Health makes it a misdemeanor on the part of any citizen or property owner after a given time to maintain a breeding spot.

The present law is sufficient only unto the measure of the present law makers' sense of liberality. What we want is greater liberality in the making up of the budget for mosquito control work.

There still remains some half of our work to be done.

It is hopeless to expect additional funds from the State without a bond issue.

Then why not a bond issue now?

Yes, bond the state for \$1,000,000. This would be done by the usual procedure of having a bill drawn creating a state liability under approval of the legislature, for the specific purpose of mos-

quito control work which bill shall provide also for the ways and means to pay the interest of such debt or liability as it falls due, and also pay and discharge the principal of such debt or liability . . . and shall be irrevocable until such debt or liability and the interest therein are fully paid and discharged; which law at the next general election shall be submitted to the people for their approval.

Such a law should receive the approval of the people of the state.

To secure this approval, many agencies might be invited to assist notably the influence of the state, and many other, Chamber of Commerce. And of recent date, a new organization has been created in the state to which appeal might be had, namely "The Association of Chosen Freeholders." Membership in this association consists of members of boards of chosen freeholders, engineers, and solicitors of the several counties of the state. The purpose of this association is:

- (1) To consider all proposed legislation affecting county government.
- (2) To suggest and endeavor to have enacted such laws as will best meet the needs of the various counties of the state.
- (3) To increase the ability of the members to better serve their constituent by conferences together on the problems that confront them.

This organization, it is prophesied, will instantly become a most powerful factor in all the legislation of the state. After two years of activity, a permanent organization has been effected, and incorporation is under way. The officers of the association consist of a President, Vice-President, Secretary and Treasurer, and a Board of Trustees of seven members. For the purpose of equal representation on the Board of Trustees, the state has been divided into seven districts of three counties each, as follows:

No. 1. Atlantic, Cape May and Cumberland.

No. 2. Salem, Gloucester and Camden.

No. 3. Burlington, Ocean and Monmouth.

No. 4. Mercer, Hunterdon and Somerset.

No. 5. Middlesex, Union and Essex.

No. 6. Morris, Warren and Sussex.

No. 7. Hudson, Bergen and Passaic.

No other organization in the state can possess so great a potential influence as this freeholders' association. Its board of trustees with the other officers of the association meet monthly except

during the annual sessions of the legislature, when weekly sessions are held prior to the weekly meeting of the association concurrent with the legislature.

To expedite the completion of the mosquito extermination project, let us seek out immediately the co-operation of this new organization of public officials already familiar with our needs. Let us secure their favorable interest in a million dollar bond issue for completion of the drainage and ditching, and the completion of our project then will be in sight.

In a talk recently had with Republican Majority Leader Senator Wm. B. Mackay, Jr., of Bergen County on the state's financial obligation toward mosquito extermination work he said: "Of course I am deeply interested. The problem of mosquito extermination is undoubtedly solved, not only from the standpoint of our convictions, but from a scientific stand-point. What is necessary is a continuous concerted active warfare against the breeding places. We can't have warfare without the sinews of war. We must have money but we cannot get it out of the air. If the result of the extermination of the breeding places will expand the taxable ratables of the state as well as contribute to the interest and comforts of the general public, then there is no sane reason why the state should not bear its rightful share of the initial expenses.

The legislature each year is invited to help and assist so many things that should be done and to consider so many demands upon the state's resources that its own problem of finance is insurmountable.

We are just as interested as you are and know what the result of the success of mosquito control must mean in benefits to the people, yet the people themselves have not demanded that we go into this work. We cannot finance everything in Trenton without the backing of the people. Our appropriations are considered most carefully in a business-like way and our budget must always be kept well within the bounds of the income of the state. If the legislature has not adequately met the needs of your project, rest assured it is because as yet there has been no effective demand made upon the legislature by the voice of the people."

The lesson to be drawn from all this is that greater publicity must be given to our project in order that its completion may be expedited by the willingness of the taxpayers to furnish sufficient funds immediately.

(During the course of the reading Mr. Howell spoke as follows) :

I should like to stop here and talk about this, but I cannot, further than to just say this: I am so sorry that we did not act on that notion of a bond issue two years ago when we had Newton A. K. Bugbee here with us. He was willing to enter into a bond issue. It has come before this last legislature, and they were pressing for a sixteen million dollar bond issue for legislative purposes, and it was so closely allied with that that it might have gone in, and that comes up for referendum this fall. Now it is unfortunate, and I am still clamoring for a million dollar bond issue. Then why not a bond issue now?

(Continues reading paper).

I should like to tell you what they have done. I do not think that there was a bill they recommended being passed, and many that they rejected themselves the legislature also rejected.

PRESIDENT RIDER: Any one who wishes to express himself with regard to the very interesting paper which we have heard, we will be glad to hear from him.

I am requested to announce that a moving picture of the new salt marsh ditching machine will be shown at Vernon Hall at 9.45 A. M. tomorrow morning, standard time. Vernon Hall is located at the front of Hadden Hall, just off the boardwalk.

Motion is made to adjourn. If there is no objection we will stand adjourned until tomorrow morning at ten o'clock.

ATLANTIC CITY, N. J., APRIL 29, 1921.

FRIDAY MORNING SESSION.

(The meeting was called to order at 10.30 A. M. by President Rider).

PRESIDENT RIDER: The meeting will come to order. The first on the program this morning is "Symposium on the 1920 work of mosquito control and its results." The time is marked here on the program to be limited to ten minutes. We will first hear from Hudson County, Mr. Lewis E. Jackson, Executive Secretary, Hudson County Mosquito Extermination Commission.

The problems encountered in mosquito control work in Hudson County during the season of 1920, the commission's eighth year of operation, on both the salt marsh and upland, did not differ materially from those met with in previous years.

As to methods employed, there can be but few essential changes in those having become more or less standard in each class of work through our state through numerous years of combat with the mosquito which pursues its life habits along very much the same lines year after year, unchanged even by constitutional amendments.

The commission has continued the cutting of new ditches in the salt marsh where required to provide permanent drainage systems, and the cleaning of systems previously installed to maintain their efficiency. The commission's present policy in installing new systems is to employ ditches of greater width with increased distance between them where the porosity of the soil will permit and to widen some of the old ditches. The width of ditches and the plan upon which they are installed, of course, depends upon local conditions in each section treated but the commission is getting away from the ten-inch ditch, the main reason, in addition to that of the limited flow of the narrow ditch, being that it readily becomes blocked, thus defeating the purpose for which it is planned and entailing a prohibitive maintenance cost.

All the ditches cut last season were thirty inches in width. The prevailing standard depth of thirty inches has been maintained, it having been found that the marsh of Hudson County drains readily without the increased depth often contended as necessary. Under conditions existing at present, I know of no section of the Hudson County marsh requiring ditches of a greater depth than thirty inches.

This, of course, does not apply to main channel and storage ditches leading to pumps and tide gates.

Some of the ditches installed last season drain the marsh for the unusual distance of 700 feet each side, a total of 1400 feet, which would seem to justify the plan adopted. Ditches cut in the cedar stump meadows in 1921 will all be thirty inches in width and the distance between them will average 1,000 feet.

Ditch specifications of straight sides, parallel at top and bottom, continuing to be found best suited to the purpose, are being maintained in Hudson County in both stump and clear meadow. As such specifications can be obtained in no other way than by cutting, proposals to use dynamite, received from time to time, have been rejected.

The new work done in 1920 amounted to 34,523 feet at a cost of \$2,504.42. The cost per foot in the cedar stump meadow was 10.6 cents and in the clear meadow 2.84 cents, both classes of the work being done by contract. 95,600 feet of old ditches and culverts, of various widths, were cleaned by contract at a cost of \$3,496.50 or 3.06 cents per foot. 35,000 additional feet of old ditches were cleaned by our own men.

The operation of two electric centrifugal pumps, one of twelve inch diameter, serving 800 acres, and one of six inch diameter, serving 150 acres, installed in the low-lying Frank Creek territory several years ago, was continued with the same degree of efficiency that has marked their use from the beginning. They were run twenty-four hours per day at the beginning of the season to draw off the winter accumulation of water, after which they were operated from day to day as required to maintain a sufficiently low level of water in the ditches.

The commission's experience with the use of pumps justifies the recommendation of such equipment for the control of low-lying and diked areas not served by tide gates or in the case of tide gates not functioning for a long enough period on the ebb-tide to sufficiently lower the head to satisfactorily drain the distant sections of a territory and, in fact, on any area where the action of a drainage system is not rapid enough to remove all the water from the surface and pools in time to prevent emergence. The twelve inch pump referred to, running full time will discharge 7,500,000 gallons in forty-eight hours at the average load, which would mean safety in the case of breeding approaching the pupal stage over an area containing 1,000,000 cubic feet of water.

An electric pump like the one referred to gives continuous service with practically no attention other than occasionally clearing the foot valve of vegetation and filling oil cups. The time actually required of the operator in twenty-four hours running costs about \$3.50 and the power consumed by a fifteen HP motor costs approximately \$5.00. Replacements and repairs on the twelve inch pump for the year 1920 amounted to but \$150.00. The original cost of this equipment in 1915 was as follows :

Pump	\$487 00
Motor	342 00
Concrete Foundations	107 00
Concrete House	650 00
Feed line poles	72 00
Installation Expense	160 00
	<hr/>
Total	\$1,818 00

The total cost of the six inch equipment was \$1,360.00.

The control of this formerly very troublesome Frank Creek section is nearing 100% completion. So few mosquitoes emerged last season from this much maligned area that their absence was the most noticeable feature—a gratifying result of the commission's work in a territory the control of which has been very difficult and costly.

At the close of the season the Town of Kearny extended for a distance of 100 feet, the 700 foot concrete flume located in the upper end of Frank Creek, in the building of which original flume the Hudson County Commission participated, and cleaned the creek for a distance of 700 feet from the outfall of the flume at a total cost of \$6,000 for both pieces of work. It is understood to be the plan of the township to further improve this open sewer each year in a like manner. Two other open sewers in that section need cleaning which will probably be arranged during 1921. The Council of the Town of Kearny and its engineer have co-operated with this commission in its work in that township in every way possible, covering a period of several years.

A large section of the Penhorn Creek marsh, lying between the County Road and the Pennsylvania Railroad, was flooded during the entire season, due to the creek being dammed at the County Road by the contractors laying the New Jersey City water pipe line. By a fortunate chance extensive breeding did not take place on this area. Long delays by contractors in completing such work,

as in this instance, proves a serious handicap in mosquito work, as control of breeding over such a widespread area would be absolutely impossible under such circumstances. This is one case in which co-operation has not been received as efforts to hasten the removal of the dam have been unsuccessful. The dam is holding back three foot of water.

As an indication of possible trouble from dikes, the break which occurred in the latter part of the summer in the dike on the west side of the Hackensack River, north of the Harrison Turnpike, on the property of the Seaboard By-Products Coke Company, is an example. A 100 foot section of this dike gave way under the pressure of a flood tide, the weakness evidently being caused by a sort of quick sand formation beneath the bank and into which many thousands of yards of various material, including broken stone, was deposited by the company before a suitable repair could be accomplished. This resulted in a large area of marsh being flooded for several weeks. Part of this area was dammed off and oiled as soon as breeding appeared. There was an emergence from the remaining part, too great in extent to be oiled, but not in as large numbers as had been feared.

All early breeding on the marsh in general was controlled with the exception of some scattered breeding in the latter part of June, which was small in extent.

A word would seem fitting at this time in relation to the project of pushing to completion in the next two or three years the improvements necessary to bring the control of the Hackensack Valley marsh to the 100% efficiency point, a matter discussed at the meetings of the Executives of Mosquito Control of New Jersey last winter. Such improvements in Hudson County embraces the final extension of the drainage systems, the installation of one and possibly two additional pumps, the dredging of a part of Penhorn Creek, the projecting of two or three drains under railroad embankments, and the construction of one tide gate at a total cost of approximately \$50,000.00 in addition to that of the work which will be done under the usual program for that period. Such improvements will be effected in time by the commission but if the additional funds necessary to finish the work in all the counties within the boundaries of the valley in the shorter time proposed, were made available, a great benefit to very extensive residential and industrial communities would accrue and this commission heartily indorses the project. As funds will not be available through the regular sources in the coun-

ties effected in the time mentioned it is felt that financial assistance along lines previously proposed to the legislature should be extended by the state.

When the shortage of fuel oil at the beginning of last season threatened to prove a serious handicap to control operations requiring that important commodity, the commission sought some suitable substitute but without success. Kerosene was of course available but the greater quantity of that oil required made the cost prohibitive. The subsequent decision of the Standard Oil Company to co-operate with the mosquito extermination forces, because of the value of their work as a public benefit, by agreeing to supply all the oil necessary for that purpose, solved a very annoying problem. The Jersey City station of the oil company met the demands of the Hudson County Commission throughout the season without interruption with the same co-operative spirit which has always been extended to the commission by the local manager Mr. S. J. Massey.

The usual methods of control on the upland were employed practically without change. Breeding places were permanently eliminated where possible by draining or filling in, but the use of fuel oil was the principal means of control. 300 cellars in the lower part of Jersey City and Hoboken, constantly flooded with tide water from the Hudson River and forming permanent breeding places which cannot be done away with, continued to give considerable trouble and had to be treated regularly. The 8,000 sewer basins of the County also had to be oiled regularly throughout the *pipiens* breeding period.

For the purpose of eradicating permanent breeding places of all description which can not be filled in or drained, it is planned to use in 1921 a portable pump with a capacity of 12,000 gallons per hour. This pump will be mounted upon a truck base in which form it can be moved from place to place as required. It is intended mainly for use on the upland but may also be employed for certain emergencies on the marsh.

With the exception of the towns of Kearny and Arlington, where infestation was rather pronounced quite early, the origin of which could not be definitely traced, mosquitoes did not appear in sufficient numbers to become troublesome until the latter part of July. They continued troublesome in various sections of the county during the month of August, a condition which prevailed very generally throughout the state, due, no doubt, to the abnormal rainfall at that time, amounting to thirteen days in July and sixteen days in August.

Insects of all kinds were particularly numerous last summer, especially the crane fly whose close resemblance to the mosquito was responsible for frequent alarms on the part of residents and the press.

With the excessive rainfall innumerable breeding places formed throughout the marsh and upland too rapidly to permit of absolute control at a time when our organization could not be expanded sufficiently to meet the emergency for the reason that the amount of money appropriated by the county for the use of the commission was less than that called for in the approved estimate submitted of the amount required.

Night collections of mosquitoes in July and August showed a large percentage of *sylvestris* and *subcantans*, uncommon in Hudson County and not definitely accounted for.

We are glad to be able to report the continued exile of the genus Anopholes from Hudson County and hope to make the banishment permanent.

The total cost of operations in 1920 was \$41,395.75 which was practically the same as the year before. The total amount of oil used was 11,570 gallons, costing \$1,743.10.

After an illness of several months, Superintendent William Delaney, known to you all as a pioneer in mosquito extermination work, died on April 24th, last. In his death the commission lost an esteemed, enthusiastic and hard worker, whose activities looking to the control of the mosquito in New Jersey, date back to the days of Dr. Smith.

The field force of the commission was re-adjusted to the present organization of Executive Secretary, in general charge; Chief Inspector in charge of the salt marsh; Sanitary Engineer in charge of the upland; with a force of fourteen Inspectors and pump operators, one auto truck driver and ten laborers, making a total of twenty-eight employees during the active season. Inspectors are grouped in three classes depending upon length of service and paid \$4.50, \$5.00 and \$5.50 per day. Laborers are divided into two classes, according to ability, at \$3.50 and \$4.00 per day. The scarcity of labor proved a handicap in limiting our force.

Commissioners C. Howard Slater of Jersey City and Thomas M. Donnelly of Woodcliffe, were re-appointed members of the Commission for terms of three years each.

The following officers of the commission were elected to succeed themselves:

PresidentHenry H. Brinkerhoff
 Vice-PresidentCharles Lee Meyers
 TreasurerC. Howard Slater

The next to be heard from is Bergen County, Dr. Lewis Brown, member of the Bergen County Mosquito Extermination Commission.

Mr. Chairman, Fellow-Members and Friends:

As we look back on the work of mosquito control accomplished in Bergen County during 1920 we cannot help but feel that distinct and certain progress was made in all phases of the work. In fact in point of the amount of work done, it stands out as our biggest year and this in spite of the late start we were forced to make and the inferior grade of labor we were compelled to make use of. These factors retarded our outlined schedule materially and caused us to fall behind our original drainage program to a marked extent. What should have been completed in June was still under course of construction in August. So that much important ditching was not finished in time to affect mosquito breeding in several large areas and the benefits to be derived from this drainage will be felt far more this summer than they were during that of last year.

In further development of the general policy which this commission has maintained since its origin, we again chose to emphasize the relative importance of drainage to the ultimate success of mosquito control measures and instructed our superintendent to make the carrying out of an extensive drainage program his paramount duty. In view of the many, many acres of undrained or partially drained mosquito breeding swampland, this appears to us as our only chance of obtaining lasting results and we have decided to build toward the future rather than to devote too much time and money to the elimination of artificial or temporary breeding spots. It is our conclusion based on an analysis of several years of experience that in Bergen County the big problem is the eradication of the large swamps and that an intensive campaign of inspection and oiling must necessarily be deferred until such time as our drainage work has reached the point where we feel that the results of such an intensive plan of action will justify the cost.

Also as usual at the outset of last year, we found the amount of drainage that should be done far exceeded the amount of appropriation available. The freeholders, because of post-war conditions, especially asked us not to submit a larger budget and as we have

always found them most willing to co-operate with us in forwarding mosquito work in Bergen County, we readily yielded to their judgment in this matter. The question then was either to postpone part of the work we had hoped to do or finance it in some other way. The first course was most undesirable because it is our earnest hope to do more work of this nature each year rather than less. The second course therefore appealed to us greatly, but presented practical difficulties. The sum we needed above our regular appropriation was approximately \$10,000 and would have to be raised among the towns and property owners directly benefited. It seemed improbable that it could be done. But we went after it hard and before the work opened in the spring, we had signed contracts for over \$16,000 of which about \$7,500 was to be paid by the mosquito commission and the balance by the borough or property owner and before the season closed, our receipts from this source totalled \$10,889.03.

Perhaps it might be of interest to note briefly our course of procedure in obtaining this outside support. First, we pick out the place which should be drained and prepare a complete survey and map showing location and extent of swamp, general system to be used in draining, and the estimated cost of such drainage. Then we correlate our data relative to breeding, oiling, and other proof that the place is a nuisance and a menace to health. Our next step is to appear before the local board of health and ask them for co-operation. If they approve, as they cannot well refuse to do, we then take the matter directly before the mayor and council and ask that an item sufficient to cover the estimated cost be included in the town's appropriation for that year. In doing work on private property, the contract is, of course, directly with the property owner or his agent. In municipal contracts, the work to be done covers the lands of so many property owners that it is impractical to attempt to deal with them directly. The benefit of the ditching is felt by the people of the whole town and it seems equitable that the expense should be met in this way. In some cases, however, the board of health assesses the cost of the work done directly against the property and collects the cost from the owner of the land. In contracts with boroughs, we ask them to contribute 50%. In dealing with the property owner, we ask that he pay $\frac{2}{3}$ of the cost.

The total cost of the mosquito work done in Bergen County during the 1920 fiscal year was \$34,364.21. The per capita cost was approximately 15½ cents and the cost per square mile \$141.73. Of

the total amount spent, 73% was expended on new drainage projects and this work was divided almost equally between the salt marsh and the upland. On the salt marsh, 171,961 feet of new ditching was dug and although this figure is given on the standard basis of a 10"x30" ditch, most of ditching actually placed was 20" in width or wider. 157,637 feet of this was dug on the Overpeck meadow and marks the first ditching to be done by this commission on these meadows. In addition to this new ditching, 103,920 feet of old drainage ditches were cleaned out and all tide-gates and dikes repaired. On the upland, 119,797 feet of new ditching were cleaned. The total footage of work done on the salt marsh and upland including new work and maintenance was 431,966 feet and besides this one large tide-gate was built and 17 small ones constructed. The work covered more than 30 boroughs and townships in all parts of the county and 20 separate drainage contracts were satisfactorily executed during the year.

Besides this work of drainage, we carried on an extensive publicity campaign by means of pamphlets, printed reports and newspaper articles, and our superintendent gave lectures in the high schools of the county on the subject of mosquito control. These lectures were well received and in this way we reached many homes throughout the county. We find that people are constantly becoming better informed on mosquito extermination and are more willing to endorse it and aid it.

We have been most successful in obtaining assistance from the local authorities and we hope to be able to continue to work in close co-operation with the County Engineer, County Road Supervisor, boards of health and the officials of our boroughs and cities for we find that this spirit of co-operation is invaluable to us in carrying forward our work.

PRESIDENT RIDER: The next on the program is Passaic, by David Young, Superintendent Passaic County Mosquito Extermination Commission.

MR. DAVID YOUNG: Mr. Chairman and friends: Passaic County occupies rather a unique position on account of the fact that it is the only inland county that is doing work in a limited territory. Fortunately we do not have any salt marsh, but unfortunately we get some of its effect.

PRESIDENT RIDER: I hope our members in the back of the room will move up front and then our speakers can follow the suggestion

by Dr. Headlee. Our speaker can stand in front of the map and point out the locality.

SECRETARY HEADLEE: The salt marsh to which Mr. Young there refers occurs in the Hackensack Valley at this point, and here is the City of Passaic, and here is the City of Paterson. (Indicating on map). These two cities form the heart of the territory in which Mr. Young worked. It is a very large marsh at that point in the Hackensack Valley, involving something like 18,000 acres. Now Mr. Young claims that they have no salt marsh, but they have an acquaintance with the product of the salt marsh, which I take it to mean a certain proof that he is not responsible for the said product.

MR. YOUNG: The people realize that there is salt marsh somewhere and I get the benefit of the doubt.

A synopsis of the scope of the work of the PASSAIC COUNTY MOSQUITO EXTERMINATION COMMISSION and what the results were in mosquito control in its limited territory within Passaic County in the year, or season of 1920 must necessarily be a short story at this time.

As an inland county that has been engaged in mosquito control work since the enactment of the Mosquito Extermination Commission Law of 1912, our problems in mosquito work have been mostly of a local character and confined to the cities and boroughs within our limited territory.

We could give you statistics of the number of rainbarrels, open cisterns, cesspools, tubs, pails, cans and all the other kinds of trash which lay behind the homes of many people who consistently furnish their own mosquito annoyance, but to what avail. They are an old story that has lost its worth to be repeated.

The area in which mosquito work has been done for the last six years is unique, in that it comprises only eighteen percent of the total area of Passaic County, and contains ninety four per cent. of the entire population, reaching its highest density in the City of Paterson, where the population is 17,000 to the square mile.

In the congested parts of large cities, the characteristic habits of the people are usually not in keeping with the highest ideals of sanitary conditions; containers of many different kinds that furnish *pipiens* annoyance are generally found on their premises. Breeding is usually found in small pools or containers that can readily be eliminated when an inspection is made. A rainbarrel, an open cistern or other container seems a small thing in mosquito control, but the

great number found within some districts is such a menace to the comfort of the residents that it cannot be neglected, if we desire to keep mosquito annoyance below the point of complaint. Inspection and advice may remove them temporarily, but usually the original conditions may be found within a few weeks, when a second visit is made. This makes backyard inspections in these sections necessary. I believe this method of control work was responsible for the great reduction in *pipiens* annoyance that we enjoyed during 1920.

Another important part of mosquito control in large cities is found in and about manufacturing plants of which we have about a thousand, such as silk dyeing and finishing works, in whose grounds or yards are usually found unused or discarded dye vats, barrels and other containers holding water. To prevent *pipiens* breeding in or about these plants, inspection is absolutely necessary.

To get results our efforts must be directed against breeding places of any kind, wherever found, if we hope to make mosquito control work successful. This can be done only by intelligent inspection in those parts of large cities where unsanitary conditions usually prevail. There seems to be some difference of opinion in various counties as to the value of backyard inspection in mosquito control work. Some counties have partly abandoned yard inspection, and give as the reason that publicity of anti-mosquito work has been so convincing that people have destroyed their pet rainbarrels and covered the open cisterns. Backyard inspections thus became just so much lost motion and the cost of such inspection could be devoted to more important features of the work. This plan may be advisable where the population is much scattered and the dominant feature of mosquito control is the elimination of salt marsh species. However, we could not make this plan fit Passaic County, especially in cities like Paterson and Passaic, where the density of population, as above stated reaches 17,000 to the square mile, and there are a thousand manufacturing plants of various kinds, whose owners fail to recognize the economic value of mosquito control work.

Passaic River

The problem of controlling mosquito breeding on that part of the Passaic River above tide-water and north of the Dundee Dam, I have discussed many times in past years. It presents an area of three hundred and fifty acres of which every inch is a potential breeding spot. The rich organic matter from the sewage sludge and the sluggish flow furnish what might be called an immense open cesspool.

During 1920, our boat patrol of the river produced very good results. Breeding was much less intensive than it had been in past years. What the future results of the operation of the Passaic Valley Trunk Sewer may have on the physical condition of this part of the Passaic River is problematical at the present time. From a mosquito control standpoint, I do not believe it will bring about any improvement on present conditions. At the present time, the low summer flow leaves a large number of sludge islands in sight and along its bank a series of sewage polluted pools. The continuous demand for potable water from the Passaic watershed will cause a further reduction in the volume of water in the river, thereby intensifying the present physical condition to some extent. In addition to this the operation of the Passaic Valley Trunk Sewer will cause the diversion of the sewage of the City of Paterson, which is approximately 17 million gallons daily. Many people are of the opinion that the Passaic River will then be brought back to its original purity. I am very doubtful of this. The continuous reduction in the volume of water will intensify the present physical conditions in a more aggravated form than they are now.

Corner Catch Basins

It has generally been accepted as a fact that the street catch basins were an economic necessity of civilization that could not be eliminated as a mosquito breeder, but changes in the method of sewage disposal, as a result of the construction of the Passaic Valley Trunk Sewer, seem to offer some expectation that eventually the street corner catch basins of present construction will not be necessary—that is, the catch basin so constructed that it retain about two feet of water. This change is being brought about by the adoption of the double or separate system of sewers which includes the storm water sewer. My attention was called to this phase of mosquito breeding places by the construction of a storm water sewer in a street that had twelve catch basins, all of which were prolific *pipiens* breeders during the summer months. Small receiving basins were substituted, which retained no water and drained directly into the storm water sewer. This change of sewage methods, if continued, will bring about the elimination of hundreds of breeding spots that were the source of much *pipiens* annoyance in large cities.

Co-operation

There seems to be an awakening interest in mosquito control work in the smaller municipalities within our territory. We have in past

years repeatedly called the attention of the small municipalities to the many mosquito breeding conditions that existed within their boundaries, for which they were entirely responsible. Some of them are now beginning to realize that heaven helps those who help themselves, even in mosquito work, and also that the mosquito commission was not called into existence for the purpose of eliminating unsanitary conditions which the various boards of the municipalities have neglected to change, or control.

If it were possible to induce the street departments and the boards of health of the municipalities in which mosquito control work is being done, to co-ordinate with the mosquito commission in eliminating the pools and swamps within their city and borough lines, a great advance in mosquito control work would take place. Usually the street department does or can control the disposal of city waste, which if supervised and intelligently directed at suggestions of the mosquito commission, would, within a short time permanently eliminate ninety per cent. of the conditions that furnish mosquito annoyance in the cities and boroughs.

Complete success in mosquito control work is mainly dependent upon effective co-ordination of city and borough departments. In a word, it becomes a vital part of the cities' and boroughs' sanitary progress. It is an economic question in the interest of health and comfort to their people. But there are none so blind as those who will not see.

We can sum up the results of our work for the year 1920 by stating that it furnished exceptional freedom from mosquito annoyance to the people residing within the territory covered by the commission's work.

PRESIDENT RIDER: The next on the program is Essex County, Wilfrid A. Manchee, Vice-President Essex County Extermination Commission.

DR. RALPH HUNT: I am sorry to say that Mr. Manchee was unable to get down and he asked me to present the work of the year for Essex County. Now a little brief sketch of the work necessary in Essex County, the territory and the kinds of pests we have may not be out of place.

Essex County, of course, like other counties, is bothered by three varieties of mosquitoes: first and most important the *cantator*, the salt marsh mosquito; next the *pipiens*, and the third variety, which is the great nuisance, is the *sylvestris*. Essex County is situated

in this way: to the east, leaving Newark, by marsh. The marsh really touches five counties: Bergen, Hudson, Essex, Union and Middlesex; and from the peculiar location of our county, in the center of this district and from the habits of the mosquito, which are to wend their way westward as soon as they have bred on the meadows, Essex County suffers from an infestation of the whole Newark Bay marsh, whether it be in our own county or in the adjoining counties; and that to me has always been the big pest in Essex County, the *cantator* mosquito. That is our greatest problem.'

The *pipiens* mosquito, of course, breeds inland, in fresh water, but we have our fair share of that. Fortunately we have control of this pest, so no longer is the *pipiens* mosquito a very great pest in our county.

On the west boundary the county faces the Passaic River. Now the Passaic River, as you all know, is surrounded by tremendous areas of fresh water marsh, and the contour of the county is such and the drainage of the watershed is such that at certain seasons of the year, in floodtime, the Passaic River is not allowed to empty itself properly and those marshes become flooded tremendously. It was through the efforts of our own commission and Dr. Headlee that we demonstrated the range of flight of the *sylvestris* mosquito. I think the worst year we ever had was in 1917. I traced the flight of *sylvestris* mosquitoes in direct lines by taking mosquitoes on the wing to a distance of thirteen miles.

One of the important works we have done up in Essex County this year was to try to eliminate its opportunity of breeding. We had a scheme whereby we wished to increase the drainage of the Passaic River by deepening the channel and so allowing these waters to drain off in such a short space of time as would not permit the breeding of mosquitoes. The proposition was gone into quite thoroughly and certain members of our commission were most enthusiastic in this matter. The thing took form and it was a matter of one, two or three hundred thousand dollars required for the proposition, and we went so far in the matter as to put the thing on the budget for approval by the State Experiment Station, an item of \$50,000 for the current year to expend in this work. We found, however, the Passaic River was the dividing line between Essex and Morris Counties in this upper part and between Essex and Passaic Counties in this lower part, so that one county could not spend money advantageously without the expenditure of money by

the other counties; and if Essex County had done the work alone it would have required the expending of Essex County's money in Morris in the upper part and Passaic in the lower part, which was illegal, and held so by the board of freeholders. However, they were so good under the mandatory features in observing the law that they allowed it to go through and we were offered \$50,000 to spend on the Passaic River, but counsel stated the illegality of the proceeding and it did not seem wise for us to use the money. They passed it privately and we refused the appropriation and turned the money back to the board of freeholders.

Now that work resulted in education and an educational campaign. It brought the matter to the attention of the three counties and it may be the starting point of some future undertaking to relieve this mosquito menace to the three counties. Of course it is a large proposition and it probably will take some time to bring it out. However, since 1917 the *sylvestris* menace has not been as great as it was at that time.

The *pipiens* problem is pretty well handled and the salt marsh problem of course is interfered with very much by construction work and improvements on the Newark salt marsh and other salt marshes. We are continually being interfered with by those improvements and it requires a watchful eye to prevent those improvements from interfering with our drainage.

DR. RALPH HUNT: The anti-mosquito campaign was carried on in Essex County in 1920 along the lines followed in former years. Active work began in the salt meadow districts on March 15th and in the upland districts on March 22nd, and pushed as vigorously as funds and labor conditions permitted.

Unable to procure a sufficient labor force, we were also forced to meet very abnormal weather conditions, which handicapped our efforts considerably.

On the salt marsh 21,000 feet of new ditches were installed and 395,000 feet of existing ditches were cleaned.

The meadows were patrolled according to an established plan and 3,915 gallons of oil were used to check the breeding found.

In our upland districts, the plan to push vigorously the drainage of the undrained areas was continued with good results. Many former bad breeding places were eliminated and the maintenance in good condition of the many places drained in previous years was kept up, with the result that 485,705 feet of ditches in our upland section were put in and kept in proper working order.

The 9,000 sewer catch basins under our care were oiled after a plan which called for a treatment every ten days, (12,109 gallons of oil being used for this work).

We inspected 66,995 yards during the active season.

We made night collections every Tuesday night. The results of these collections showed *A. cantator* predominated. There was a noticeable decrease in *A. sylvestris* as compared to 1919. *Culex pipiens* while not appearing in sufficient numbers to be classed as troublesome were more numerous than in 1919.

The cost for our work for 1920 was \$69,148.25.

Though we, with others, had to struggle along with insufficient as well as mediocre help due to very short labor market, we are not satisfied with our results of last year. We start this year with changed conditions, our organization has been rearranged, and from the results shown to date, we believe we now have a working force that can meet and handle any phase of the work which may show itself. The labor situation is much improved, and we hope for a successful season.

I might say in addition that there has been a spirit of co-operation which is very gratifying between our commission and private owners, whether corporations or simply in private ownership, railroad corporations or mills or things of that kind, and even the city departments. The commission has insisted upon these property owners bearing a fair share of the expense of keeping their property free from nuisance. It is our custom to invite individuals to our meetings to discuss in a friendly way the conditions which exist on their property and premises, and we have yet to find a representative who has not listened in a co-operative and kindly way, and usually we have gotten our point. This results in placing the responsibility for nuisance upon the man to whom it properly belongs and makes him feel his responsibility by making him pay the cost of cleaning up.

The educative value of this kind of work is tremendous but redounds to great benefit in cleaning up the county.

We haven't anything especially new to offer. We are experimenting now with the ditch cleaning machine which Mr. Brooks is perfecting, along with other men from other county commissions. We hope to be able to report in the near future that ditches can be cleaned in an effective way at less cost than has been done formerly. (Applause).

PRESIDENT RIDER: Union County, Mr. Jacob L. Bauer.

DR. R. G SAVOYE: A Californian turned two good for nothing

plants into the loganberry. A lame doctor was carried up to Sing Sing and developed a man from a criminal. But it remained for the mosquito commission to transform a doctor into a civil engineer. Therefore I am speaking for Mr. Bauer. Mr. Bauer was to have read this paper, which Mr. Gies has written. I have looked it over. As near as I can find out I can merely say ditto to what has already been said by the different commissions; their work has been carried on effectively, co-operation has been had with counties surrounding them, which is important, and the only way in which particularly this salt marsh problem can be controlled, Dr. Hunt has just explained.

Contracts have been made so far as possible with the corporations, more particularly that they should do the work or that we would do the work for them and charge them with the cost, which has been the only way in which our funds could be eked out.

One of the important things which is brought out in this paper, which I am not going to read, is the necessity of a true biology of the mosquito and I think that is one of the reasons we are having trouble in accomplishing complete results.

A penny a day laid away would probably develop adequate income to take care of us in our old age, provided we live as old as Methusaleh; otherwise it won't. The funds that the various mosquito commissions are absorbing come in in about the same score. You and I will never see the complete results or even adequate results of the mosquito work under the conditions that we are permitted or we dare to ask for. We talk about the work done in Cuba and Porto Rico and along the Panama Canal as if it was what we were going to do here. It is an absolute impossibility unless you can get funds to do it in the way they did. Your educational propaganda is absolutely useless until you have shown the public first. Talking to it about what you are going to do is absolutely useless.

PRESIDENT RIDER: Middlesex County, Charles E. Hull.

MR. CHARLES E. HULL: Mr. President and gentlemen: I am one of the members of those local boards, and I think your co-operation has been so often bespoken, and I think I am safe in saying at this time that if that co-operation is sought you will find it without a doubt. All you have got to do is to go after it.

MR. CHARLES E. HULL: Mosquito control work in Middlesex County is not new. As early as 1903, the late Dr. John B. Smith made thorough surveys of the mosquito problem in the Raritan River areas. Later on sections of the salt marsh were ditched both for experimental and practical purposes, so that, when in 1914 the

Middlesex County Mosquito Commission commenced active work over 400,000 (four hundred thousand) linear feet of 10x30 inch ditching had been installed.

Middlesex County has a salt marsh area of approximately 8,200 (eighty-two hundred) acres. In 1914, when active work was started, practically the entire salt marsh was a potential breeder. An appropriation of \$5500.00 was received from the board of chosen freeholders with which to fight the pest. The commission realized from the start that the appropriation received was insufficient to fight both fresh and salt marsh mosquitoes. The control of salt marsh mosquitoes being of greater economic importance due to a longer flight range, it was decided that the county funds should be spent entirely on salt marsh work, but that the commission would offer expert over-sight to locally supported campaigns, for the fresh water mosquito.

The commission has adhered to this plan. The close of each year's work has seen the completion of some important piece of drainage. Fortunately for the commission several important war industries began operations on or near the county marshes. It was considered fortunate because two of these concerns, the T. A. Gillespie Company and the Raritan General Arsenal Depot offered their support to help control broods of salt marsh mosquitoes on the marshes affecting them. This offer of help was gladly accepted, for it meant the carrying on of work that the commission with its small appropriations would have been unable to have touched for several years.

County mosquito extermination work is now in its eighth year. Salt marsh drainage is far enough advanced so that unless adverse weather conditions prevail over an extended period, breeding can be controlled by supplemental drainage or by the use of oil.

During the summer of 1920, night collections on a large scale were made throughout the county. These collections proved both interesting and instructive. It was found that while mosquitoes were a pest throughout the county, the salt marsh species were noticeably absent except in certain isolated districts.

Another condition, not as agreeable as the one just mentioned, was also brought to light. *Anopheles* mosquitoes in alarming numbers were captured in collections made at New Brunswick, Highland Park, and Piscataway Township. It was also evident that these mosquitoes were not idle visitors, for investigation showed that over 200 (two hundred) cases of malaria existed in the City of New Brunswick.

The city authorities were notified. A complete survey of the city was made by an inspector of the mosquito commission. A one day report, picked at random from the files, show how bad a situation existed. This report reads as follows :

250 yards inspected.
125 breeding mosquitoes.
75 breeding anopheles.
22 people ill. (Symptoms-malaria).

The local health authorities were notified of this inspection and prodded into action. Oil was obtained, transportation secured from the City Fire Department, and temporary relief was enforced. Similar work was done in Highland Park.

In the Borough of Metuchen, a local campaign was undertaken as in previous years. Excellent results were obtained until about August 10th when Dismal Swamp, a large, low-lying, fresh marsh area near the town gave forth one of the largest broods on record. Mosquitoes fairly swamped the borough and spoiled the results of an excellent house-to-house canvass. With the aid of the local and state boards of health, the mosquito commission has succeeded in receiving a \$1,000.00 (one thousand dollar) appropriation from the Metuchen Council for drainage work. The Raritan Township Committee is now considering a proposed \$800.00 (eight hundred dollar) appropriation to finish this work.

In Highland Park and in New Brunswick plans for drainage and inspection service have been formulated and placed before the local health boards. Highland Park has already appropriated the funds asked for and New Brunswick will probably take action within the next few days.

So it would seem that the campaign for mosquito control in Middlesex County is progressing towards its ultimate end. Appropriations have been small; the amount of work to be done, large—but the county mosquito commission with its nose to the grind-stone has always been able to show a substantial gain in the fight against the “onery pest.”

To the future we look without qualms or misgivings, for the foundation of our work is strong and, the people, our strongest ally, have expressed a desire to help and believe in mosquito work rather than to hinder and doubt the practicability of it.

PRESIDENT RIDER: The only thing that strikes me as singular in this report from Middlesex County, is that all our mosquito work seems to have been planned in this county and yet here in the City

of New Brunswick they are the least appreciated in the work; and Dr. Headlee will have to look to his laurels. We must remember the old saying that a prophet is not without honor save in his own country.

The next on the program is Monmouth County, Dr. G. V. V. Warner, Treasurer of that commission.

MR. HARRY G. VAN NOTE: Mr. President and gentlemen: Dr. Warner is not here and at the last minute he informed me that he did not have time to prepare a paper because he was so busy that he did not have time to sleep, and so I have jotted down a few notes here this morning which may be interesting so far as I have written them.

MR. HARRY G. VAN NOTE: The Monmouth County Mosquito Extermination Commission, wishes to emphasize the fact that their work is mainly adapted to the control and maintenance of the salt marsh areas of the county, which number 3,378 acres, stretching from the Raritan Bay, which forms the north boundary to the Manasquan River forming the southerly boundary of the county, a distance of approximately 32 miles from one extreme point to the other.

There are some fresh water areas adjacent to the salt marsh, which the commission assumes the responsibility of maintaining freedom from the annoyance of the fresh water species.

For the past two years it has extended its operations to the fresh water areas further inland whenever the funds available for this purpose would permit. It is also active in initiating and exercising supervision of eliminating and controlling the house mosquito in the large inland towns of the county with very satisfactory results, and as the inhabitants of these various municipalities become more educated to the necessity of mosquito elimination they become more enthused with the work and discover that the small expenditure is infinitesimal in comparison to the result obtained.

The commission finds that the people in our county are becoming more interested every year as the mosquito elimination work progresses to the extent that they look upon it as an asset rather than an experiment, but the proof had to be shown in order to obtain this optimistic spirit.

From observations of public sentiment the commission feels that the peak of criticism has been reached and the skeptical have retrenched and become boosters for the work to go on and to be extended to every municipality in the county.

Mosquito draining ditches have been installed on some of the

salt marsh areas as far back as the year 1903 by private contributions donated by wealthy property owners of Rumson and Monmouth Beach.

After their installation the proper maintenance and control was neglected and they became partly filled up and conditions were almost as bad as before.

The commission since its activities begun seven years ago is engaged in the recutting of some of those old ditches and installing new ones from year to year in addition to the maintenance work.

Last season during the most critical time or the breeding season a prolonged rainy period added to the difficulty of controlling the salt marsh species, but in spite of this condition the commission succeeded in keeping the mosquito annoyance down to a fair degree of immunity.

The population of Monmouth County, especially along its bay and seashore sections is increased during the summer season to over 500 per cent., and would be subjected to the onslaught of the salt marsh mosquito were it not for the constant drainage and maintenance work being done every year on these salt marsh areas.

As a result of this work much of this land which formerly was considered useless by mosquito annoyance has become built up with summer homes and their inhabitants are enjoying the comforts of the bay and ocean breezes and the mosquito annoyance in these sections is considered to be 90 per cent. efficient.

This could not have been possible had the salt marsh areas not been drained to say nothing of the hundreds of thousands of dollars added to the tax ratables, which is an important factor to be considered.

The Monmouth County Extermination Commission believes that for every dollar expended in mosquito extermination work at least two or three dollars have been returned in increased values of the tax ratables to say nothing of the human comfort that is enjoyed in districts that formerly were mosquito ridden territories.

The maintenance and control of the mosquito work in Monmouth County for the year 1920 was very successful and proved to be one of the best years since the commission began its activities.

SECRETARY HEADLEE: Mr. Chairman, I would like to make a remark relative to the papers that have been read. There are certain points, it seems to me, that need emphasis. You will note all the way through that there is more or less of a tendency on the part of the commissions to secure local co-operation. In the counties where

the entire territory is being covered with more or less adequate funds there has been a good deal of private development, notably in Essex and Union and in Bergen and to some extent in Hudson. In Union I believe that private expenditures in one year equaled the county expenditures of that year. In Essex they are dealing with large ponds that have been impounded, streams that have been impounded and ponds formed for power and manufacturing purposes, in some cases pleasure. Now the Essex Commission has taken the position that that procedure obligates the concern bringing the impounding about to take care of mosquito breeding, and it has been able in the way which Dr. Hunt mentioned and which Mr. Jackson explained last year to put it over in good shape, and the educative value of that thing is tremendous.

Now passing to counties like Middlesex and Monmouth, where the appropriations have always been small, owing to the fact that there was such a heavy proportion of the population in the back country, in those counties the moneys have been placed on the salt marsh, but I believe I am safe in saying with very satisfactory results; that the amount of work accomplished for the amount of money expended is amazing. The commissions have then turned around and said to the local authorities of borough and cities, "We have the salt marsh mosquito under control. If you will expend enough to take care of your local conditions your people can have adequate protection."

And we are seeing this year the results of that type of campaign. A very considerable number of towns and boroughs have taken up and are supporting local campaigns under the direction of the mosquito commission. The results obtained in past years have in many cases been amazing. In all cases they have been very satisfactory. In the Borough of Metuchen that sort of campaign has been on for a number of years and the *pipiens* mosquito, that is, the mosquito that breeds in the borough limits primarily, has been conspicuous mostly by its absence. Of course that does not take care of Metuchen entirely, because there is the Dismal Swamp area, as was mentioned. But even that area, since the people of Metuchen realized that that was the source of their trouble, plans were called for for taking care of that particular area and plans were made, money is being raised from local sources to take care of that area.

Now the educative effect of that sort of campaign is tremendous and I have tremendous hopes of the results of that sort of a movement. I am not at all discouraged with the small amount of moneys

available in Middlesex and in Monmouth Counties, for I think they are working the matter out on a different plan, that is all, and that it will come to pass and I believe eventually the demand will grow to a point that the county mosquito work in those counties will become absolutely county wide.

You have to cut your sail according to your cloth, and that is what these two counties are doing. They found difficulty in getting large appropriations, because, as I said a moment ago, the bulk of the controlling factor is in the back portions of the county where the salt marsh mosquito is not so serious a pest, and in some cases does not even reach.

Now in Hudson and in Bergen and in Essex the salt marsh mosquito reaches all over and the attitude, consequently, is very different. Not only that, the attitude of the city dwellers is entirely different from the attitude of the country men. The country man does not look upon the mosquito as so serious a matter as the city dweller. The city dweller is used to having his comfort looked after to a much greater extent and much more efficiently than the country man, and consequently the country man does not readily take up and support mosquito campaigns, where the city dweller, on the other hand, will do so.

I do not think that we want to be discouraged by reason of the fact that we have small appropriations in some of these counties. With small appropriations we can accomplish wonders and we can at the same time pursue an educative campaign that will finally bring the countywide work in. I am really very much pleased with the progress that has been made.

Now the story in New Brunswick is a long one. I have had a lot of contact with the city commission and I remember one time preparing a plan of \$1,500 for the City of New Brunswick. The commission appropriated \$1,000 and we told them it could not be done for that and that we would not undertake it on that basis. We felt quite sure that as the mosquito work progressed on the salt marshes and the New Brunswick people continued to be bothered with mosquitoes, we would have to answer the inquiries as to why we did not control the mosquitoes by saying that we were controlling the salt marsh mosquito and that the New Brunswick people were to put up money into the local campaign.

The Health Officer of New Brunswick said not over two months ago, "We will spend any sum of money that may be necessary to control our local breeding this year." Now that is the case. And

you can take the case of Freehold, for instance. Only two or three years ago they had an enormous outbreak of *pipiens*; everybody was bothered and complaints came thick and fast. And the Freehold people got in touch with Mr. Van Note, he came up and made a study of the situation, found that the broad field of the sewage disposal plant was the source of mosquitoes; with the result that the Freehold authorities took hold of it, furnished the money necessary to clean up that area, and cleaned up the town, with the final result that those mosquitoes dropped out and they haven't had any infestation since that time. This thing moves out. It can start small and it will move out.

Now I want to make one additional point, that as the mosquito work goes on in one county the results of the knowledge and the results of that work filter over into the adjacent counties, and that that is the most powerful agent for starting mosquito work in that county. There is no other agent equal to it. I have seen this grow right on this Atlantic coast, that filtering out process, and today the results of the mosquito work in Atlantic and Cape May are filtering over into Cumberland, but you will find Cumberland more susceptible to mosquito work than Salem, which is a little further away.

This story is not a short one. It takes a good while to do a job of this sort, but we do not want to become discouraged with it. Just at the time we think we have got everything in this particular county cleaned up in good shape, as I have often heard members of this association say, then in comes an influx of mosquitoes and everybody is discouraged. That is the time to buckle on the armor and stiffen our backbone and find out what the trouble is and put it out of business.

DR. RALPH HUNT: I do not want to take up much of your time, but I just want to bring this matter to your attention. There has been a good deal of talk made on these papers, comparing the work done in New Jersey with the work done in Havana and Panama and such places. Now I think we ought to understand and the public ought to understand that this proposition that we have here and the proposition down there are entirely different things. We are dealing with a different kind of mosquito. We are dealing with the mosquito as a pest and not particularly as a disease producer, as a disease propagator, and we here have to get rid of all the mosquitoes, because they are all varieties and they all bite; but in those particular places they only have to deal with mosquitoes which were disease producers; and there is some difference in the life and habits of mosquitoes.

Now the mosquito, as we know, which carries yellow fever is practically a cat and dog mosquito, a domestic mosquito. It lends itself by its habits to eradication. And that is one reason why they have found it possible to eradicate the yellow fever mosquito in those tropical countries.

The malarial mosquito is a different kind. Its habits of flight do not lend themselves to as easy disposal as the yellow fever mosquitoes. Consequently they have had a much more difficult proposition to get rid of the *Anopheles* mosquito than they had the yellow fever mosquito. They have not particularly concerned themselves except incidentally with salt marsh mosquitoes and other mosquitoes which were not a menace to health, but which were simply a pest for all the people in the family. I think that should be borne in mind.

But if we cannot compare the work done in New Jersey with that done in the tropics—I feel that very heartily—it is certainly a wonderful thing and we should not be discouraged in this work. But we all know who have been in this work from the start that the mosquito today in New Jersey is nothing like the pest it used to be before we began the work. The results have been simply tremendous and we must not be impatient.

There is a little psychology in this thing that one should carry into other walks of life, which tells me and tells many observers that work which begins slowly and proceeds not too rapidly, in making sure of the ground as you go on, thereby establishing a firm foundation, is a good deal surer in its results than quick, flashy sort of work. And perhaps it is a wise dispensation of providence for the money givers of this state that we are not allowed to spend enormous sums of money immediately; but from the evolution of our work in methods, the obstacles we have met, the changes in methods which have been brought about through observation, of necessity have been tremendous in the mosquito work in New Jersey. Our methods have changed entirely in many things in our state.

Last night in the little paper that I read I called attention to the wonderful optimism of Prof. Smith—"In a few years New Jersey will be mosquitoless"—and the method we should use, in his opinion, is working practically to that end. We practically followed his ideas from that time on and have changed them to meet new conditions, always ready to take up a new thing when it offers better results.

So after all there is something, perhaps, in the slowness with

which we are carrying on this work and perhaps it is an asset rather than a liability.

PRESIDENT RIDER: I am very glad to have this explanation from Dr. Headlee. I think he is entirely exonerated for the conditions at New Brunswick. He has made an explanation which I think is entirely satisfactory to all.

Next is Ocean County, our former ex-President, Robert F. Engle. We will hear from him next.

MR. ROBERT F. ENGLE: I have an idea that not everybody here knows just where Ocean County is. It is quite a good sized county, and it has a good many things in it and some bad things—a good many things we do not want, and some of those we are getting rid of. We happen to be very nearly in the center of the state. Those of you who came down here from the northern end of the state in motors realized how pleasant it was to ride over some beautiful gravel roads. Most of that gravel road, except a few miles in Atlantic County, belongs to Ocean County, and most of the time that is the most delightful road to ride over there is in the state, not barring the cement.

We have got a tremendous stretch here of seashore property, about 40,000 acres of salt marsh, which is a little more than our share. Just how all that salt marsh was unloaded on Ocean County I am not enough of a historian to tell, but we are doing the best we can with it. It is an asset as well as a liability. The upper part of the county, adjoining Monmouth County, was early attacked by the state as being the easiest for them to get at with the meagre amount of money the state had given them; and later, when we got awake and got some money, we have carried on the work.

I would say that we have a little more than two-thirds of our initial drainage done. Now it might have been necessary to explain what initial drainage is to this convention some years ago, but from these papers and experiences it is easy to see that you know what initial drainage is. And you also know that a large part of the work has to come after the initial drainage is done. I suppose that if you would take the ordinary child and make him understand what he had to go through in order to make a man of himself he would go out somewhere and commit suicide right off, he would be so discouraged. So if we had known when the late John B. Smith came across with his \$350,000 appropriation to clean up the whole state of New Jersey of the mosquito and if those embryonic mosquito fighters of that time had known what was before them they

certainly would have gone into a hole, as the groundhog has done, for another sleep. But we know the child can be sure to make a man of himself, and this mosquito work is going on about the same way, we are being educated from day to day, and the first thing we know there will be a complete apparatus generated from it that will clean up our state and make it just exactly what we want it to be.

You must bear in mind that the very effect of the education is against us. The more you educate the people to these things the harder your problem becomes, because they know all you know. If they are bitten by a mosquito after this educational proposition has gone forward they say, "Why, here, you fellows were going to kill all these mosquitoes." Now that requires a little explanation, but we are getting so we do not have to explain. We just simply wait until the idea develops in their minds and the first thing we know they are with us and after a while they understand the proposition.

Our problem in Ocean County, as I said before, is the annihilation of our salt marsh menace and that is what we have confined ourselves to. Our board of freeholders has been just as generous, I think, as they ought to have been. We have had an appropriation for several years of \$10,000. This year we asked them for an appropriation of \$12,000. We went before them and simply explained the problem, that our problem was so and so, and the sooner we got the money the quicker we could get through with it, and we would like to have had \$5,000 additional. But they thought it over in their wisdom, considering the taxation in Ocean County, and they said \$12,000 was all they could give us.

We have taken the money and put it in and tried to get the most number of feet of ditches that we could build in order to cover this additional drainage. We have had during this time to go back over and perfect a great deal of the drainage that was done before. What we are doing we are doing worth while and covering our problems as they present themselves.

We have got in Ocean County something like five hundred and seventy miles of ditches. That is quite a number of feet of ditches. When you take it into the millions it is sometimes easier to conceive of than when you speak of it in miles.

We are rather fortunate in the labor market down there. We have a good many men living in the central part of Ocean County who are meadow men, who are either used to haying or ditching or working around the salt marsh and are content to do that. We can so move those men back and forth to their daily tasks and their

homes that we can keep the gang together and get our work done very efficiently and very cheaply.

We have carried out our inspection, covered the meadows about once a week or ten days by the superintendent and his assistants, and our conditions there are such that it lends itself to pretty rapid inspection.

We have not tackled the fresh water problem at all. We haven't any very large cities, very much congested centers of population down there, the larger cities being Lakewood, Toms River, Point Pleasant, and New Egypt away up at the upper end of the county, where they are not troubled much by our salt marsh variety and do not complain much in the way of fresh water mosquitoes.

We added last year to our total number of ditches 367,839 feet. The bulk of this was done by contract at a cost of 2.2 cents per foot. A great many thousand feet were added by our own commission in work.

We have been very lucky in our ditches in their condition as to the cleaning. We have been able to clean the ditches at a very low rate. At the same time we are up against the problem of future cleaning, and we are hoping, as all the rest of you are, and we are looking forward with a great deal of hope to the development of this ditch cleaning machine, so as our ditches require it we can hope to clean them and take care of them at a still lower rate.

We will continue to take care of our marshes as the main part of our program, feeling that until that is done we cannot hope to stop our peak migration. Only three times last year those big crops came off of the undrained meadows. Fortunately last year when those crops came off we were favored with southeast winds, sea breezes, which kept those flights from the beaches. So that the inhabitants of the beaches, if they think back over the summer, will realize that they had wonderful relief, something that could never have happened before without all this work being done.

Our vast territory of trouble is down around the Mullica River. We should have had a large map here showing the black areas. The Atlantic County map in their agricultural report shows very much the situation around the Great Egg Harbor River, and we are all struggling with the ground to the westward of us, that is, from which the prevailing winds occur. As far as Ocean County is concerned we have cut out a great deal of that Mullica River marsh. Atlantic County, as I have told you every year we have talked here, is only interested in their particular problem to the south-

west of them, as it were, and after they have gotten their house all cleaned they promise to come up and clean house for us. We are living in hopes on that problem just the same as we are with some of the others.

I do not think we have in Ocean County any particular problem that is different from anybody else, except perhaps that in the northern part of our bay, Barnegat Bay. There the rise and fall of tide is only a few inches, less than six, and the meadows there, part of them, are very soft and flexible and it is impossible to keep and maintain a ditch. But so far the breeding on those meadows has not been very great.

Now when we come down a little further south, about the Forked River district, the neighborhood of Barnegat, in which we find the bay shore sand appears, we will cut a nice, beautiful ditch across the meadows and let it drain into the bay today and it is all right. A northeast storm or a heavy wind from somewhere comes up and we go and look for this ditch and nature has put a nice little sand-bar across the end of it. To offset that we have right angle ditches and run them away into the creeks and bayous that put out into the meadows. In that way they have gotten along with the job pretty well.

Along the beaches we have a problem there where the ocean used to go over and join the bay, with a line of sandhills, leaving a natural pocket right in the middle. Now that is one of the hardest pieces of drainage that you can get. You have got to cut through that rim of sandhill or find some outlet which is equivalent and then you have got to take care of the mouth of that ditch. The County of Ocean has not done very much of that work. We have had a very good friend in the state and they have done a certain amount of work and we have let them tackle that difficult problem. I think that we ought to have some description later on, if the members are interested in it, as to how this has been handled. A large wooden trunk has been sunk in the sand. I personally have not seen it so I am not able to describe it, but it is quite a problem, and we think it has been solved, by which those glades can be drained, kept open by the force of gravity, in spite of the sand sometimes covering the tip end of this trunk as it goes out in this sand shore of the bay. But we have got a good many records of them and it is pretty expensive, but we are making progress. So that is the biggest problem we have in our territory.

I do not know that there is anything else that can be added at

all for your information regarding Ocean County. We are getting along all right. We need more money, and as our enemies are dying off one by one, or being converted, which is much the same thing, it is going along all right. We have some flourishing resorts down there that are holding their heads up now and are forgetting what the old mosquito used to do to them. It is an unfortunate fact, however, that there is just as much fuss made over six mosquitoes as there used to be over six hundred. (Applause).

SECRETARY HEADLEE: Relative to the outlet of those glades, last June, nearly a year ago now, a wooden trunk was installed running from back of the sand rim at the mouth of the pocket, entirely under the sand, being kept about eighteen inches under the sand, out into the bay. This was carried out something around one hundred feet, and at the end of that hundred feet a box, still being under the sand, an upright chimney was placed, which came about six inches above the sand bottom of the bay. Now a tide-gate was placed on the inner end, which allowed the water to go out but was planned not to allow the water to come in.

Now this was an experiment and it was hoped that this tidal outlet would stay open. Ever since that time the thing has been under observation, so we have all last summer's experience, we have all last winter's experience and all this spring's experience on it. We thought at first that the seaweed would be sucked into the tube, because we soon found that this gate, instead of closing, because the difference in tide level was small, it simply flopped back and forth except on exceptionally high tides. In order to keep the moss from the glade from going into the trunk and the seaweed from sucking into the drain, at the other end we placed wire screen, quarter inch mesh, over each opening, and within a week of that time the entire outlet was absolutely plugged as tightly as could be. Mr. Walden was observing it. He went down there and found that condition and finally decided to investigate the screen. He pulled the screen off the chimney at the outer end, let it go down the tide gate well and pulled the screen off the inner opening; and as soon as he pulled the screen off the inner opening he found the screen was absolutely felted into a mass so that no water could go through it. As soon as he pulled the screen out the water shot down the tube and shot back immediately, struck the center plug, shot back immediately and wet him from head to foot; and by the time he got his head out of that tide gate well the sea water was coming up on the outside. As soon as the plug had been blown out there

was a stream of water shot above the surface of the bay eight or ten inches.

Therefore we decided to leave off the screens and we have left off the screens, and in spite of the seaweed, in spite of the flooding up of our sand gate, that trunk has been working there from that time to this, and it looks as if we have in that trunk a method of operating those gates which will stay open and which will provide adequate drainage. (Applause).

PRESIDENT RIDER: Now we will skip over Burlington County I see nothing here from Burlington County. I think Burlington County is responsible for a good many mosquitoes up in the neighborhood of Ocean County. The next one is Atlantic, represented by Dr. Darnall. I don't think he needs any introduction to this audience.

DR. WILLIAM E. DARNALL: Gentlemen, Atlantic County is very glad to be your hosts again on this delightful occasion, always glad to see you.

We began the year thinking very seriously of some way to increase our efficiency, some way to cut our ditches a little faster and get along over the fifty thousand acres from which the drainage had to be removed.

After thinking over the subject very carefully and realizing that our old cutter and our old ditching machines plugged along slowly, Mr. Reiley took some tests and found that we were losing about one-third of our time shifting machines around and pulling cutters out of the ground, etc. It took about five men to get our cutters out of the ground and stick it in again. It took some little time—it took fifteen minutes—took some little time to shift around the stationary engine and pull it by its own power from place to place.

So the first development was to improve that cutting plow to some extent and put improvements on it so it would pull itself out of the ground, and we did not need the men. He constructed a device to accomplish this, and now since the plow is finished it has got this A shaped affair raised up and coupled up for it to pull out and put in again, and it saves a great deal of time.

Well, then, the second thing that we had on our minds was to do something to get along a little faster. We did not think our old stationary engines were getting along as fast as we could get along. And we began to investigate the tractor situation. We had tests made of various tractors and finally decided on a tractor which with certain modifications we thought would work. That was put

through and the developments and improvements have been made to the tractor which Mr. Reiley will describe to you this afternoon and which he hopes to demonstrate to you tomorrow morning on the marshes. The result has been that with the tractor and the equipment we have now, instead of the highest number of feet of ditches we could cut with our two machines and two squads of men being 4,500 feet a day, now, with one tractor, we have cut 9,200 feet a day. We have only one, but we believe with another we ought to increase our efficiency four times. So I think that is a very decided advance and a very decided increase in our efficiency and methods of getting along. And that is one of the big things for Atlantic. I think it is one of the things we should be very proud of.

The ditching started by this new tractor on the 16th of July. We found again that the spurring was getting away behind. We cut ditches so fast we could not keep up to them. So we thought it over to see if we could not use that tractor to do some spurring, and we constructed a cutter that cuts about eighteen inches instead of thirty, for the spurring, and you can hitch that up to the tractor and cut your spurring work and get along very much faster than you can with your old hand spurring.

Of course the short ditches we still have to cut with the hand spade, but the tractor is very efficient lots of times in doing spurring and keeping up with the work.

One question I want to emphasize that I think is very important, and I do not think some other commissions do think so, and that is the filling up of holes with sod. When you fill up a hole with sod you have destroyed that hole forever; you do not have to bother with it any more. We feel that the filling up of holes with sod as we go along is a very important part of this work. We have been forced to fill those holes for several reasons. In the first place, if you do not fill them up the high tide comes and floats them everywhere, and therefore we have a great deal of complaint from the haymen and baymen and oystermen of floating sod that get over the oyster beds, and they also plug our ditches and make trouble for ourselves. Now as we go along, if we have adjacent holes that we can fill up it makes the work a little bit more expensive per foot, but it is well worth while doing, and when you have filled up your holes you have provided for the sods not to float and you are destroying the breeding places forever. And we filled up 15,617 square feet of holes.

The footage for the year was nearly half a million feet, 456,356.

15,000 square feet of holes represents about 7,200 holes. We have at the present time about 6,710,780 feet, or 127 odd miles of footage.

We had ideal weather all last summer, as you remember, for mosquito breeding. You often times forget the weather day by day. You not often can tell what last Thursday was, a week ago. But if you remember, last August was actually a rainy season. It rained all the time. Well, in spite of that Atlantic City had only one night of trouble with mosquitoes, and that occurred on an occasion which is a very rare one here, considering the prevailing direction of the wind, from the south and the southeast. We never get mosquitoes on a north wind. We have only done so twice, I think, since we have had the commission. At the time that we were filled full of mosquitoes last summer there was a north wind. It was very amazing.

As was said about fresh water inspection, we keep track of that very closely. Our inspector is on the job all the time all the season. We feel that we have the fresh water problem solved. We have it under control by reason of the fact that we watch it all the time, and we have it very thoroughly collocated and systematized, so that when breeding breaks out it is not so very long before we have it.

But I do think that the Atlantic Commission should feel a little proud and a little perhaps of vain-glory in the fact that all the improvements, pretty nearly—I do not say this to boast, but I say it simply to give credit—Atlantic's commission has led the state in two or three different ways. It has led the state in the amount of work done; it has led the state in the progressive new methods: first, the scheme that we are all familiar with now, that was invented, put out, by our former chief inspector Mr. Eaton, and then the improvements that have been made, it seems to me, have led the state and led in progressive ideas. And I feel that due credit should be given to those two representatives of our commission, our two chief inspectors, our ex-chief inspector, Mr. Eaton, and our present chief inspector, Mr. Reiley. Mr. Reiley will have something interesting to say to you this afternoon, and I hope as many of you as can will go out on the marshes tomorrow morning at ten o'clock and see the demonstration. It is a wonder.

A MEMBER: In filling up those holes on the side do you use the tractor to pull the material over to it?

DR. DARNALL: No, I think not. There are sods close by and they simply pull them over with a hook.

THE MEMBER: Hasn't that been tried?

DR. DARNALL: Likely, yes.

THE MEMBER: I thought perhaps you used the tractor and skid to pull it over.

DR. DARNALL: It probably could be if you had to pull it any distance, put a hook in it and pull it along.

MR. ENGLE: I would like to ask Mr. Darnall if those north wind mosquitoes were any different from the south wind mosquitoes we get.

DR. DARNALL: The same old thing.

PRESIDENT RIDER: You can determine where they came from, they came from the Mullica River.

MR. ENGLE: That is what I wanted to bring out. I am very glad they got a little dose. I think they are the same kind of mosquitoes we get up our way.

PRESIDENT RIDER: Our people up along the Mullica River are getting very anxious that we should get up that way. They are anxious, and justly so.

Next is Cape May County, William Porter is Secretary.

MR. WILLIAM PORTER: Mr. President and gentlemen: This is the last of the chapter. If anybody should not know where Cape May County is we will point it out on the map. It is down here at the dead end of the state. You can't go any further unless you want to swim. You have heard from the north, where some of these *Anopheles* mosquitoes come from, but if you come down here you will find many more, at least five years ago.

You know all these papers and all these reports travel in parallel lines. They can't be very much different from one year to the other, because they are all doing the same things, very largely. As you remember, last year, when we had the pleasure of reading a report, we had something to say like this: all the mosquito work will not be done when the initial ditching is finished. And we use this little comparison from a certain doxology that is often sung in a certain church: "As it was in the beginning, is now and ever shall be, world without end." So the cleaning will have to be continued long after we have done our little existence; and long after the initial ditching has been done.

Now Cape May County, the dropping off place, is also a fitting place to conclude this ceremony. Fearing the unfortunate predica-

ment, as some of the other gentlemen have been in, that we were going to read somebody else's paper, the Secretary of the Cape May County Commission, of which I happen to be the gentleman, is part of a sort of Poobahism, holding public offices in which he gets very little time in which to write up on mosquitoes, and so occasionally he puts a squib into the paper.

Up to the time in which the mosquito work began in Cape May County it was scarcely bearable in the summer time. I believe I recollect a little incident of a friend of mine that used to come down to Cape May Point. I think I related this last year. He is a musician, a man older than myself, at least by ten years. He used to come down to a place known as the Delaware House, at the extreme point of the cape. It became infested with mosquitoes. At that particular time there was a bar; prohibition was not in existence then; and the gentlemen, musicians, used to invite themselves up to the bar, and when the beer was on, the foam reaching to the top, he immediately discovered that it was black with mosquitoes and he had to blow them off with the froth. Over there they sat in a little open pavilion and it was necessary to cover it around with a mosquito netting so that they could play without so much discomfort. But now you can go anywhere in Cape May City, and about three times in the summer you may have mosquitoes, but not more. Even last summer, with all the disadvantages of weather, we only had two severe infestations, of about two nights each. Fortuntaely the wind was in our favor, but unfortunately it was not in favor of the last gentleman, but so it was with us. You know a southeast wind does not give us many mosquitoes; it takes a westerly wind to do it.

Now if it is not imposing upon you, and as the Secretary wishes this paper read, we will proceed. There is a certain creed in certain churches like this: "Whosever will be saved, before all things it is necessary that he hold the Catholic faith." I want to paraphrase it this way; "Whosever will be saved must believe in mosquitoes extermination."

MR. WILLIAM PORTER: As we review the work of the Cape May County Mosquito Commission for the season of 1920, we feel more than satisfied with the results, although we fully realize there might be a difference of opinion if the matter were taken up with those not connected with the work.

In spite of the weather conditions and the great storm late in the winter; which damaged all our drainage systems, this commission reduced the *Aedes sollicitans* to the point where they were only a

the winter; which damaged all our drainage systems, this commission reduced the *Aedes sollicitans* to the point where they were only a nuisance in the sections which have not been drained. The wet summer, unfortunately, produced numerous small breeding places around the more thickly settled sections and resulted in enough fresh water mosquitoes to make our pessimistic friends doubt the benefit of the salt marsh work done by the commission.

Maintenance work is one of the largest problems that confronts us in Cape May County. Each year the amount of ditching installed grows greater and the work necessary to keep the systems in order increases, as also must the amount of money used in this work. In another year it will be necessary for us to divide the county into districts, each with an inspector and laborers responsible for the conditions of that section.

The sluices and tide gates which have to be placed at all marsh lands on the Delaware Bay shore, although not a difficult problem to install, use up the greater part of our appropriations and thus keep us from advancing as rapidly as we would like with the new ditching systems.

At the beginning of the 1920 season for mosquito control work the commission was confronted by a serious problem. The great amount of ditching installed in the various marshes throughout the county was badly blocked by the debris from the great storm tides and required immediate attention; the labor question was serious and a sufficient force, to do the work rapidly, practically unobtainable.

Due to these conditions it was decided to adopt a policy of first cleaning all the old ditching systems and putting them in perfect working order and to use what time and money there was left for permanent work.

The balance of the season, after the completion of the maintenance work, was spent in new ditching. 117,451 feet were dug in various parts of the county. Cape May has about 54,000 acres of marsh lands, 45,000 acres of this being salt marsh. About two-thirds of this will have been drained at the end of the present season.

The board of freeholders appropriated \$15,000 to this commission; which has been applied entirely to the draining of the salt marsh meadows for the control of the *sollicitans*, the most numerous species in this county. The drainage of the marshes will require several years for completion but the number of mosquitoes is decreasing each year as the work is extended and when the work is

finally completed the results obtained will be well worth the time and money expended.

The commission is steadily advancing in the work of mosquito control and each year troublesome breeding places have been permanently done away with or put under absolute control and all the meadows; which have been drained, are now in excellent condition.

During the five years of this commission's activities, to the beginning of the season of 1921, 1,326,373 feet of standard ditches have been dug on the various meadows. The Cape May County Board of Chosen Freeholders during this time, appropriated \$53,000, which was spent entirely on salt marsh work.

TREASURER'S REPORT FOR 1920

RECEIPTS

Cash on hand	\$822 74	
County Collector, Appropriation	15,000 00	
Board of Health, Cape May	68 25	
Sale of Runabout	150 00	
		<hr/> \$16,040 99

DISBURSEMENTS

Administration	\$1,847 65	
Inspection	997 00	
Labor	10,522 47	
Equipment	1,640 87	
Miscellaneous	84 73	
		<hr/> 15,092 72
Cash to balance	947 27	
		<hr/> \$16,040 99

NOTE—Chief Inspector's salary is included in Administration.

REFERENCE

- Total feet of ditching, 1,326,373 feet, 251 miles.
- Acres Salt marsh, 42,858.
- Acres Fresh marsh, 2,295.
- Acres Cedar swamp, 6,355.
- Appropriations, \$53,000.
- Area of County, (a) square miles, 255; (b) acres, 163,200.
- Population, 24,407 (year around).
- Assessed valuation (1918), \$38,545,109.00.

DITCHING IN SECTIONS

	<i>Feet</i>
Pond Creek	103,490
Mill Creek	197,056
Cape May	59,050
Ocean City	(state work)
Beesley's Point	367,000
South Cape May	58,817
New England	73,511
Cox Hall	51,650
Two Mile Beach	56,474
Spicer's Marsh	35,188
Fishing Creek	81,575
Shaws Meadows	4,860
Wildwood	178,013
Sea Isle City	15,910
West Cape May	1,200
Anglesea	6,630
Anglesea, Stone Harbor, Court House.....	100,000
Green Creek	8,181

Now we have also one thing more. Very little help has been given to us by any of the local authorities or municipalities. Cape May City has, through its board of health, attended to one very important item, and that is the oiling of the sewer inlets, of which we have about one hundred and fifty in our district. The Board of Health of Cape May City has paid the bill for this commission to do the work, inasmuch as they had no conveniences to do it themselves. Now all the other municipalities along the shore haven't done anything, have not yet got awake to their own local interests. Cape May Point and West Cape May in two previous years contributed about \$200 to the work which this commission has done in their territory, but since then nothing; nothing for this year.

I believe that is about all, Mr. President. (Applause).

PRESIDENT RIDER: We will now pass from New Jersey to Connecticut. We will hear from Dr. Britton, State Entomologist of Connecticut.

MR. SEELEY: Dr. Britton was unable to come down here today, and I have been in direct charge of this work and he has asked me to read the paper.

The Connecticut law provides that three-fourths of the cost of new work be provided locally, the other fourth to be borne by the state; then the Director of the station can make contracts and supervise the work, and the bills will be paid upon order of the State

Comptroller, who will collect three-fourths from the town or local organization raising the funds. This system might be satisfactory if the people in all mosquito-infested towns were equally interested in getting rid of mosquitoes, but such is not the case. Consequently we have certain communities and towns which have taken advantage of the state aid, raised funds and have ditched their salt-marshes. Perhaps adjoining towns have taken no action, consequently the work which has been done is more or less sporadic and spotted, because it is necessary to depend upon local initiative.

As an example, all towns from the New York State line as far as Westport have ditched their salt marsh areas, and the same is true of Fairfield, adjoining Westport on the East. Westport has taken no action, yet it breeds mosquitoes, not only for home use but supplies a goodly number to the adjacent towns, which have done and are doing all they can to eliminate the pest from their own territory. Likewise the salt-marshes of Orange, New Haven, a large part of East Haven and Branford as well as Guilford and Madison have been ditched, but there is a small section lying between Momauguin and Branford River and a large portion of the Quinnipiac Marsh in North Haven still unditched and the towns raising the funds for this work do not and cannot obtain the maximum benefit from their efforts and their expenditures, until this adjacent breeding territory is cleaned up.

Believing it to be a statewide matter, a large number of interested and influential men formed an organization, and attempted to obtain the necessary legislation to permit the state, through the Director of the Agricultural Experiment Station, to initiate work wherever it needs to be done, and asked for an appropriation sufficient to ditch within the next two years, all the remaining unditched salt-marshes in the state, and some of the worst fresh water swamps. On account of the present financial condition of the state, every effort is being made to cut down appropriations and to devise new tax measures to avoid a heavy deficit. Consequently the time is not opportune to obtain large appropriations for anti-mosquito work. In spite of this, it at first seemed probably that the new legislation would pass, perhaps with a small appropriation, which would enable the director to connect up the areas already ditched. A hearing was held on February 16, before the Committee on Public Health and Safety, to which this bill had been referred; a good case was presented and no opposition was recorded. At that time and on several occasions thereafter, members of the committee stated that

probably a favorable report would be rendered and the bill referred to the Committee on Appropriations. Imagine our surprise to learn five weeks later, that an unfavorable report had been made and accepted in the Senate and the bill rejected. The opposition was inside the committee, which apparently did not favor a change in policy at this time.

The only new work carried out during the year was the ditching of sixty acres at Groton Long Point, where 28,000 feet of 8x20 inch ditch was installed by Eaton, Brown & Simpson, Inc., of New York. This ditching was done and a bridge over the main outlet, constructed by this firm at a cost of \$1,000.00, three-fourths of which was subscribed by the members of the Groton Long Point Association. As there are no other marsh areas in the near vicinity, this work should bring marked relief to the locality from the mosquito pest.

Preliminary surveys of mosquito conditions have been made in a number of localities; one at the request of Mr. J. Frederick Jackson of the State Health Department, covering Lydall's Brook in Manchester. This stream is polluted by waste from paper mills and other factories and the house or rain barrel mosquito was breeding abundantly in it for a distance of nearly three miles. The State Health Department has taken up this matter and will probably find some solution of this problem.

During the season, all work done in former years and coming under the state aid plan has been properly maintained under the supervision of Mr. Sealy. The total cost for the year of all new work and maintenance, including supervision, amounted to \$6,199.89.

PRESIDENT RIDER: We have yet remaining two papers on the morning program, which it was thought best to put over until after dinner, as our people are used to New York time and we are getting hungry, and we want to get dinner on time. Of course we are an hour later. But there are some matters, I understand, that we want to consider briefly before adjourning.

MR. ROBERT ENGLE: I think everybody here has noticed the fact that we have got to depend on the women for a good deal of help. We always did, but we did not always recognize it. And they have come to the front recently very strongly and I believe that therein lives one of our greatest hopes. If we can enlist the women in our campaign we certainly can get a good deal further than we have gotten, and I know they are anxious to help us.

Last Fall, I think it was, the Women's Republican Club was

formed. They had a meeting at the Robert Treat Hotel in Newark and they expected about two hundred women to respond to the call to form or concrete this Women's Republican Club; and instead of two hundred there were nearly seven hundred women reported at that time. Now I will defy anybody to mention any call sent out to a lot of men, no matter what the cause, unless it be a jamboree of some kind, that will be responded to like that.

Now if there is that much enthusiasm in simply joining a club let us with our big project approach these women and get them into partnership with us. It so happens that we have the spring conference of the New Jersey Women's Republican Club starting today at one o'clock or two o'clock this afternoon. Tonight they have an informal reception in the convention room of Haddon Hall. They are to be addressed by Senator Edge. And as I came out from the moving picture exhibit there a little while ago a lady who is from the upper part of the state, from Morris County, very much interested in mosquito work, said, "Why don't you get the women to help you?" "Well," I said, "We want to." She said, "Why don't you go and tell them about it tonight?" I said, "I think that is a very good idea. Do you think they would like to see us?" She said, "I am sure they would."

So I have had it on my mind ever since, and I sent an emissary, or an emissary volunteered to go, and Mrs. Feichert who was President, said they would be very glad to hear us.

Now, gentlemen, I suggest that we have an almighty good spokesman here in this audience for this cause, a man who knows how to talk to anybody, particularly the ladies. He has made this work his lifework, almost, and I feel sure that you will agree with me that if Dr. Ralph Hunt would present himself to the ladies this evening and tell them our project and ask them to help, that he would meet with a good reception and the mosquito cause would suffer no setback. I make that a motion. (Applause).

PRESIDENT RIDER: Is that motion seconded?

(The motion was seconded).

PRESIDENT RIDER: Are you ready for the question?

(The question was called for).

PRESIDENT RIDER: All those in favor say aye; opposed no. It is a unanimous vote, Dr. Hunt. You will see that our association is properly represented before the ladies.

MR. DOBBINS: May I call your attention to Mr. Howell's paper of last night. I think that paper was passed over rather lightly.

It seems that Mr. Howell has gone into certain ideas that are essential to this work and I think if his ideas were taken up and investigated we might get some benefit from it. If it meets with your approval I would offer a motion that his paper be referred to the Executive Committee of this association.

(The motion was seconded).

PRESIDENT RIDER: The same thing occurred to me last evening. I waited for some time for some motion of that kind, but it seems we were occupied with something else and neglected it.

All in favor of the motion say aye; opposed no. It is so referred to the Executive Committee.

SECRETARY HEADLEE: Mr. Chairman, on next Monday one of the Atlantic City papers expects to run a very full account of the convention with pictures, and it is intended that the pictures shall include a picture of the men in a group at this association, and a picture of the ditching machine, in fact several pictures of the ditching machine in operation. And the photographers are outside and they want your pictures for this purpose; and it seems to me that it is a good, first-class proposition to give them that picture, in order that it may be used in the paper. If you are inclined that way all we have to do is to walk through this hall to the first outlet just across this open space, right down here alongside the building. The photographers are out there and in a few minutes they will have the picture and you can go to dinner.

Now as regards the afternoon session, I think the Chairman did not mention that the afternoon session should begin not at two o'clock but at 2.30, so that you may have time to get your dinners.

FRIDAY AFTERNOON SESSION

(The meeting was called to order at 2.40 P. M. by President Rider).

PRESIDENT RIDER: The meeting will come to order. There were two numbers on our morning program that were not carried out, and we will take those up first before the business meeting.

Next will be "Anti-Mosquito Work in Nassau County," by W. M. De Mott, Chief Inspector, Nassau County Mosquito Commission.

The Nassau County Mosquito Extermination Commission was organized in June, 1916, with county wide powers directed by law to exterminate mosquitoes throughout the extent of Nassau County.

SALT MARSH.

During the past four years, the commission has installed a little over 5 million linear feet of ditches on the salt marsh from Inwood to Seaford, draining an area 14 miles long and 3 miles wide, at a cost of \$38,827.47.

During the season of 1920, a salt marsh labor crew consisting of 21 men was employed for maintenance and patrol from April to October 1st. The cost of maintenance and patrol was \$10,471.59.

After the maintenance and patrol work was discontinued, the commission employed a labor crew to install new ditches on the mainland areas at Seaford, using the new salt marsh ditching spades which I have invented.

With these new spades we can install the main 10x30 inch ditches for two cents per linear foot, and the spur 8x20 inch ditches for one cent per linear foot. We are saving money by installing our own ditches. We have carried on the ditch digging all winter, and have drained some of the worst breeding areas on the salt marsh in the county.

There was a marked decrease of salt marsh mosquitoes from Inwood to Wantagh, a distance of 12 miles on the South Shore, and no salt marsh mosquitoes on the North Shore from Great Neck to Cold Spring Harbor, a distance of 17 miles.

We found our worst breeding areas on Long Beach, Nassau-by-the-Sea, and High Hill Beach where very little work has been done to eliminate the trouble. During the season of 1921 special efforts will be made to get these beaches under control.

NORTH AND SOUTH SHORE UPLAND FIELD WORK

For the purpose of mosquito control on the upland, let us first make a study of malaria. From whatever angle it is viewed, the malaria problem must appeal to any thoughtful person as one of the chief questions in any community where it is prevalent. Health must be considered as one of the main aspects of any place.

Why is it important? It is important from simply the standpoint of health. Physical preparedness underlies all other preparedness. Malaria is a subtle disease. It constantly lowers the efficiency of the patient, it decreases the resisting power of the system to throw off other disease germs, it enters frequently into complication with other diseases and, at times, makes diagnosis uncertain.

Why should the presence of malaria be kept secret any more than other diseases? Malaria can be prevented.

How? By exterminating the *Anopheles* mosquitoes and keeping their breeding places under control, by organizing a system that will enable the men in charge of the inspection and oiling to get over the territory often.

The chief engineer must be in constant touch with his men, co-operating with his force at all times, and with but one object in view—mosquito extermination and malaria control.

In Nassau County we have had a long fight against the *Anopheles* mosquitoes as our malarial problem has been a serious one. Following is the record made by the commission since its organization in 1916.

Previous to 1916 the number of malaria cases in four communities was 475 annually. During the year 1916, the number of cases in these four communities was reduced to only 56; in 1917 to 51. Then in 1918 the automobile transportation was installed and we reduced the number of cases of malaria for the whole county to 5; in 1919 to 3. During the year of 1920 the *Anopheles* mosquitoes were fought to a standstill, although breeding was found in 24 communities. The field force worked with untiring efforts to keep malaria out of the county with the satisfying result of no cases of malaria in Nassau last year.

We are also fighting and exterminating the *Aedes and Culex* mosquitoes that are found breeding when inspections are made of the upland violations. Following is the percentage of the different kind of breeding found and exterminated on the North and South Shore field work during the year 1920:

	South Shore	North Shore
<i>Culex</i>	46%	48.2%
<i>Aedes</i>	49%	12. %
<i>Anopheles</i>	5%	39.8%

To date no attempt has been made to start a house to house campaign against the *Culex pipiens*, as we have a large number of field violations to keep under control. This year we anticipate starting the house to house work in the incorporated village of Freeport.

Our yearly appropriation is not sufficient to carry on a county wide house to house campaign together with the salt marsh drainage and the upland field work, so we are going to clean up one village at a time until we get all of the salt marsh drained and under control.

Summary of upland work season of 1920:

Total number of owners of violations.....	652
Total number of inspections.....	12,595
Total number of times breeding killed.....	1,877
Total number of gallons of oil used.....	16,443
Total footage new ditches installed.....	28,864
Total footage old ditches cleaned.....	663,449
Total footage old ditches recleaned.....	12,425
Total number of ponds lowered.....	34
Total number of swamps drained.....	1
Total footage pond edges trimmed and cleaned.....	5,000
Inspections made every 6 days.	
Territory under control, 200 square miles.	
Cost per acre, 12 cents.	
Number of malaria cases in entire County, 0.	

AUTOMOBILE TRANSPORTATION

The commission owns 8 automobiles, 3 motor boats, and 1 motorcycle which are used as follows:

Two suburban body cars are used to transport the upland labor crews.

One touring car for the chief engineer.

One motorcycle for the machinist (used to reach a break-down).

One truck for the salt marsh mainland labor crew.

Three boats for the mainland and island areas.

Four small commercial cars for the upland inspectors.

The upland inspectors' cars are equipped with a small box body, large enough to carry one barrel of oil, two spray pumps, and 2 four gallon oil tanks.

Instead of employing a man to do inspection and another to oil, I combined the work and had the inspector do the oiling. I am very much in favor of team work; two inspectors work together better than one alone. This is the method, 1 automobile, 2 men, 1 barrel of oil, 2 small oil tanks and pumps, hose, and spraying nozzles attached.

Inspections are made and when breeding is found, the violation is oiled, and the larvae killed immediately.

Following is the cost of operations from April to September 30th :

Chief Engineer, Secretary and Clerk.....	\$2,526 00
2 District Inspectors.....	1,663 00
11 Inspectors	7,287 50
2 Foremen	1,200 00
24 Laborers, salt marsh and upland.....	11,834 00
Total	\$24,510 50

MOTOR TRANSPORTATION

Repair parts, 8 cars, 3 boats, 1 motorcycle.....	\$375 57
Gasoline, 8 cars, 3 boats, 1 motorcycle.....	1,181 34
Lubricating oil, 8 cars, 3 boats, 1 motorcycle.....	64 50
1 machinist	685 00
Total	\$2,306 41
Cost per vehicle per month.....	\$32 04
Cost per vehicle per working day.....	1 24

One big factor of our success is our motor transportation. We have a fully equipped repair shop and one expert machinist who keeps the cars and boats in perfect running order.

Unquestionably, motor transportation has given Nassau County mosquito extermination.

PRESIDENT RIDER: This report was very gratifying. As the result of work in Nassau County, if all the counties that are affected with mosquitoes would do as effective work we would soon learn to appreciate the absence of mosquitoes.

"Anti-Mosquito Work in Greater New York," by Eugene Winship, Sanitary Engineer for the New York City Department of Health.

Mr. Chairman and Gentlemen: At the request of Dr. Headlee, it gives me extreme pleasure to present for your information, a brief resume of anti-mosquito work in Greater New York since its inception.

Greater New York has been an active participant in the work of mosquito extermination since the year 1903 to the present time.

Doubtless there are a number attending this convention, who have passed through the experimental stages of the anti-mosquito campaign. Taking it for granted that the delegates at large are fully conversant with the difficulties encountered, and overcome, during this period of stress and hardship it is not my intention to insult your intelligence by enlarging upon this phase of the work.

The character of the work, and the methods employed are so well known that we do not think it necessary to take up your time by a descriptive detail. While many methods have been employed with more or less success, it has been agreed by the authorities, that the present methods employed are most economical to obtain the required results; namely, filling, ditching, and oiling, when necessity requires, pending permanent improvement.

The period between 1903 and 1905 was spent in experimentation, with a view to determining the greater source of supply. Oil was distributed promiscuously with indifferent results. Finally it was learned that the salt marshes were responsible for the greater number of mosquitoes.

In 1905 a contract was let, and the digging of ditches on the salt marshes in Staten Island was commenced.

The development of anti-mosquito work in Greater New York absolutely depended upon the success of the initial work. Because of the success of this work the authorities were assured that the proposition was practical, and could be accomplished. The necessary funds were appropriated, additional contracts were let, embracing all boroughs with the exception of Manhattan, and a permanent force of mosquito exterminators established. At the present time all the salt marshes have been drained in the city limits.

Our work is largely augmented by the efforts of the regular sanitary force of Inspectors, and is a part of their regular district work. Local breeding is practically taken care of in this way under a section of our sanitary code provided to cover the breeding of mosquitoes.

We have been particularly successful in securing the co-operation of the various civic associations, private interests, and realty operators throughout the city.

As a result of our work we find that after a number of years the drainage system as applied on our salt marshes requires supplementing because of its solidification. This is being done as rapidly

as possible with the force available. It must be borne in mind that tide covered areas require no drainage.

The area of activities is gradually decreasing, because of fills completed, and in progress, public improvements by private interests, and pump fills, covering large areas of what was formerly salt marshes, prolific breeding places for mosquitoes.

From the foregoing it must not be inferred that our progression has been without let or hindrance. In many cases we find our work wholly or partly nullified by artificial conditions, created by commercial interests, which, however, are only temporary, and which eventually will be abated. Physical conditions occur through human agency, which can only be overcome by persistent effort.

With a few exceptions we have no hesitation in stating that as a whole the salt marsh area in Greater New York is practically immune from the breeding of mosquitoes. The exceptions are due to the filling in of creek beds intentionally or otherwise, which necessitates the grading of ditches; and obstructions caused by commercial interests which are being corrected as expeditiously as possible.

We have endeavored to anticipate the change in physical conditions, and find that our efforts in this direction have been worth while. Excellent results have been obtained by early spring work, opening outlets, even though drainage ditches remain frozen, thereby permitting the ditches to flush thoroughly, when released from the clutch of winter. During an open winter there are very few days, either on the salt marshes, inland swamps, or water courses, when we cannot work to advantage.

It is impossible to estimate the resulting improvement in the health and comfort of our 6,000,000 population. Large sections of land, at one time under water, are now thriving farms. Home sites are now available that were formerly inaccessible, permitting the settlement of sections otherwise impossible without drainage and the elimination of the mosquito pest.

The original costs and maintenance of the work is very small in comparison with the increased revenue derived from taxes and other valuations of marketable value, which have increased in proportion.

The days of experimentation are past, and the finish of the mosquito, as an economic factor is in sight. It has been a long and bitter struggle against natural forces, and until recent years, the hostility and indifference of mankind. However, until we have eliminated the mosquito as a factor in our lives, we cannot afford

to relax our efforts. Co-ordination and co-operation from every source are absolutely essential before we can accomplish what we have fully determined to do. We must have the good will and implicit faith of those we are striving to benefit. Once we are assured of the foregoing, nothing else matters. Undoubtedly propaganda that can be readily assimilated will gain many recruits and beneficial results realized not only in the present but in the future generation. Last but not least enthusiasts not only to lead, but, content to follow, ever keeping in mind that humanity is the beneficiary.

In Greater New York from 1905 to 1921 there was a total of 14,085,621 feet of ditches dug at a cost of \$444,952.98, draining approximately 25,000 acres of salt marsh and inland swamps. In addition there has been \$700,000.00 worth of work done by private interests.

The maintenance force employed annually and on a per diem basis, including equipment and supplies, costs the City of New York about \$50,000.00 per annum.

In conclusion, in behalf of the Department of Health, City of New York, we wish to thank the states and counties, contiguous to the Greater City for their co-operation during the past year.

PRESIDENT RIDER: We are very glad to hear from our neighboring city of New York.

We have with us today our friend Dr. Howard, who you have seen here before and heard, and he is obliged to leave, I understand, sooner than arranged on this program, and it is suggested that we let him take the place of what was to be the next on the program, a business meeting, and postpone our business meeting until after we hear from Dr. Howard. It gives me very great pleasure, gentlemen, to reintroduce to you Dr. Howard. (Applause).

DR. L. O. HOWARD: Gentlemen, I always feel as if I were somewhat out of place before the New Jersey Mosquito Extermination Association, because I am not able to talk about the exact and particular problems that you are dealing with so successfully; but Dr. Headlee assures me that your interest in mosquito problems extends beyond the state problem and you are interested in everything connected with mosquito work.

A year ago I gave you a general summary of mosquito work which has been going on in the world and has been going on since the beginning of the world war. At this convention Dr. Headlee suggested that two of my very competent assistants, Drs. Van Dine and King,

who are carrying on some plantation work in Louisiana, send up a paper, and they were unable to come themselves but sent their paper, which concerns one, especially, of the very interesting problems.

Five or six years ago I gave a talk about the initiation of this experiment. Down in the south repeatedly, in the richest part of the south, which is the delta region of Louisiana and Mississippi, where the soil is richer, probably, than in any other part of the world except possibly the delta of the Nile, the great obstacle is malaria, and the planters down there have realized for a good many years that there is an enormous economic loss from malaria among their laborers. Now we have gone into a large plantation to see if we can find out exactly what the economic loss is and how it may be abolished. We worked on that for some years. And this paper of Drs. Van Dine and King deals with one particular phase of this question. I shall read only two or three pages of this manuscript and hope that you will find it interesting enough to pay you to read it, so that you can get the details better than I can give you in this short time.

DR. L. O. HOWARD: In connection with a general study of the biology of malaria mosquitoes on a plantation in the lower Mississippi valley, a large number of collections of adult *Anopheles* have been made over a period of several years (1914-1920). The following report is an analysis of these data to show the average abundance of malaria mosquitoes in the typical rural community and among the class of residents most affected by the disease. No attempt is made in this paper to compare the abundance of *Anopheles* with local breeding conditions, or with any other contributing factors that influence abundance.

The collections were made on a plantation located at Mound in north-east Louisiana. In this plantation there are approximately 1800 acres of open land of which 1200 acres are in cultivation under the negro tenant system of labor. Cotton is the principal crop grown with corn secondary. The remaining 600 acres of open land is devoted to pasture and hay with some cotton grown on the day-wage system of labor which is drawn from the tenant class. There is an average of 69 tenant families on the plantation with a tenant population of 296 persons, giving an average of 4.26 persons per family. Each family cultivates an average of 17.4 acres of land. The tenant houses are scattered over the plantation in typical rural fashion, each tenant being located on the land assigned to him for cultivation. The open land is intersected by

roads and bayous separated into fields of varying extent by timber growth and by undrained portions of the plantation, so that the distances between the houses are greater than would be indicated by the comparatively small amounts of land cultivated by each tenant. The collections considered in this report are those taken from the tenant houses only, those from the town of Mound not being included. Thus the results apply strictly to the rural conditions found on a cotton plantation in the delta.

An indication of the malaria infection among the tenants on this plantation is shown by blood examinations which were made during August in 1915, 1916 and 1917 and which gave an average parasite rate for the three years of 16.5 per cent. This is of interest for comparison with the *Anopheles* abundance on this place and for further comparison with the parasite rate and *Anopheles* abundance found in similar work elsewhere.

The mosquito collections have been made inside and under the tenant houses, in the stables, and in practically every kind of out-building or resting place to be found about the tenant homes. The houses of the tenants consist of two, three and four room frame buildings which are raised an average of 2.5 feet off the ground, the sills being supported on wooden blocks. At most of the houses there is a small stable or shelter for the work animals or cows, there is usually a small cotton house, and often a corn crib, chicken coop or shed. In all of these buildings mosquitoes are to be found during the daytime, resting in the darker corners or on the walls and ceilings. The majority of the resting mosquitoes are engorged with blood and are easily caught in the collecting tubes. The elevation of the houses from the ground provides a large open space underneath which is frequented by dogs, chickens, and other domestic animals and, as is shown, is the principal resting place of adult *Anopheles* during the daytime. The stables are next in importance in the relative abundance of *Anopheles* resting in them. Fewer numbers are found inside the houses and in the out-buildings, other than the stables.

During the seven years in which this investigation has been in progress, over 1800 collections have been made at 90 tenants houses and out-buildings, and from the various buildings at these locations a total of 132,167 *Anopheles* have been collected, counted, and classified as to species, sex, and resting place. The majority of these, 98.53%, were *Anopheles quadrimaculatus*, 1028 specimens or 0.84% were *Anopheles punctipennis* and 836 specimens or 0.63% were

Anopheles crucians. A very few specimens of *Anopheles pseudopunctipennis* have also been taken. As all of these species are proved to be carriers of the malaria parasite, they have all been included in the general averages although some differences in habits have been noted.

In summarizing the collections monthly averages were obtained for each type of resting place and these monthly rates were then averaged for a yearly rate or for a monthly rate for all years. These averages are naturally subject to errors and one source of error in our data is the fact that collections were not made uniformly for each month in each year, also further error arises from the fact that during the first few years different groups of houses were examined in different months. Beginning in 1918, after the preliminary work covering all the houses on the plantation had indicated the principal resting places, 20 to 25 locations, well scattered over the plantation, were selected and these same buildings examined each month.

Unfortunately for the value of the final averages, most of the collections in 1918, which was the low mosquito year in the series, could not be included in the summary since they were only partial collections. In 1920, which was a year of extremely high mosquito abundance compared with previous years, collections from the stables were not made and the relative proportions of mosquitoes found in these buildings in previous years was applied to the house collections in 1920 in estimating the total numbers present around the tenant homestead. This probably makes the figures for stables too high for 1920 and in that case the average would be proportionally high. However, the average miscellaneous collections in out-buildings other than stables about the tenant houses are believed to be too low, due to probable incomplete search in all places at time of each collection, and the one tendency may serve to offset the other in the final averages.

TABLE I

AVERAGES OF TOTAL ANOPHELES COLLECTIONS AT NEGRO TENANT HOMES, MOUND, LOUISIANA, FOR 1914-1920

AVERAGE PER BUILDING						
Month	No. of yrs. *	Inside house (Incl. porch)	Under house	Barns	Misc'l out-bldg.	Total
Jan. and Feb...	4	.5	.8	5.8	.1	7.2
March	2	5.3	3.3	7.6	1.1	17.3
April	4	5.5	10.6	10.7	1.0	27.8
May	4	23.1	151.0	57.0	4.6	235.7
June	4	19.8	336.9	101.4	8.4	466.5
July	5	60.7	314.2	101.3	6.2	482.4
August	5	34.7	211.4	50.2	3.5	299.8
September	5	23.9	150.3	57.4	4.1	235.7
October	3	6.3	17.4	13.4	1.1	38.2
Nov. and Dec..	3	.3	2.5	1.5	.3	4.6
MAY TO SEPTEMBER						
Average		32.5	232.8	73.4	5.3	344.0
Per cent of total.....		9.4	67.7	21.3	1.6	100.0%
OCTOBER TO APRIL						
Average		3.6	6.9	7.8	.7	19.0
Per cent of total.....		18.7	36.5	41.1	3.8	100.0%

*The number of years in which a monthly average for the corresponding month is included in the summary.

The above table, Table I, gives the final averages by months and by types of resting places for the negro tenant buildings for all locations which could be included in the summary. (Months in any one year in which only a few collections were made are not included).

The principal months of *Anopheles* abundance were the five summer months from May to September, and the *Anopheles* collected during this period constituted 94.8% of the total catch. During the warm summer months two-thirds (67.7%) of the *Anopheles* were found underneath the houses. About one-fifth (21.3%) were taken from stables, 9.4% from inside the houses and 1.6% from the miscellaneous outbuildings.

During the cooler months, October to April, the resting places for the relatively few mosquitoes found (5.2%) changed consider-

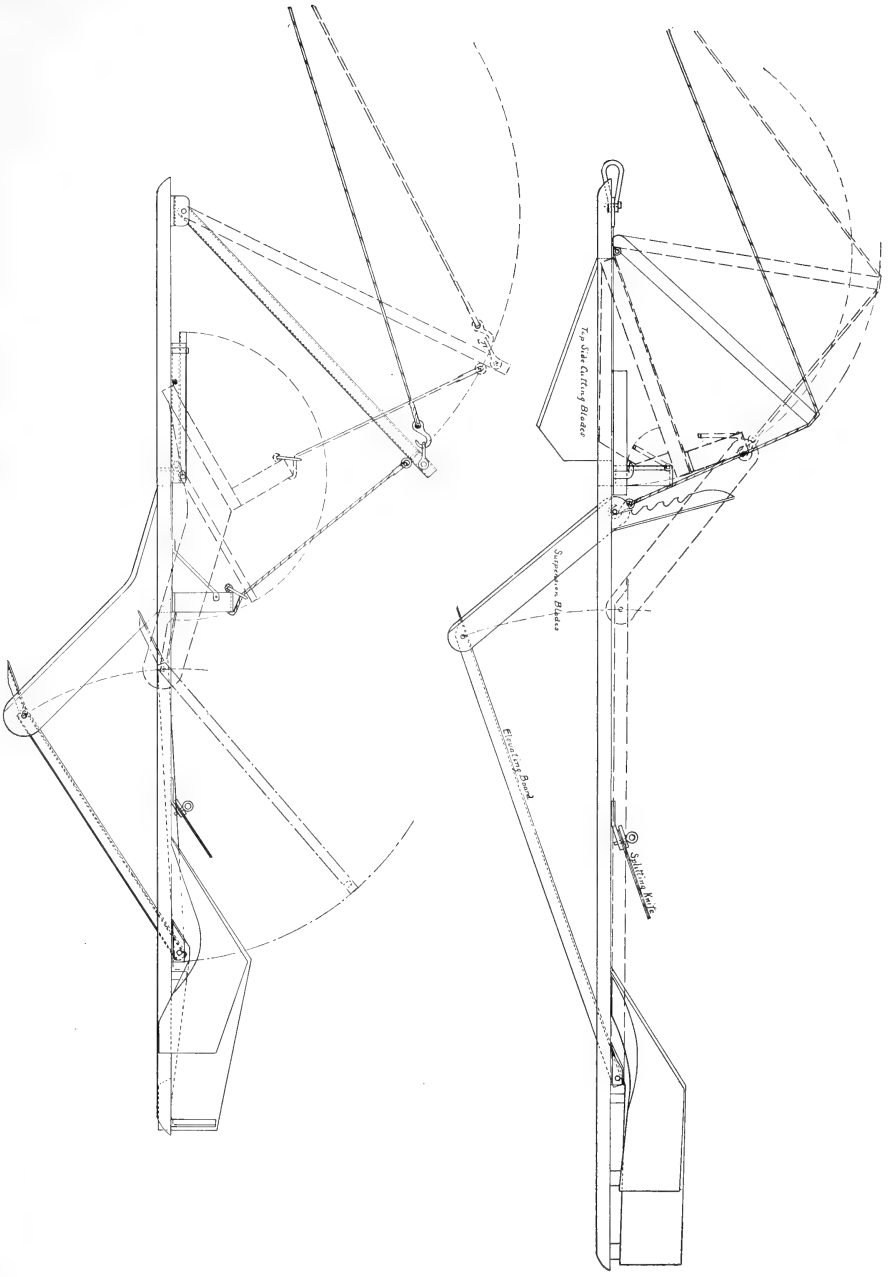
ably, the proportion under the house being reduced (to 36.5%) and the proportion from the stable and inside the house being nearly doubled (41.1% and 18.7% respectively).

The two months with the highest rates were June and July, with the July rate slightly higher than that for June, and with an average of well over 400 *Anopheles* per collection for each of these months for each tenant house and its out-buildings. There was some variation in the highest month in different years. In 1914 the August rate was higher than for July and in 1919 and 1920 June was the highest month. For 1916 and 1920 the September rate increased somewhat over the previous month.

The rate for the five summer months from an average of all years was 344 *Anopheles* for each tenant house and its out-buildings. About 10% of these, however, were males, which subtracted from the above figure gives a total of 310 female *Anopheles* from which the average tenant family and his domestic animals are subject to attack during each day of the five months. The daily rate is, of course, a varying rate and the actual curve of density shows a rapid rise from a low point in April or early May to a high point in June or July and this is followed by a correspondingly sharp drop to the latter part of September or the early part of October, as shown in the accompanying chart (Chart 1).

Some explanation of the rate obtained per tenant home is necessary inasmuch as the averages for one year (1920), the high mosquito year of the series, varied so much from the other years. The record for the low year (1918) of the series could not be included in the summary and the high year, when averaged with the other years, about doubled the rates obtained, at least for the collections under houses. The summer (May to September) rate for 1920 alone was 627.0 *Anopheles* per collection for underneath houses, while for 1919 the summer rate was 96.5 and for 1915 was 78.8 for underneath. The summer rate for all years previous to 1920 (not including 1918) was 115.6. On the other hand to include a low year would not affect the final averages as much as might be expected. For example, if the summer rate for 1918 had been as low as 50, for underneath the houses, to include this rate in the average for all years underneath the houses would reduce the final figure only about 14% or from 232.8 to approximately 200. In this connection, too, the facts must be considered that in the earlier years different groups of houses were worked in different months and that the work as to methods and technique was in process of development with con-

FIG. A—(ABOVE)—SHOWS FIRST ATTEMPT. FIG. B—(BELOW)—SHOWS FINAL PLOW



sequent changes in untrained personnel. These factors do not apply to the collections for 1920, and it is true that the increased totals for that year are due in part to the facts that all of the collections were made from the same group of representative houses, that these houses were collected regularly and that the work was done by the same personnel under careful checking throughout the season. From this it is seen that subsequent data may show the final averages obtained to be nearly normal, at least much nearer the normal than any low year available would indicate.

A few of the highest collection records made during the work are of interest to show what has been encountered on this plantation in the way of maximum abundance. Four hundred and thirty-five *Anopheles* were collected inside a four room house occupied by a tenant family of eight people in 1915, 754 *Anopheles* were taken from a single table in September, 1919, and 4968 were found under one house in June, 1920. In the last record not all of the mosquitoes were collected, the remainder being counted after more than 3800 had been actually collected in the chloroform tubes. In 1920 this same house had an average of over 2000 *Anopheles* for each collection of the five summer months (collections made once a month). The June averages for all of the 25 houses which were collected underneath in 1920 was 1040 *Anopheles* per collection per house and these houses were all scattered over plantation with a maximum distance between the two farthest removed from each other of about three miles.

The tenant houses and their out-buildings are apparently the principal resting places for the engorged female *Anopheles*, and the majority of the specimens which have fed at night on the people or on the domestic animals around the place can probably be taken the following day from these resting places. An idea of the amount of feeding which takes place may, therefore, be obtained from the above data. The average of 310 female *Anopheles* is taken as the daily rate for each tenant house and its out-buildings. The percentage of fed females as indicated from the dissection of over 2085 *Anopheles* collected at Mound in 1917 was 84%. This applied to the rate of 310 reduces that figure to 260.4 fed females about each place. The average number of people in the tenant families on this plantation was 4.26 for the years, 1915, 1916 and 1917. A count of the domestic animals at 24 places in 1920 gave totals of 53 mules and horses, 32 cows and calves, 172 hogs and 26 dogs, or an average of 11.79 which when added to the number of people makes

a total average of 16.05 animal hosts at each location, without including chickens or other animals which may also serve as hosts. The 260.4 fed females divided among the 16.04 animal hosts gives an average of 16.2 mosquitoes per animal host for each day of the five summer months. This would not be the daily feeding rate if the females remained more than one night around the buildings and did not seek a blood meal every night. This is probably the case. The rate of 16.2 *Anopheles* per animal host does, however, express the average number of fed females found about a tenant house and its out-buildings each day whether the meal had been taken one, two or more nights previously.

The June, 1920, average of 1076.2 *Anopheles* per house (inside and under) gives an indicated total of 1395.7 mosquitoes per location, from the proportions as shown in Table I. This figure when reduced by the relative proportion of males for that year (13.6%) and by the per cent. of unfed females gives a daily rate for fed females per animal host (including humans) of 63.1. Computed in the same way the daily rate for the five summer months in 1920 the number was 40.1 per animal host, and for the same five months in 1919 the figure was 6.4.

SUMMARY

1. Collections of over 132,000 adult *Anopheles* have been made from houses and out-buildings of the negro tenants on a cotton plantation at Mound, Louisiana. The records extend over the years 1914 to 1920 and have been summarized to indicate the average abundance of malaria mosquitoes around the typical tenant house.

2. The five summer months, May to September, were found to be the months of principal abundance, with the highest rate occurring in July. The average number of *Anopheles* found during these five months resting in and around the tenant house, including the out-buildings, was 344, of which about 10% were males and 90%, or 310, were females. Of the females 84%, or 260, are considered as having had blood meals previous to collection, the percentage being taken from dissections made in 1917.

3. The average tenant family on this plantation consists of 4.26 persons, and there are for each family an average of 11.79 of the larger domestic animals (mules and horses, cows and calves, hogs, and dogs). This gives a rate of 16.2 female *Anopheles* for each host (without attempt to consider any host preference which *Anopheles* of this region may or may not have). The May to September

daily rate for fed females was 40.1 per host in 1920 and for the same months in 1919 it was 6.4 per host.

4. The types of resting places in which *Anopheles* were found, with the relative abundance for the summer months, were as follows: Under houses, 67.7%; stables, 21.3%; inside houses, 9.4%; and miscellaneous out-buildings, 1.6%. In the colder months, October to April, with an average of 19.0 adults for each tenant house and its outbuildings (including stable), the relative abundance was: stables, 41.1%; under houses, 36.5%; inside houses, 18.7%; and miscellaneous outbuildings, 3.8%.

5. Four species of *Anopheles* have been encountered, of which *Anopheles quadrimaculatus* is by far the most abundant, constituting 98.53% of the total number of *Anopheles* collected. 0.84% were *Anopheles punctipennis* and 0.63% were *Anopheles crucians*, while only three specimens of *Anopheles pseudopunctipennis* have been determined.

6. Blood examinations of the tenants on this plantation in August, 1915, 1916, and 1917, gave an average malaria parasite rate for the three years of 16.5%.

The authors wish to acknowledge the assistance received in the collections from the following: Messrs. H. H. Kimball, R. Cox, T. H. O'Neill, W. H. Dumont, U. C. Loftin, A. H. Greer and L. Z. Naylor.

As I say, this is only one aspect of the investigation and is given to you to show how extensively they have been going into the investigation. I will leave the paper with the Secretary for future publication. (Applause).

PRESIDENT RIDER: Next on the program is a discussion "The Mound Louisiana Work" by Dr. Frederick L. Hoffman, Statistician of the Prudential Life Insurance Company. Now the Prudential Insurance Company has as much interest in prolonging life as any of the rest of us.

Abstract of Address
on the
Malaria and Mosquito Investigation at Mound, La.

BY FREDERICK L. HOFFMAN, LL.D., *Third Vice-President and Statistician, The Prudential Insurance Company of America, and read before the New Jersey Mosquito Extermination Association at Atlantic City, N. J., April 28, 1921*

The present discussion is largely concerned with the methods of inquiry followed at Mound, La., by the U. S. Bureau of Entomology under Capt. D. L. Van Dine; the International Health Board; and Dr. Louis J. Petritz. The investigation extends over five to six years, having been seriously interfered with by the war, which has made a complete reconsideration of the original plan inevitable. The investigation concerns (1) topography and external conditions affecting the local prevalence of mosquitoes and the local incidence of malaria; (2) the relative prevalence and density of anopheles mosquitoes, differentiated according to species, sex, etc.; (3) the correlated medical aspects of the problem; (4) the population facts and related sociological considerations, particularly housing conditions; (5) agricultural economics, including actual data relating to cotton production as affected by malaria occurrence; (6) meteorological data correlated to mosquito density, disease frequency, etc.; and (7) preventive measures purposely or incidentally introduced as the result of the investigation.

The technical information secured does not readily lend itself to mechanical or statistical analysis, and the methods are necessarily affected, if not determined, by local conditions as well as by the appropriation available for scientific research. In its final analysis, however, the collective results of such an investigation are chiefly statistical, suggesting qualified consideration of the facts by those who are familiar with standardized methods of statistical procedure.

Emphasis has been placed throughout upon agricultural production in relation to malaria occurrence but only in so far as correlated to the biology of the *Anopheles* and their function in malaria transmission. There has been a careful avoidance of duplication of efforts by other governmental departments or associated voluntary health-promoting agencies, for the work fundamentally concerns the biology and bionomics of the *Anopheles* mosquitoes and the ascertain-

ment of environmental conditions affecting density, disease transmission, etc.

An important factor has been the hearty co-operation of the Maxwell-Yerger Corporation, which has unreservedly placed at the service of the Government the facilities of a large plantation most suitably situated for the purpose.

The preliminary work thus far has been rather in the nature of a survey, in which every promising clue was followed, or is being followed, as far as the available means permit. The work, for the time being at least, is not looked upon as a demonstration in the sense of determining a method of malaria control suitable to this particular section, but as an intensive investigation having for its objective the study of mosquitoes that convey the disease and the ascertainment of all facts or information useful in the better application of known methods, or the development of new methods and measures, to place malaria prevention upon a strictly economic basis.

The topography of the Mound area opposite Vicksburg is of special interest in connection with malaria investigations. The section has been admirably surveyed by the U. S. Geological Survey and all the essential facts are a matter of convenient record. The location of every house has been indicated on a large-scale map in its relation to more or less predisposing conditions, and the whole territory, of some thirty thousand acres, has been divided into four sections presenting special features, which are being studied.

Some twenty-five species of mosquitoes have been determined for this section, the prevailing anophelene varieties being the *quadrimaculatus*, the *punctipennis*, and the *crucians*. The *quadrimaculatus* is the main source of malaria in this region but the actual degree of infection has not been determined. The record card adopted both for mosquito and malaria occurrence seems well adapted to the purpose. The tentative results show the monthly distribution of the different species of mosquitoes as ascertained by the usual method but with the important addition that the amount of time required for catching purposes is indicated. This would naturally show a wide range during a period of years and according to the conditions under which the catch was made. All conclusions based upon such statistics must for the time being be looked upon only as suggestive of the direction in which such inquiries are likely to be most useful. But considering the *Anopheles* collected during 1919, certain facts may be stated as follows:

The catch data throughout are divided as to whether the insects were caught under the house, inside the house, or in barns. The catch under the houses was at the rate of 229.6 specimens per 100 minutes of time consumed in making a total of 176 collections; for the inside of houses the catch was at the rate of 63.5 specimens per 100 minutes of time, while the total number of collections was 162; the catch in barns was at the rate of 171.2 specimens per 100 minutes of time consumed, while the number of collections was 170. In brief, there is very little difference in the number of collections, all of which were probably made at the same time, while the range in the relative number of specimens was highest under the houses, indicating a serious potential possibility of infection to those inside the houses; there was a material reduction, no doubt, in part at least, as the result of effective methods of screening; while the catch in the barns was midway between the two. The results may be considered of practical value in that they clearly indicate the relative mosquito frequency in the vicinity of houses, and the reduction of such frequency in the houses as the result, no doubt, of protective measures.

In a somewhat similar manner the larval production record has been ascertained. For the whole area 231 collections were made during 1920, representing 2,620 dips, producing 2,261 larvae and 28 pupae in the a water area of approximately 35,000 square feet. The relative production record for the year was, therefore, 86.3 larvae per 100 dips, or 64.4 larvae per 1,000 square feet of area. This information is, of course, available by months and for all the different stations under observations, but are indications of the method which would seem sufficient for the present purpose, for it seems of the first importance that some kind of standardized form of relative mosquito density and of relative larvae production should be adopted. At the present time no corresponding comparative data for other areas are available, but extended over a period of years the present method should be of considerable practical usefulness for the section under review.

Much, of course, has been published in the nature of mosquito surveys, but as a rule such investigations are limited to the specimens found, and while the actual numbers of insects are given, no standardized method of relative density has thus far been found feasible. The question becomes of considerable practical importance in the correlation of such observations to medical and economic data. The medical statistics which have thus far been collected are only tenta-

tive, but a new form of record cards has been adopted by the International Health Board which will virtually establish a continuous individual health record of every person on the plantation. The local incidence of malaria infection is unquestionably very high but no data exists at the present time which would justify positive assertions. Published statements to the effect that malaria has been very materially reduced in Madison Parish, La., during the last few years are not in accordance with the facts. It would not seem advisable to utilize the earlier statistical investigations, for there are reasons for believing that the new records will yield decidedly more trustworthy results, both as to blood infection and actual disease occurrence.

Nor would it seem advisable for the time being to discuss the correlation temperature and rainfall data as derived from the Vicksburg station, although it may be said in passing that there does not seem to be the close relation between rainfall and malaria occurrence in the river belt of Louisiana and Mississippi as observed in countries decidedly more malarious.

In the absence of really trustworthy malaria statistics for Louisiana the admirable morbidity data for Mississippi have been utilized for the present purpose. These data extend over a period of seven years and, as far as known, they are the only comprehensive malaria morbidity statistics for any section of the world. They show that the incidence of the disease has slightly diminished during the last three years compared with the preceding three years, although the average rainfall was higher during the latter than during the earlier period. The Mississippi data also show that the monthly variation in the frequency of the disease is practically the same for the two races, while the recording incidence of the disease is somewhat higher among the whites than among the colored. Comparing the 1915-17 rate with that for 1918-20, the white malaria morbidity rate diminished from 93.1 per 1,000 of population to 66.9, while the colored rate diminished from 77.6 to 59.5. This reduction, while not as gratifying as anticipated, is nevertheless an indication of the effectiveness of preventive measures, particularly in the Yazoo Delta, where the disease continues to prevail to a very considerable extent. It may be said in passing that the malaria mortality rate per 100,000 of population for the Delta counties of Mississippi was 126.8 for the period 1915-17 against 91.0 for the period 1918-19, indicative of a reduction equivalent to 28.2 per cent. I may add to the foregoing the statement that in the intensely malarious counties of

southeastern Missouri the malaria death rate for 1911-17 was 156.6 per 100,000 against 71.6 during 1918-19, a reduction equivalent to 54.3 per cent.

The economic data of the Mound area clearly indicate a substantial per capita crop reduction as the result of malaria occurrence. In this case also the earlier conclusions advanced by Captain Van Dine can no longer be used as indicative of present conditions, largely affected, of course, by the price of cotton and the disturbed industrial conditions resulting from the war. The investigation includes an analysis of the cotton-ginning statistics of Madison Parish in indicating a maximum ginning period during the two weeks of November 1 to 14 which is at variance with statistics for the Yazoo Delta.

The address, in its final form, will include a considerable amount of new statistical material, amplified by observations derived from recent foreign investigations, including particularly the malaria research in Great Britain under Sir Ronald Ross and Col. S. P. James, and the really extraordinary malaria surveys of Bengal under Dr. Charles A. Bentley, as well as the admirable malaria report and anopheles survey for the Colony of Trinidad and Tobago under Deputy Surgeon-General C. F. Lasalle. We have as yet nothing to compare with the scientific presentation of the results of the mosquito and malaria research work which is being done in these countries. The report on Trinidad, for illustration, includes some very admirable maps showing the mosquito breeding and potential breeding places, which are necessarily the first basis of persistent mosquito reduction efforts. The Trinidad report also includes an elaborate list of mosquito-breeding places, differentiating the position, amplified by a descriptive account, the kind of larvae found, and whether potential, temporary or permanent. The report further includes observations on rice fields and mosquito-breeding places produced by men, as well as on the effect of rain on mosquito prevalence, and the effect of malaria on agricultural economics.

In its final analysis the problem of mosquito control is a national or state rather than a local one; but at the same time all effective measures for permanent reduction are essentially local though dependent upon the most hearty state and national support. The effective co-ordination of different agencies aiming at the same objective is, therefore, a question of the first importance. It is most gratifying to be able to say that the co-operation at Mound, La., is perhaps the most promising of its kind which has yet been developed in this

country. The Mound investigation is however but one of numerous and most encouraging efforts throughout the United States to solve the malaria problem on the basis of mosquito extermination. Probably the most ambitious, far-reaching, and promising effort of this kind is now being made in the State of North Carolina. There is no undeveloped area in the whole United States of greater future promise than the water-logged lands of eastern North and South Carolina. All those who are concerned with local measures of mosquito eradication can not do better than take the facts for the State of North Carolina into particular consideration. There, also, the most hearty and effective co-operation has been developed between the State Board of Health, the State Geological Survey, the State Drainage Commissions, the U. S. Public Health Service and the International Health Board. The outlook for the future in the direction indicated is, therefore, one of great promise, and it is with pardonable pride that attention may be called to those efforts which best illustrate the lessons learned from the war as underlying principles of a policy of industrial and social reconstruction.

In the discussion which followed Dr. Hoffman said in part:

"It is not a waste of money to publish intelligent reports. It is a waste of money to pad reports with unnecessary data. I sent Dr. Howard the other day an extraordinary report from Trinidad, two or three hundred pages, dealing in the most detail with every anopheles breeding area in that island. And he says there is enough in that for the whole United States for which the data are thoroughly understood, as is the data in Trinidad.

I could give you reports from a portion of India, the Straits Settlements, Ceylon, showing enough detail of sufficient importance, and the facts must be thoroughly provided and the government must provide for the publication of the report as well as the gathering of the information.

We are at this time research mad—more research and more research. The results of research are fairly popular and are frequently inaccessible. Rarely are they made use of anything like the way they should. Your work that you have been doing is one of the poorest described works done in the State of New Jersey. Atlantic County makes an exception, but how many of your counties publish proper reports? And even the report for this county is not by any means a full justice to what is being done here, a fully described account, that those who study the subject can really judge

of the results achieved. And I do think of an important county, a very important county in this state, from which a report has not been published I believe for several years. A small typewritten report is all that is available to people who want to know what is being done; while \$100,000 is spent, yet in accounting for that expenditure is but a fraction of what it should be.

Every year—this is the fourth year I have spoken of it here, emphasizing the foreign reports we get, illustrating in a beautiful way how the malarial problem may be visualized for educational and other purposes. You are making lots of mistakes if in the Mound investigation you do not tell your own story as picturesquely, as dramatically, if you please, as closely as you possibly can, and in doing that should attract your attention. They are going to solve, if they are allowed to do so and allowed to continue, they are going to solve the first essential of agricultural economics in the south, the question of how far the mosquito is the cause of the local malaria, how far the local malaria interferes with crop production. It will be able in course of time to show that crop production is diminishing at a certain per cent.; that there is less cotton produced, less corn produced than would be the case, a considerable loss in many cases, were malaria done away with.

They will go further; they will show what the economic burden upon the individual is, what the plantation cost is in medicine, in medical attention, in drugs, in hospital facilities, in absence from work, in other elements. If that is brought together in a proper way we should have an unanswerable argument for malaria work on the largest possible scale, and all malarial work ultimately is mosquito work.

You are doing splendid work in this state. You are keeping down mosquito production and at the same time, though you may not know it, you are undoubtedly keeping down the malaria rate. Malaria does not bother us in this county very much, as far as I know. How much it bothers us without knowing it is an open question. I said this before, I say it again: in my judgment there is a good deal of latent malaria in this state that accounts for much of the difficult cases that doctors have to deal with. We need to consider this question more seriously, even in this state; but you who are directly engaged in eradicating the breeding places, you have to solve the larger problem of malarial production as well. (Applause).

PRESIDENT RIDER: Dr. Headlee suggests that we have been doing in New Jersey perhaps a little more in that line that he has sug-

gested than has been suggested in the address just preceding. We would like to hear from Dr. Headlee.

SECRETARY HEADLEE: Very shortly after 1912, when the mosquito work was taken up on a wide scale, the necessity of measuring results of mosquito work in some definite way was realized, and the rule finally adopted is now known as the night collection method. The method referred to has been published already in at least one bulletin of the Experiment Station and I think has been repeatedly mentioned in the proceedings of this association.

There are factors that have to be evaluated. Almost every species of mosquito with which we deal requires a little different method of collection to get results that are readable and comparable. I asked Dr. Hoffman concerning the evaluation of the factor of the collector; assuming, of course, that the collectors are faithful in the performance of their duties. That must be assumed before you can get anywhere and it must be a fact.

Now assuming that you must evaluate the value or determine the value of that factor not only as a collector but as an attractor of mosquitoes. There are men, and we have had them in our organization, that do not attract mosquitoes, men whom mosquitoes such as we have in New Jersey will not bite. Now that must be determined. You must evaluate the attractiveness of your collectors. You must evaluate the speed, mechanical, manual speed or celerity of the collectors; because one man, by reason of quicker movements, will collect twice as many mosquitoes under the same conditions as the fellow who is slower.

You must evaluate the nature of your collecting places. You cannot compare collections taken on a street corner with collections taken in shrubbery. You cannot compare collections taken in a low lying gully, where there is a lot of moisture, with collections taken in the same neighborhood on top of an adjacent hill.

You must evaluate a number of other factors. You must evaluate the time of the day when the collection is made. You must evaluate the temperature. You must evaluate the atmospheric moisture to get these collections sufficiently comparable to read them as reliable data. You must evaluate wind movements. A collection made on the windward side of a patch of shrubbery will be entirely different from a collection made on the leeward side.

Now all those things must be taken into consideration. Our experience has shown that and we have had these night collection

systems in operation for a number of years. And in many cases some of these factors were not evaluated, with the result that the data were not reliable.

Now take the case of the principal malaria mosquito, that is, the *quadrimaculatus*. Under ordinary evening collection you get practically none whatever unless you are close to a place of breeding. That has been met evidently in the south by collecting in buildings, around buildings where they gather.

Now in the Princeton anti-malarial work we found that our collectors in ordinary evening collections in bunches of shrubbery got no specimens of *quadrimaculatus* whatever unless they were close to the place of breeding. At the same time a mile away, in the village of Princeton, considerable numbers of the *quadrimaculatus* would be caught inside the houses, and yet no breeding of *quadrimaculatus* could be found in the immediate territory adjacent to those places. It was evident, judging from the breeding then, that they had traveled nearly a mile, in many cases, to get to these houses. So you see ordinary evening collection work will not answer for the *quadrimaculatus*.

In the case of the *pipiens* the evening collection is very successful. But again these factors I mention must be evaluated. You may collect on a street corner in a certain portion of Montclair, we will say, and get no *pipiens* whatever. You may step one hundred and fifty feet back into the backyard, where the shrubbery is, and you may catch one *pipiens* a minute.

Now we have evaluated the time factor; we have used that for a number of years. We count that when a collector is getting thirty mosquitoes in five minutes his further collection is limited by his speed of collection. We count that when we get a mosquito a minute we have got a serious infestation that needs immediate looking to.

Another thing is the question of your cyanide or killing tubes. Every inspector has to have at least two tubes, so that while the mosquito which is caught is dying in that tube he has got another tube to catch with. And if his tubes are not very active he has got to have three tubes, and so on.

Now we have used this method of collection to determine the density of the mosquito fauna and we have used that to determine the movements of mosquitoes, the migrations of mosquitoes. We have used it to determine the appearance of mosquitoes from un-

suspected points of breeding within the territory where control work is going on.

In connection with the Shipping Board during the war I went to Wilmington, North Carolina, at the outset in fact, before any work was there. I was on the ground when the \$30,000 was raised in the City of Wilmington and the adjacent county. Wilmington had ten thousand acres of old rice land lying just across the river, ten thousand acres; dikes all gone, nearly, just traces of them; tide gates absolutely gone, most of the flumes gone; and in addition to that it had a number of cypress swamps nearby the town.

Well, they raised \$30,000. The United States Public Health Service added some to it, and they went ahead. I heard only one report; but believe me, if they completely drained that ten thousand acres of old rice land, which is only slightly above tide level, they have done a whale of a job at Wilmington. And I don't know—I didn't go further down the coast, but I did see the situation at Wilmington and had a chance to study it.

I thoroughly agree with Dr. Hoffman that if you will evaluate these factors which are mentioned, which are the ones, so far as New Jersey is concerned, that seem to be important, you can get a reliable basis on the efficiency of your mosquito control work. I know some of the men in this room do not agree with me on the use of the night collection as a detective measure, but it is like a good many other educational factors. Let's give time and it will work out. Either they will be convinced or I will be convinced. And I hope that it will work out so that they will be convinced, because I believe it to be one of the best detective measures that we can get. (Applause).

PRESIDENT RIDER: Next in order on the program is the business meeting and Dr. Headlee, I guess, has prepared some sort of a program. I can't tell you what it will be.

Report of the Secretary. We will hear the report of the Secretary.

Report of the Secretary

In accordance with the direction of the Executive Committee 1500 copies of the Proceedings of the seventh annual meeting of the New Jersey Mosquito Extermination Association have been printed and with the exception of 200 they were distributed to the county commissions as follows:

Atlantic County	150	copies
Bergen County	150	"
Cape May County	100	"
Essex County	200	"
Hudson County	200	"
Middlesex County	85	"
Monmouth County	85	"
Morris County	30	"
Ocean County	100	"
Passaic County	100	"
Union County	150	"
	<hr/>	
	1,350	"

It may be of interest to the association to know how many copies of the proceedings of the various years there are now remaining. The Secretary's office has 25 copies of the First Proceedings, 3 copies of the Second, 75 copies of the Third, 1 of the Fourth, 2 of the Fifth, 87 of the Sixth and 55 of the 7th.

In accordance with an authorization the Secretary has collected 48 complete copies of the six annual proceedings and together with the Seventh has had them bound. These bound volumes in accordance with the authorization are now at the direction of the Executive Committee.

The revision of the Experiment Station Bulletin No. 276 on the "Mosquitoes of New Jersey and Their Control" has been completed and is now in page proof. Eight thousand copies will be printed and as many as may be needed for the actual work of the commission will shortly be available. This revision represents an attempt to bring the mosquito material up to date and is intended to form a manual of information for the anti-mosquito worker.

Mr. Alfred Gaskill, Director of the Department of Conservation and Development, placed a request for \$200,000.00 for mosquito ditching in his regular yearly budget. It was cut out by the Governor's budget commission and refused insertion by the Appropriations Committee. The Experiment Station requested the sum of \$15,000.00 for the carrying on of its work on the salt marsh and its activities in correlating locally supported anti-mosquito work. The Governor's budget commission allowed this item of \$15,000.00 to pass and the Appropriations committee accepted it at the same figure.

The Secretary has not been able to get anywhere with the instruction relative to having a national anti-mosquito organization, either in the form of a section of the American Public Health Association,

or of the American Association for the Advancement of Science, or as an independent organization, and he doubts whether the time is yet ripe for such a movement to succeed.

The work of the committee on a ditch cleaning machine, which will be presented to the association, speaks for itself. The needs of the anti-mosquito work in the state apparently calls for a committee with wider powers than the one whose duty it is to develop a ditch cleaning machine. It would seem wise, in view of the urgent need for satisfactory machinery both for drainage and maintenance of drainage, to have a standing committee of the association whose business it is to devise such machinery as the same is most appointment of such a committee be authorized at the present urgently needed and the Secretary would like to suggest that the session.

By the authorization of the Executive Committee the program which is now before you has been prepared. The present meeting has been arranged for and the publicity attendant upon the same has been provided.

PRESIDENT RIDER: The report of the Treasurer.

Report of the Treasurer

THOMAS J. HEADLEE, PH.D.

Balance, February 2, 1920.....	\$437 45
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MONEYS RECEIVED

Feb. 4, 1920—Cape May County (1919 assessment) ..	\$70 00
Aug. 27, 1920—Atlantic County	125 00
Aug. 27, 1920—Passaic County	75 00
Sept. 25, 1920—Ocean County	75 00
Sept. 25, 1920—Essex County	138 00
Oct. 8, 1920—Union County	125 00
Oct. 25, 1920—Hudson County	138 00
Nov. 1, 1920—Middlesex County	50 00
Nov. 4, 1920—Bergen County	125 00
Nov. 9, 1920—Monmouth County	50 00
Jan. 18, 1921—Morris County	25 00
Feb. 23, 1921—Cape May County	70 00
	1,066 00
	\$1,503 45

EXPENDITURES

Feb. 20, 1920—To J. Heidingsfeld Co., for printing Proceedings of the 6th Annual Meeting	\$394 25
Feb. 20, 1920—To Christie Press, for printing programs of 7th Annual Meeting	30 00
Feb. 20, 1920—To W. R. Reed, for paper and envelopes for sending out invitations and programs of the 7th Annual Meeting	19 30
Feb. 20, 1920—To Wm. C. Perry, for clerical assistance in sending out invitations and programs of the 7th Annual Meeting	24 95
Feb. 20, 1920—To N. R. Mehrhof, for clerical assistance in sending out invitations and programs of the 7th Annual Meeting	23 80
Apr. 7, 1920—To C. H. Flitman, for typewriting revised copy of 7th Annual Proceedings	4 80
Apr. 8, 1920—To Strong Hardware Co., four boxes to send 7th Annual Proceedings to the various commissions, 1½ lbs. nails	55
Apr. 12, 1920—To C. R. Woodward, for postage in sending manuscript of 7th Annual Proceedings to printers for estimates	3 00
Oct. 5, 1920—To C. R. Woodward, for editing Proceedings of the 7th Annual Meeting	50 00
Oct. 8, 1920—To Arthur W. Kelly for reporting 7th Annual Meeting	136 50
Oct. 8, 1920—To Unionist Gazette Association, for printing 7th Annual Proceedings	251 50
Nov. 17, 1920—To Charles T. Wales, for carting boxes containing 7th Annual Proceedings from Van Ness Hall (left by mistake) to Entomology Building....	1.50
Apr. 9, 1920—To stamps for mailing advance notice of 8th Annual Meeting to Boards of Health, Boards of Trade, Boards of Freeholders and Chambers of Commerce	8 00
Apr. 20, 1920—To postage for sending out invitations and programs of 8th Annual Meeting	37 00
Apr. 25, 1920—To postage, for sending out additional invitations and programs	3 00
Apr. 25, 1920—To E. C. Brown, to pay for student assistance in sending out invitations and programs of the 8th Annual Meeting	12 60
	<hr/>
	\$1,000 75
Cash Balance, April 27, 1921.....	<hr/>
	\$502 70

BILLS PAYABLE

To Louise C. Duigon, for clerical assistance in addressing envelopes and sending out invitations and programs for the 8th Annual Meeting	\$35 00	
To John C. Scheller, for binding 48 complete sets of the Proceedings of the 7th Annual Meeting	134 40	
To Christie Press, for printing letter of invitation and programs for the 8th Annual Meeting	105 50	
To W. R. Reed, for 4½ thousand envelopes and 1 box of Mimeo. paper	14 20	
	\$289 10	
Balance		\$213 60

I, Abram H. Cornish, Chairman of the Auditing Committee of the New Jersey Mosquito Extermination Association, do hereby certify that the receipts and expenditures, the bank deposits and checks have been properly audited to date and found correct.

ABRAM H. CORNISH,
Chairman Auditing Committee.

SECRETARY HEADLEE: For the first time we are completely solvent. The report of the Executive Committee is as follows:

There have been two meetings of the Executive Committee, the first was held at Beach Haven and the second at Atlantic City during the present sessions. At Beach Haven, the principal problem before the committee was the question of increased state appropriations. It was not at that time known whether the Director of Conservation and Development was planning to carry any appropriation in his budget. It was found that the Director of the State Experiment Station, while he was willing to accede to the wishes of the Executive Committee in a matter of that kind, felt that it would be better for the Department of Conservation and Development to carry the request for the larger appropriation. He stated that the usual request for \$15,000.00 had been included in his budget for the year beginning July 1, 1921.

It should be understood that there are two types of State appropriation needed for mosquito work. The first type is one which has been received for many years by the State Experiment Station and is intended for the support of an organization which is charged with the duty of furnishing plans for mosquito control work to such local organizations as may call upon it for work of that kind. This organization has the further duty of investigating the exact conditions under which the county mosquito extermination com-

missions work; the passing intelligently upon the plans, methods and estimates of the individual county commissions; the furnishing of information principally in the way of plans and estimates for contemplated work, and the general correlation of the activities of the individual county commissions. In the past, the funds supplied have always been sufficient not only to do the above work but to do additional actual drainage work on the salt marsh in places where it is most needed.

The second type of appropriation is the part or the whole of the \$750,000.00 which it is estimated are needed from the state to supplement the efforts of the county mosquito extermination commissions in such a way as to furnish the drainage of the salt marshes within a limited period.

It was later found that the Department of Conservation and Development had planned to include in its budget a request for \$200,000 for salt marsh drainage. In this form the request of the State Experiment Station and the Department of Conservation and Development went to the Governor's Budget Commission. The \$15,000.00 request of the State Experiment Station was approved and during the session of the Legislature was inserted in the Appropriation Bill. The \$200,000.00 request of the Department of Conservation and Development was eliminated by the Governor's Budget Commission, and neither it nor any part of it was inserted in the Appropriation Bill during the Legislature's session.

By correspondence the executive committee authorized the secretary to prepare the program for the coming annual meeting and later approved this program.

In the second session, the committee considered two matters which were presented to it by the field executives of the various mosquito extermination commissions, both matters took the form of resolutions and are submitted in this report in the way in which they were presented by the field executives.

"WHEREAS problems in anti-mosquito work arise from time to time which affect all the mosquito extermination commissions collectively, the prompt solution of which is important to the successful prosecution of control operation throughout the State, and

WHEREAS such solutions can be best determined by the field executives of the several commissions combined in conference, therefore, be it

RESOLVED that the unofficial organization composed of the field executives the State Experiment Station and of the county commissions actively engaged in mosquito control work and known as the 'Associated Executives of Mosquito Control of New Jersey,' be recognized as an official and efficient

instrument in anti-mosquito work, and that such organization be recommended to individual mosquito commissions for their endorsement and support."

WHEREAS it is recognized that there exists an urgent necessity for the development of mechanical means of constructing and maintaining drainage systems, be it

RESOLVED that a standing committee be appointed to study this phase of anti-mosquito work, and be it further

RESOLVED that this committee consist of the executive officer of the state mosquito extermination work as chairman and one representative from each active county commission, preferably their executive officer or such member of his staff as they shall designate."

After giving these resolutions careful consideration, the committee has seen fit to endorse them and to present them as a part of its report for your consideration and possible adoption.

JOSEPH CAMP.

REID HOWELL.

EDWARD W. JACKSON.

WILLIAM E. DARNALL.

H. H. BRINKERHOFF.

ROBERT F. ENGLE.

WALTER R. HUDSON.

Executive Committee

PRESIDENT RIDER: Gentlemen, I think it would be best to take up in the first place the reports of the Secretary—Treasurer for your action.

MR. BROOKS: I move that the reports be accepted and approved.

PRESIDENT RIDER: Is that motion seconded?

(The motion was seconded).

MR. HOWELL: I am only interested in one item of the Treasurer's report, and that has to do with the fees received from the counties. Will the Secretary give some details as to just what that means?

(Secretary Headlee reads from report).

MR. HOWELL: Where does this money come from?

SECRETARY HEADLEE: It comes from the county mosquito commissions.

PRESIDENT RIDER: That is according to the assessment, according to the agreed upon assessment.

MR. HOWELL: It has been paid?

PRESIDENT RIDER: Yes.

MR. HOWELL: It comes out of the appropriation that the freeholders give to the different county commissions?

SECRETARY HEADLEE: Yes.

MR. HOWELL: What I had in mind, gentlemen, was if we can do so much with the fees contributed to the different commissions by the different counties is it not possible for us from the same source to gather up sufficient funds to carry on publicity work that many of you have heard me speak of, that I think is so essential? If a portion of this money can be used, as it has been used here, for publicity work, why can't we use \$10,000 during the coming year? That is the thought that I have in mind and I only wish to bring it out at this moment.

PRESIDENT RIDER: Are you ready for the question? All in favor of receiving and approving the report of the Secretary-Treasurer manifest the same by saying aye; opposed no. It is so ordered.

Now take the report of the Executive Committee. I suppose we will take the report up generally first and then the resolutions independently.

SECRETARY HEADLEE: Just as you wish them.

PRESIDENT RIDER: What is your wish concerning the report of the Executive Committee and their recommendations? If it is so desired you can have those resolutions separate or you can discuss them individually.

DR. BRINKERHOFF: I move that the report of the Executive Committee be received and the recommendations adopted.

(The motion was seconded).

PRESIDENT RIDER: You have heard the motion, that the report of the Executive Committee be received and the resolutions which are included in it be adopted. Are you ready for the question? All in favor say aye; opposed no. It is so ordered.

The Secretary requests that if there are any amendments desired we shall be glad to present them for consideration at this time.

DR. WILLIAM E. DARNALL: We all recognize the fact that our very efficient Secretary has perhaps about all that he can do. The mosquito business is but one of many departments of which he is the head. He is probably more busy right now on two or three other things than he is on the mosquito problem. And feeling that he was more or less overburdened with work and also feeling that we could not spare him as Secretary because he is the keystone of the arch, has all reins in his hands and keeps his ear to the ground for all sorts of things, I feel that we should use some means to help him out a little bit. The means suggested are these; to divide his office

and relieve him of his duties as treasurer, and to appoint an assistant secretary to help him in carrying out of the secretary's work. And therefore, in accordance with Article 8 of the constitution of the New Jersey Mosquito Extermination Association, I wish to present the following amendment and move its adoption:

That the words "and Secretary-Treasurer" in Article 3 be struck out and that the words, "Secretary, Assistant Secretary and Treasurer," be inserted.

PRESIDENT RIDER: You have heard the resolution offered by Dr. Darnall. What is your pleasure?

DR. BRINKERHOFF: I second the resolution.

PRESIDENT RIDER: It is moved and seconded that this resolution be adopted, and recommend this amendment be made to the constitution by striking out certain words and inserting certain others in their place. It is not necessary for me to repeat. Are you ready for the question? All in favor say aye; opposed no. The constitution and bylaws are so amended.

Anything further? If not it will be in order now to receive the report of the Auditing Committee.

MR. CORNISH: The Committee on Audit has been over the treasurer's report and has examined the receipts and expenditures and checks and deposits and finds everything correct.

PRESIDENT RIDER: You have heard the report of the Committee on Audit. What is your pleasure?

A MEMBER: I move it be accepted.

(The motion was seconded).

PRESIDENT RIDER: It is moved and seconded that the report of the Committee on Audit be accepted. All in favor say aye; opposed no. It is so ordered.

Report of Committee on Resolutions, Dr. Brouwer, Chairman.
Read by Secretary Headlee.

Report of Committee on Resolutions

Your Committee on Resolutions reports to the 8th Annual Meeting of the New Jersey Mosquito Extermination Association held at Atlantic City, N. J., April 30th, 1921, that it recommends the following:

1. RESOLVED that we make known to the management of the Hotel Chalfonte our sincere appreciation of the manner in which we have been received and entertained and to their employees for their courtesy.

2. That we appreciate the faithful efforts put forth during the past year by our officers and committees and we are sure that by reason of their work, the cause for which we have been striving has been greatly advanced.

3. That we are particularly pleased with the good reports made by the various counties and look forward with great expectations to the work of the Atlantic County Commission, particularly with the machine used for the cleaning of the salt marsh ditches.

4. We wish especially to commend the recommendations made by Mr. Reid Howell of Rutherford, N. J.

5. We are more than ever convinced that the mosquito can be practically exterminated, and municipalities of this state are perfectly justified in the expenditures of money for this object.

6. We are still commend watchfulness over the mandatory appropriation clause and urge that every effort to defeat same be thwarted.

7. We heartily commend the work of the State Experiment Station and appreciate the faithfulness of Dr. Lipman and Dr. Headlee in their tireless assistance to us.

8. That we extend our thanks to Dr. L. O. Howard, Chief of Bureau of Entomology, U. S. Dept. of Agriculture; Dr. Jacob G. Lipman, Director of N. J. Agricultural Experiment Station; Dr. Thos. J. Headlee, Executive Officer in charge of mosquito work of the N. J. Agricultural Experiment Station; Dr. Frederick L. Hoffman, Statistician Prudential Life Insurance Company; David C. Bowen, Chief of the Bureau of Local Health Administration; Dr. W. E. Britton, State Entomologist of Connecticut; W. H. DeMott, Chief Inspector, Nassau County Mosquito Commission; Mr. J. Albert C. Nyhen in charge of Fly and Mosquito Suppression Work, Board of Health, Brookline, Massachusetts; Eugene Winship, Sanitary Engineer, of New York City Dept. of Health and all others who have participated in our meeting and have brought before us the result of their investigations, and who by reason of the presence and cooperation have made us more than ever determined to continue our work.

PRESIDENT RIDER: You have heard the report of the Committee on Resolutions. What is your pleasure?

A MEMBER: I move it be adopted.

(The motion was seconded).

PRESIDENT RIDER: It is moved and seconded that the report of the committee be adopted. All in favor will say aye; opposed no. It is so ordered.

Report of the Committee on Nominations, Dr. Darnall.

DR. DARNALL: Mr. President, the Committee on Nominations submits the following report:

For President, Charles Lee Meyers, Jersey City.

For Vice-President, Wilfrid A. Manchee, Newark.

For Second Vice-President, Joseph Camp, Pierces.

For Secretary, Thomas J. Headlee, New Brunswick.

For Assistant Secretary, Wilbur Walden, New Brunswick.

For Treasurer, Lewis E. Jackson, Jersey City.

For Executive Committee, Robert F. Engle, Beach Haven, Walter R. Hudson, Paterson, Andrew J. Rider, Hammonton, Ralph Hunt, East Orange, Reid Howell, Rutherford, W. H. Randolph, Rahway, William E. Darnall, Atlantic City.

PRESIDENT RIDER: You have heard the report of the Committee on Nominations. What is your pleasure?

DR. BROWN: I move the Secretary cast one ballot.

(The motion was seconded).

PRESIDENT RIDER: It is moved and seconded that the secretary cast the ballot for the election of officers recommended by the committee. All in favor say aye; opposed no. The secretary will cast the ballot.

(The secretary announced that the ballot was cast for the officers).

DR. BROWN: I believe the Bergen County Commission is in favor of the county commission entering in their budget an increased appropriation for state organization, and I would like to get the sentiment of the other commissions here so that we may have an increased fund to increase our publicity campaign.

PRESIDENT RIDER: Do I understand that motion to mean that the individual counties are to request the freeholders for an additional appropriation in each county?

DR. BROWN: Well, if they increase it \$100 more they would only include that in their budget. Each individual county can make their own business accordingly. But where we are paying our \$25 in Bergen County some counties are paying \$75, it seems to me that there should be an additional increase, \$100 or whatever they think wise, so that the department at New Brunswick can have it to increase the propaganda on publicity throughout the state.

PRESIDENT RIDER: You mean not the department at New Brunswick, you mean this association?

DR. BROWN: Well, they are the ones that control that, the

spending of the money. If we contribute \$1,000 it goes for the carrying on of the convention and all this publicity writing and everything else, as far as the funds that are received there that are regularly expended for expenses of running this organization.

PRESIDENT RIDER: But this fund that is provided by the state goes to the department there and those provided for by the county appropriation, the freeholders, are supposed to be handled by them.

DR. BROWN: The receipts of the secretary-treasurer were from the individual counties. Several thousand dollars of that were spent for different things, for carrying on this convention and expenses in general. Now if they increase our appropriation for the individual counties they will have that much more money. Will they devote it to a publicity campaign throughout the state?

MR. WILLIAM PORTER: May I rise to a question of privilege, to ask a question? By what authority does the Executive Committee assess local commissions for anything? I merely ask this to clear the way. Now the commissions have always paid whatever the Executive Committee of this association has requested, but we have never known from what authority it has come, constitutional or other. We will pay it just the same, as far as that goes.

Now what we are trying to get at is this. If you have in your constitution authorized your Executive Committee to do certain things by way of assessment why may they not also do this other item by assessment? That is what we are trying to get to, sir.

DR. BROWN: This money is appropriated by the county at the suggestion of the individual commissioners of a county. We make out our budget, and from that budget we make payments for legitimate expenses, and this is considered a legitimate expense by the County of Bergen. They consider it \$125 towards the work of the association for the elimination of mosquitoes in this state. It is considered a worthy proposition and it is considered legal. You can send your chief of police to a general conference of police commissioners throughout the state and pay his expense out of the public funds by order of the common council or the health department or on any other thing that is done in our state organization that says where the money comes from, and it is considered legal. My expenses for coming down here today are paid out of the funds that the county contributed according to our budget, and this is also considered fair and reasonable for the propagation of the work. And I cannot see why any individual commission cannot feel as though if this is good work, for the benefit of the public at large, anybody should question it.

MR. CHARLES LEE MEYERS: Mr. President, this is a little bit different from the idea as put forth. There is no assessment of the New Jersey society on the commissions in that sense. They are told what part of this necessary expense contingent upon our work and meeting here and exchanging views, which is a legitimate and proper thing, told what part the expense of this thing is divided into for each commission, which is clear and plain.

Now while I am perfectly and heartily in favor of a campaign of publicity—in fact, I have had two instances lately. Three weeks ago in a Sunday newspaper was published an article whereby a minister whose charge is on some beach—I am sorry I did not bring it with me; I intend to, but in the hurry of getting away I left it in the house. He had been annoyed by the bathers having what he considered suits which exposed too much of nature, and he threatened that if they did it this summer that he would breed mosquitoes all along his beach.

Now there, it seems to me, is a perfect place for an educational campaign, for if the good minister knew or thought of doing which of course I believe to be simply an idle threat; to emphasize his position—the untold damage that he might do by carrying out that threat, the myriads of health destroying mosquitoes that might come from such an attempt to put modesty into bathing suits—he has not been properly educated.

Now I read a short time ago a most beautifully written thing, the most exquisite English, and this gentleman stated with the utmost positiveness that mosquitoes bred in the deep foliage and in the shrubbery and in the tall grass and in the tall timbers; and he also stated that when the last mosquito exterminator was carried to his grave that there would be a mosquito to sing the requiem over his grave; and when Gabriel blew his trumpet and the last mosquito exterminator arose, still there would be a mosquito to welcome him into the new life.

Now there is another case where a man of great genius, with beautiful literature, at least, was not properly educated. So that while I am in favor of this thing I would like to know before any action is actually taken what the opinion of the county counsel would be on that, because in my judgment it is a little different from the assessment. I use that word inadvisedly; I mean an apportionment of the expense to the commissions. This, it seems to me, is a little different thing.

DR. BRINKERHOFF: Just one word. I don't know that there

really is anything before the house but a sort of argument. I believe it is my personal opinion and think probably it will be backed up by the counsel from Hudson County, at least, that the expenditure of money for a state-wide campaign of publicity would probably be against the law, as the money appropriated by the county should be spent in the county. For an organization such as this I believe that we have been advised that money is well spent. However, we are talking about a state-wide campaign of publicity and the counties subscribing money to this organization or to the state department.

Let us go at it in another tack, which will probably be perfectly legal. If we are going to have a state-wide campaign let each individual mosquito commission of the state get the same literature out at the same time, paid for by the funds from the various counties, of their own county fund, for their own county distribution; and wouldn't that be a state-wide campaign paid for by each county, without having it a state assessment? It seems to me it would give the same purpose. Our county can spend \$100 for campaign literature for educational purposes in Hudson County, or give testimony or anything, or any other county; but whether the county counsel would say those counties are justified in turning over to the state association \$100 for this purpose, I think we would be in wrong. And I think some time ago Dr. Darnall reminded me of it, that when we were talking about a campaign manager and a whole lot of other things, didn't the Attorney General decide that our funds were not available for that purpose? Dr. Headlee, don't you remember something like that?

SECRETARY HEADLEE: Yes, I had that up with the Assistant Attorney General, Mr. Boggs, of Newark. Mr. Boggs, after I explained the situation to him thoroughly, said it would be at least a misfeasance in office and I am not sure it would not be malfeasance.

DR. BRINKERHOFF: That is as it seems to me. Now what Dr. Brown spoke about, followed out on the plan I suggested, would reach the same conclusion and yet be within the law.

PRESIDENT RIDER: There is really no motion.

DR. BROWN: Mr. President, the money we now spend comes from that very fund, assessment or whatever it is, invitations to the various board of health, chambers of commerce and various things is all public campaign for the elimination of the mosquito. It is paid out of that very fund. It is part of the receipts of the treasurer's office here, a thousand and some dollars from the various

counties. If it is \$500, if it is \$1,500, it is simply expended. I cannot see, if one dollar is illegal it is all illegal, as far as that is concerned.

SECRETARY HEADLEE: This is a question that we had to give a good deal of consideration to, because in connection with a movement two years ago for a state-wide publicity campaign this question arose many times. It seemed advisable, after learning the opinion of the Attorney General, to arrange our expenditures under this association as a return for services. You will remember when I call it to your mind that for the last two or three years you have received, when the proceedings are printed, a bunch of proceedings; that in addition to the expenditure of county money for the attendance upon these meetings, for the printing of programs and the distribution of the same and that sort of thing, that in addition to the benefit which you receive, which I think no man would hesitate for a moment to acknowledge, you get a certain number of the printed copies of the proceedings, so that you have got something, to show for the money which you have spent.

Now when we move over into this larger field of larger expenditures—it will take \$6,000 to run a campaign of publicity for one year in this state, not less than \$6,000—the assessment is going to run pretty high, and I do not know how your county counsel will look upon it; but if I may judge from past experience I think Dr. Brinkerhoff is right. I think that your county counsel will say that that is money expended outside the county for which you in Hudson County or you in Essex County are getting no particular benefit. And I believe that he would rule against it in a great many cases. This thing would have been on its feet already, gentlemen, if it had not been for the adverse attitude of the Assistant Attorney General; and what he tells me in our department is what we have to do. So that is where we stand on it.

MR. WILLIAM PORTER: May I have just one more word? My question has been answered. Assessment is the wrong word to use for the situation. The amount that is divided between the various commissions for the expenditures of this association is what it means; is that correct?

PRESIDENT RIDER: Yes.

MR. PORTER: Whereas the other would be an assessment pure and simple, if you had a campaign fund.

PRESIDENT RIDER: There seems to be no objection to distributing these reports, which are a necessary expense of the organization,

to the different commissions throughout the state in proportion, as is the judgment of the executive committee, to their benefit or to their membership or to the amount of their appropriations. That seems to be provided for and seems to be perfectly feasible and I do not think it would be policy to do something that would attract attention and cause the antagonism, possibly, of those who make the appropriations.

Now as far as the matter which Mr. Meyers suggested is concerned, I think as far as that preacher is concerned, he ought to be ashamed and the county in which he lives had better be notified of this preacher's position, so it can take him in hand and treat with him.

In the other matter, as far as the dress of the ladies is concerned, I don't know anything better than to refer that to Dr. Hunt, who is going to speak to them tonight and he can tell them all about how they ought to dress in connection with the mosquito association. I don't know that we need any motion. I will leave it to him for the inspiration of the moment.

MR. ENGLE: I would only suggest that this matter might be put up to the Attorney General's office as presently stated. Attorney Generals, justices and members of the legal fraternity generally are frequently allowed to change their minds. I don't know that there would be any different verdict, but I would like to see it put up to them as it is presently stated and see whether there is any change.

PRESIDENT RIDER: Have you any motion to make in that connection?

MR. ENGLE: I will make a motion to that effect.

PRESIDENT RIDER: Who will you delegate to put it up to them?

MR. ENGLE: Dr. Headlee.

PRESIDENT RIDER: Is it seconded?

(The motion was seconded).

MR. CHARLES LEE MEYERS: I would like to make an amendment to that motion, that the same question be put by each of the commissioners to its own county counsel. My reason for that is that you may get a decision from the Attorney General and then have your county counsel reverse it.

DR. BRINKERHOFF: My question is this. It might be all right for Dr. Headlee in his department to get the opinion of the Assistant Attorney General or the Attorney General; but whether that opinion would be any good in the county where we have county counsel to

decide it or not, I do not think it would. I think we would have to go to our own county counsel. You know Dr. Brown is all right. I like the idea. But he comes from Bergen County, and therefore he has Senator Mackay. We have got him in Jersey City just now.

MR. REID HOWELL: This recommendation of Mr. Engle, of course, is good, but I can see ourselves frittering away another twelve months getting this question answered. That is no reflection upon the program. It seems to me that the proper procedure would be this. Let us get somewhere. If we are going to make any effort to have a campaign of publicity let us do something. If it is necessary let us have a new bill in the next legislature that will permit the expenditure of those funds. That is such a simple matter if we go about it. It is only the intent that we honestly ventilate this subject. That was my purpose in bringing to your notice the fact that funds were being used for what appear to be publicity purposes, and yet I can see that this distinction as raised on the other side here is very proper. There is a distinction, it is very plain—whether our board of freeholders, who are spending all the money, fully realize what we are spending it for. We cannot spend it except in certain respects where it is provided for. For instance, in Bergen and Essex we spend funds jointly on a bridge, or spend it in Essex and Bergen. We spend ours on one-half of the road and they spend it on the other. But when it comes to a real necessity one county can do the whole work and the other county pay it. That is our experience that I have gone through, and it is perfectly feasible and possible under the present law.

If there is something lacking in our legislation that prohibits the use of these appropriations that the freeholders are making in the several counties, let us have a bill through the legislature that will permit the use of those for publicity work. It can be done if we have only somewhere in connection with our organization, the executive committee or somebody, a legislative man or somebody that we can appeal to that has the ability to get up one of these bills. I am not calculated for that purpose. A group of our legislators, a representative from one of our counties, any one of you might think of the right man, one who would study the work and write this bill, that would permit the use of the funds appropriated by the board of freeholders in the several counties to be used throughout the state jointly for publicity purposes.

MR. BROOKS: May I offer an amendment to the resolution, that this matter be referred to the executive committee? We are losing time.

PRESIDENT RIDER: The other amendment was made. That was not seconded, hence the original motion is now before us, and now the second amendment is seconded.

MR. ENGLE: I will withdraw my motion and second this motion.

PRESIDENT RIDER: The original motion is withdrawn, and with the consent of the second?

A MEMBER: Yes.

PRESIDENT RIDER: And the motion is now that it be referred to the executive committee. Are you ready for the question? All in favor say aye; opposed no. It is so ordered.

Now there is nothing but the new program. Next on the program, that is, after our business session, is, "Practical Drainage Systems, Their Variations, Cost of Installation and Cost of Up-keep." Twenty minutes is allowed for this discussion, and the man who will discuss it is Jesse B. Leslie, Superintendent Bergen County Mosquito Commission.

JESSE B. LESLIE: In considering the subject of practical drainage systems for mosquito control, it is quite necessary to bear in mind the fact that such drainage systems have a definite object in view and that all general rules applicable to drainage for other purposes should not always be closely followed in designing and constructing such systems. In fact, sometimes ditching which is entirely satisfactory from the standpoint of eliminating mosquito breeding would be hopelessly inadequate for agricultural or other development and on the other hand you too often find that ditches which keep a certain area well enough drained for the accomplishing of a particular purpose are themselves intensive mosquito breeders. In mosquito ditching, there are two main objects to be fulfilled. 1st to draw the surface water from all the separate pools, pockets, rat-runs, and depressions into a main pond, ditch, or a series of ditches and 2nd to provide adequate means to prevent larvae from maturing in such central places after the water has been thus pounded. Each place to be drained presents its own unique problem and a discussion of drainage methods could well embrace a long and detailed analysis of many varied questions. It is not the purpose of this paper to attempt such an analysis but merely to touch briefly on the chief underlying and fundamental principles. And as mosquito work naturally divides itself into salt marsh and inland drainage, it would probably be wise to consider these separately.

The drainage of the salt marshes is undoubtedly the biggest problem of mosquito control in New Jersey today and the working

out of good drainage systems for the salt marsh has been and is a vital question. Nor is it an easy one because each salt marsh must be dealt with as an entity and experience gained on one meadow often fails to be of use on a contiguous one. In designing a system for the elimination of salt marsh mosquito breeding, the points which apparently are most often forgotten are 1—That drainage, not ditching is the ultimate goal to be reached and 2—That the installation of initial drainage measures will inevitably bring about changes to the character of the meadow itself that will tend to decrease the efficiency of the system constructed unless such changes are anticipated and provided for. Yielding to expediency in conducting salt marsh drainage operations is a short sighted policy and will eventually prove to be costly economy. The tendency to cut a lot of ditches to see what they will do with the idea of trying something else if that does not produce the desired result should be guarded against. There is only one practical way to drain any section of salt marsh and that is to make a thorough and comprehensive study of the meadow to be drained noting especially its size, shape and location, the nature and condition of the soil, whether pervious or impervious, the normal rain-fall to be expected, the rapidity of runoff after heavy rains, the natural water table, the height and reach of tide-water both on the apogee and perigee tides, the amount of water brought to the meadow from adjacent highlands, the nature and extent of natural outlet streams, and the amount and location of the breeding to be destroyed. Much valuable knowledge can be gained by such a survey and with the possession of these facts and due allowance for emergency or peak loads, a comprehensive drainage system can be designed, which should prove adequate and satisfactory under most adverse circumstances. This study should indicate clearly whether the marsh is such that open ditching is desirable or whether tide-gates and dikes will be required or whether pumping must be utilized. It will give sufficient data to allow the engineer in charge to arrive at proper conclusions as to width, depth, and spacing of the ditching to be dug. It will furnish sufficient information for the computation of tide-gate cross sections and the preparation of dike specifications. It will afford a basis for determining size and character of pumping outfits needed. Any other method of procedure will finally produce a system of drainage which is complicated, unwieldy, difficult to maintain, and worst of all one that is often woefully inefficient. The method of thoroughly studying the situation before starting any work whatsoever may mean a

delay and the consequent escape of several broods of mosquitoes but it has this compensating advantage that when the work is finished, you know the area in question is as nearly mosquito proof as man's ingenuity and the application of good engineering practice can make it. It is far better to drain one area completely than to attempt to drain many areas partially and when a drainage system is designed simply to meet conditions which are apparent at the time the drainage is needed, the system cannot be expected to prove serviceable under circumstances that might have been but were not taken into consideration.

The type of drainage therefore that is best adapted for salt marsh drainage cannot be empirically set down but must be largely governed by local conditions as determined by intelligent study. If open ditching is decided on, the system should be laid out so that no point in any lateral ditch will be more than 2,000 feet from an outlet. Otherwise in long ditches there may be a section of the ditch in which the water does not change with the tides and there is always the danger that breeding may take place in such ditch sections. Well constructed and scientifically designed open ditching systems are the cheapest now in use. They have the advantage of a free circulation and the change of water with each flowing and ebbing tide. They have the further advantage of allowing ready access to fish and thus providing a supplemental auxiliary patrol to prevent any ditch breeding. Where circumstances warrant its use, the open system of ditching is to be recommended.

However, on some areas, this system of drainage is not practical sometimes because the sections are sunken to such a level that the tide-pull is insufficient to allow rapid or complete drainage, sometimes because the place to be drained is so cut off that the outlets are not large enough to drain off both tide water and storm water in the required time and sometimes because there is a substrata of clay under the meadow which forms a natural basin and prevents good seepage so that water which overflows on the high tide is not drawn back into the ditch on the receding tide, but remains on the meadow surface to become stagnant and to breed. Under such conditions, open ditching will not avail and the drainage system must be varied to meet the facts as found. If a ditching system will not handle both tide-water and storm quickly enough to do away with mosquito breeding, the plan usually followed is to exclude the tide water altogether by means of dikes and tide-gates and make the ditches of sufficient capacity to handle the storm water and surface

drainage only. The initial cost of tide-gate and dike construction is more than open ditching, but it has the advantage that areas so diked can be inspected at any time regardless of the tide and the water table at all times is at a much lower level than in open ditches. It has this distinct disadvantage, that the water in the ditches has a very sluggish motion and breeding is likely to occur in the ditches themselves. If possible, in designing a closed ditching system, provision should be made to obtain circulation of the water by opening all tide-gates or certain of them at fixed periods. This flushes out the ditches and lets the fish into the diked area where they can help keep down the ditch breeding.

The use of pumps in clearing areas of mosquito breeding is not as yet very general. Yet there is much to be said in favor of it. On some areas, natural conditions are such that gravity drainage even aided by tide action cannot move the water away from an area fast enough to prevent the emergence of a brood. The practical method then is to make use of auxiliary means of pumping to supplement nature. Although the initial cost of a pumping unit is comparatively great, it furnishes the means of moving water away from an area faster and more completely than any of the other methods and certainly is a most active ally in times of storm. So often drainage systems which are apparently all right under ordinary circumstances will break completely under exceptional conditions and a large brood will escape in mid-summer because of the failure of this system. Such a brood on the wing will discount the work of months and often do much to discredit an entire season's patient labor. If mosquito control is to be ultimately accepted, such extraordinary working conditions must be expected and successfully handled. For emergency times, there is no system so dependable as a pump and it is probable that as our knowledge of drainage for mosquito control broadens, pumps will be used more and more. And in placing pumps, it must be kept in mind that a pump can only take water which is brought to it and proper reservoir ditches are most important.

So much for the types of mosquito control drainage on the salt marsh. On the upland, the task differs from that on the meadows because here there is no tide action to be considered. With this exception, however, the problem is much the same and there is the same necessity for thorough and intensive study of each place before attempting drainage. And here again the size, shape and general location of the swamp or pool to be drained, the rain-fall and

run-off, the sources of the water, the nature and condition of the soil, and amount of grade possible are all governing factors in designating the system of drainage which is most feasible. The greatest amount of upland labor is spent in improving already existing conditions rather than in draining areas that have never been drained before. The obstructed stream, the grass-grown brook, the polluted gutter, the partially drained swamp are far more prevalent especially near habitations than are swamps and pools which man has never before attempted to improve. Much work is also made necessary because man in draining a particular spot often shows an utter disregard for the drainage of the section as a whole. For instance, a land development company in redeeming its own property will carry the water from one side of the road to the other, or into a woods where it is out of sight and then "ostrich-like" think that the section is drained. Engineers in charge of road construction also will insist in locating culverts at the apparent grade of the stream instead of at the true grade as determined by a complete survey of the areas to be served by this culvert. "Culverts too high to allow complete drainage" is a phrase which occurs over and over again on mosquito inspector's reports of investigations made of breeding areas. And by lowering culverts to proper grade much swampland can be completely drained and acres of mosquito breeding territory can be made practically free from breeding. Old ditches which perhaps once served a good purpose and were put in with the best intentions but which have been abandoned or neglected and are congested and choked are other heritages which descend to the energetic mosquito inspector. But whether it be the old ditch to be cleaned, the partially drained swamp to be finished, or the drainage of the hitherto undrained swampland to be attempted, the proper method to be followed can be decided upon only after a most complete and thorough study of the conditions existing at each place under consideration.

Open ditches are most often used because of the expense involved in under drainage. For instance, if in draining an area it is found necessary to clean out, trim and re-grade a main stream or series of ditches 8 or 10 thousand feet in length, the impracticability of considering any other means than open drainage with the amount of money available for mosquito control is at once apparent. However, if the ditching under consideration involves a ditch of a few hundred feet or less and requires a deep cut or a cut through sandy or shifting soil, tile drainage is the better and more economical means of drainage in spite of the original cost. Often a nearby storm-sewer

offers ready outlet for an isolated picket and a small pipe line into such a sewer or catch basin will bring about good drainage at a comparatively low cost. The advantage of under drainage is its permanence and the subsequent reduced cost of maintenance. Open ditches unless through heavy clay or very solid soil should always be cut with sloping sides and a V cross-section. But even the most carefully constructed open ditches will overgrow in time and may become blocked. They require constant inspection and periodic cleaning. On the other hand, open ditches have earned their place in mosquito control work because they permit a far greater number of breeding spots to be successfully done away with in a single season than any of the other methods and because the cost of maintenance is as a rule only a fair proportion of the first cost. The best drainage systems on the upland are planned so that the water will be completely drained from the swamps or pools and swiftly carried to a main brook, river, pond or tidal stream where breeding will be quickly destroyed. Sometimes, however, such a plan cannot be worked out and partial, drainage is the best that can be obtained. Under such circumstances the water is gathered into a central "sump" or ditch where it is later treated with oil. This system has such obvious draw-backs that it should be used only when no other means can be utilized.

As to the cost of installation of the practical drainage system, the remarks made above in regard to the design and construction apply with equal force to the cost. Each place to be drained presents so many individual features that so called average cost figures are not of much practical value. It is easy enough to declare glibly that to drain a salt marsh requires so many feet of ditching and that the cost per acre should be a certain sum but you are paving the way for trouble when the man in the field finds that in his case it simply can't be done with that amount or at that price and then you have to explain just where the fallacy occurs. And the deeper one studies into this subject the more firmly one becomes convinced that figures of ditching in one locality form no basis of comparison for figures gathered in another locality and do not give sufficient data for a conclusion as to an approximate general quotation of the fair cost of drainage work per given unit. And as the work in different localities differs in cost, so does the cost of the work from year to year fluctuate for it is primarily dependent on the cost of labor, which is a variable quantity. As the labor cost is the big item, it is customary in many organizations in quoting cost figures to derive the

cost per foot by taking the total footage and dividing it into the number of man-hours multiplied by the unit cost per man hour. And in quoting such cost figures the basic man-hour cost should always be mentioned. This method excludes all engineering, supervision, equipment, material, and transportation charges and leaves them to be absorbed by general overhead or other divisions of the work. Figures obtained in this way are accurate so far as they go, are readily attainable, and have a certain value to the men and organizations actually engaged in the construction operations. They give a rough standard for the foreman and serve as a barometer to the chief inspector to detect a gang that is falling behind. They are not, however, true cost figures and these can only be obtained by taking into consideration cost of surveying, laying out, inspecting, and supervising the work, cost of equipment and material used on the construction of that unit, cost of transportation, insurance, depreciation and a proportion of general administration. To determine the exact amount of each item contemplated in this method of arriving at cost data would of course mean the filing of additional records and involved bookkeeping, but there is no reason why the executive officer cannot readily and quickly make such apportionments and adjustments as will allow him to charge these costs directly against each drainage project with reasonable accuracy. Certainly such figures properly arrived at and duly correlated are a great help in drawing budgets and outlining new drainage measures.

Cost of maintenance also is a point which will bear some discussion. Maintenance costs are usually based on the original cost of the work and are placed at a fixed percentage determined from previous knowledge obtained while the first work was being conducted. With information on hand relative to the cost per foot and the base from which this cost per foot was derived and knowing the present market price of labor, it is merely a question of proportion and computation to obtain the basic figure for maintenance. But here again the radical differences which exist in each section under drainage enter to upset the budget maker. Sometimes areas which are costly to drain at first, require but little maintenance work and per contra some areas that are originally ditched at a very low cost require such thorough cleaning that the maintenance cost is comparatively high. The proportion of maintenance cost to initial cost, therefore, is not a constant but varies considerably with each area. It can only be ascertained by frequent and careful study of the work installed. The man who arrives at mainten-

ance cost estimates by juggling figures in the office is like the man who inspects for salt marsh breeding by walking along the railroad track and gazing at the meadows—he may guess right but the chances are he'll guess wrong. Maintenance is of absolute importance to successful mosquito control. It must not be carelessly done. It must not be neglected. And in carrying out maintenance measures you learn once more the paramount importance of planning carefully and scientifically the original work and constructing it with due regard to good workmanship. Maintenance on an area which was well drained the first time is a simple matter easily accomplished within a short time. But when you try to maintain a section on which the initial system was faulty—you are in trouble from the start and maintenance costs rise rapidly. This is especially true of tide-gate work. To repair a tide-gate that was hastily and carelessly built is a most difficult undertaking and one that is costly as well. With the work increasing in volume and quantity so constantly, maintenance has now assumed a most important part. The time is rapidly approaching when mechanical means must be utilized to clean the salt marsh ditching systems and a machine must be devised that will make it possible to do this work at a cost of from 1-10th of a cent to 1-15th of a cent a foot. Hand labor is too expensive and too scarce to make it practical to hope to maintain the vast ditching systems especially in South Jersey by that means and a ditch cleaning machine appears to be the only solution.

To sum up then: the practical drainage system for mosquito control is the one that so drains an area that no matter what the condition of tide or weather, the man in the field does not have to S. O. S. The publicity man to gently inform the public that "because of heavy rains, unusually hot weather, etc. a brood is about to emerge despite the earnest and untiring effort of the county mosquito extermination commission to prevent such emergence." The type of drainage best adapted to produce such a condition is directly dependent on the geographical, hydrological, topographical, meteorological, and biological elements of the section under consideration as determined from a comprehensive and intensive study. The cost of installation varies widely according to kind of drainage to be used, type of meadow to be drained, local conditions to be overcome, market price of labor, etc. Any system that does not produce results is expensive no matter what it costs and that system which is followed by complete drainage and the eradication of all breeding is cheap even tho it takes all or a large part of the funds

available for drainage work. The cost of maintenance is directly proportionate to the initial-cost of the work and dependent on it. Properly installed drainage systems entail low maintenance costs; drainage poorly planned and poorly executed means rising maintenance. Steady improvements in organization and equipment mean better drainage at lower costs as the work goes on and each year should see decided progress being made in all departments, scientific study and planning, good engineering in the actual construction work, careful and constant inspection are the fundamentals of mosquito control drainage measures and if these are practiced, drainage systems for mosquito control will reach a maximum of efficiency at a minimum cost with a proportionately reduced cost of maintenance.

PRESIDENT RIDER: The next number on the program is, "Oils and Larvicides Used in Mosquito Control Work, Their Efficiency and Their Practicability," fifteen minutes, by Walter R. B. Delaney, Sanitary Engineer of the Hudson County Mosquito Commission.

MR. WALTER B. DELANEY: The most effective of mosquito control, aside from drainage and filling, is the intelligent and efficient use of oils and larvicides.

The object to be attained in using oils and larvicides is to destroy larvae of mosquitoes. To attain their destruction the surface of the water must be completely and continuously covered with a film of oil, or if a larvicide is used, it must readily mix with water.

The effects produced by using oils and larvicides in preventing mosquito breeding are:

When Oil is Used—Larvae cannot penetrate the oil film with their breathing tubes, and therefore drown; oil appears toxic to tert young larvae, but with older larvae, it is the mechanical action of the oil resting on the surface of the water in an even layer that suffocates the larvae, and not any poisonous effects; oil reduces surface tension, making it difficult for the larvae to stay at the surface of the water long enough to breath the oil film and obtain air; mosquitoes do not oviposit on well oiled water surfaces.

When Larvicide is Used—Larvae are killed by direct contact, and in some cases, the development of ova is retarded, if not entirely prevented.

PETROLEUM: The use of oil—petroleum has been known since early in the nineteenth century, but to Dr. L. O. Howard, the Father of Mosquito Campaigns, goes the credit for its first practical application.

There are many grades of petroleum on the market that can be used for larval destruction, but the one best grade to use, is a matter

of experimenting with several grades, until one suiting local requirements is found. The distillates of crude petroleum, kerosene and fuel oil, are most commonly used in mosquito control in New Jersey.

The use of kerosene, although very effective—inasmuch as it makes a thin film and spreads quickly—is impractical in county-wide operations, due to the following disadvantages; first, rapid evaporation; second, excessive waste, owing to the difficulty of seeing the oil film on the surface of the water; and third, high cost.

The heavy oils, those having a mixed or asphalt base, while cheapest in first cost, do not spread as much or as rapidly as the lighter oils. They are often too thick or too heavy for use in the sprays and more oil must be used per unit of area to secure a killing film. The heavy oils, however, may be treated with kerosene or larvicide, to increase their spreading qualities, but such treatment makes for increased costs.

Gasolene has been used, but it evaporates rapidly and completely and owing to its excessive cost, its universal use is impractical and limited to certain production areas on private property, where disfiguration by the use of oil would meet with opposition on the part of property owners.

Fuel oil is generally used in New Jersey. The grades available vary considerably due to the locality from which the crude product is obtained and the method of refinement, and range from light yellows to almost black. The light oils evaporate quickly and the black oils film too slowly. A satisfactory oil should film and spread rapidly, withstand evaporation and be comparatively cheap.

Petroleum may be applied in various ways. In New Jersey the Standard Barrel Spray Pump is most commonly used and found to be very satisfactory. The use of sprinkler cans, oils drips, subaqueous bubblers, oil-soaked waste and oil-soaked sawdust, either in connection with the spray or separately, depends on the various types of production areas. Each method of application has its advantages, as well as disadvantages, which makes its use practical or impractical. This is a problem that must be solved by those in charge of operations, based on a full knowledge of local conditions. It is generally a combination or a modification of several methods that secures the best results.

The effectiveness of petroleum as a larvicide depends on a perfect film, which must remain unbroken for several hours to insure the reduction or destruction of the larvae under it. In actual field

practice, the perfect film cannot always be obtained. Especially is this true in salt marsh and fresh water swamp control, where continuity of the oil film is impossible, owing to the presence of cat-tails and other grasses, normally present. The perfect film is prevented by wind action, floatage, vegetation and sewage or other organic matter and is easily destroyed by medium or heavy rains. The intelligence and the interest in the work of the oiling squads and the intelligent supervision of their work, has a direct bearing on the effectiveness of petroleum.

LARVICIDES :

Larvicides or substitutes for petroleum are certain substances that will diffuse with water uniformly and with fair rapidity, killing mosquito larvae when they come in contact with it.

The Panama Larvicide, described by Le Prince and Orenstein, in their book "Mosquito Control in Panama" consists of crude carbolic acid, resin and caustic soda. In addition to being a larvicide, this is useful in destroying algae, and is a good disinfectant. As a mosquito larvicide it is used by spraying an aqueous emulsion (one part larvicide to five parts water) over the surface to be treated and along the margins of pools and ponds, or other mosquito breeding places. This larvicide kills in a dilution from 1:1000 to 1:15000.

The advantages of this larvicide, as set forth by Le Prince and Orenstein are :

- 1—High toxicity to mosquito larvae. A 1:5000 emulsion kills full grown larvae in from 3 to 19 minutes.
- 2—Concentration. Being effective for practical use in a 1:5000 emulsion only a relatively small amount of the larvicide need be transported to a given body of water.
- 3—Uniformity of toxic power. This product, when carefully made, is uniform in toxicity.
- 4—Simplicity of composition. The manufacture of this larvicide requires neither complicated apparatus nor highly skilled labor.
- 5—Low toxicity to higher animals. It is practically harmless in ordinary dosage or in dilution to cattle, poultry, etc.
- 6—Rapidly of toxic action. When used in the field, it killed all anopheles larvae and pupae in 10 to 20 minutes.
- 7—Cheapness of the product. In Panama, the cost is about eighteen cents a gallon.
- 8—Absence of danger from fire. The concentrated larvicide is inflammable, but not easily ignited. In dilution it is not inflammable.
- 9—It is useful in the rapid determination of the presence of mosquito larvae and kills those at rest embedded in the mud.
- 10—In addition to its toxicity for mosquito larvae the phenol-resin larvicide

is also highly toxic to protozoa and algae, as well as most varieties of common grasses encountered in Panama. The algacidal and herbicidal properties of this larvicide are of frequent use in mosquito eradication.

The disadvantages of this larvicide are:

- 1—It does not emulsify and is inert in brackish water. This is a serious disadvantage because many *Anopheles* breed in brackish water and *Culex* breed in salt-water marshes and pools. This defect, however, is shared by all the commercial larvicides tested on the Isthmus.
- 2—The pure larvicide deteriorates upon exposure to the air and must be kept in drums, barrels, and other tightly closed containers.
- 3—It rapidly loses its toxicity after mixing with water containing algae and other organic matter. After 24 hours its toxicity is so far diminished that it is practically non-toxic from the standpoint of field practice.

The toxic action of this phenol-resin larvicide upon mosquito larvae is probably due to the action of its phenol content upon the protoplasm of the larvae, probably intensified by the fact the phenol is in emulsion.

The Panama Larvicide, according to many authorities is very effective, but its use is limited to fresh water control.

Nitre Cake, a by-product of the manufacture of explosives, is a grayish hygroscopic salt, consisting of anhydrous sodium sulphate and acid sodium sulphate. Dr. R. C. Deriveaux used nitre cake during the Crossett, Arkansas, anti-malarial campaign and found it to be lethal to larvae and pupae and to prevent the development of ova in a dilution of 1:400. He treated five barrels, using one pound of the cake, stirred into solution, to the fifty gallon barrel. No breeding occurred in any of the barrels during the season.

R. E. Tarbett, found niter cake very effective for treating fire barrels. He dosed each barrel with three pounds of the cake, which was added dry, without any attempt at pulverizing or making into a solution. Fifteen hundred barrels were dosed and no breeding occurred in any of the barrels during the season. It was found that niter cake in a dilution of 1:400 killed larvae in fifteen to twenty minutes, but did not affect pupae. Tarbett also dosed a catch basin, using ten pounds of the cake to the basin and no breeding occurred.

Dr. Headlee experimented with nitre cake and found that a 1:1000 solution was barely sufficient to destroy the larvae of *Culex pipiens* in two days time, but that stronger solutions, 1:100 destroyed this species readily and remained effective for 21 days or longer. A solution (6 grams of nitre cake to 1000cc of water testing 7% salinity) was found to destroy the larvae of *Aedes sollicitans*, but required three days to accomplish the result.

Nitre cake is fairly efficient, but its use is somewhat limited, being entirely unsuited to running streams or to ponds frequently washed out by heavy rains. Its use is practical, however, in treating fire barrels, vats, old wells, abandoned cisterns, or any artificial container, where there is no danger of poisoning persons or stock.

The advantages of nitre cake as a larvicide are: low cost, in carload lots averaging fifty tons to the car; nitre cake costs about \$5.00 per ton; remains effective for a month or more; readily kills larvae in a dilution of 1:400.

The disadvantages of nitre cake are: destructive to the skin and clothing; poisonous to stock; diffusion relatively slow; alkalinity of soil neutralizes active agent, namely, sulphuric acid; limited use.

Water gas tar is a by-product of the manufacture of illuminating gas. It has been used by several workers and found to be very effective. This by-product has practically the same gravity as water, having a tendency to float in masses slightly below the surface of the water. Owing to chemical properties of the tar (phenol, naphtha and creosote oils) larvae are killed in much less time than is required with a film of oil. I have noticed larvae of *Culex pipiens* become inactive a short time after coming in contact with a mass of the tar. Water gas tar can be used straight or mixed with kerosene and fuel oil, greatly increasing their efficiency and resistance to conditions that tend to break the film. This product can usually be obtained free of charge or at a nominal cost at any plant manufacturing gas by the water gas process. Its use is recommended as an efficient and practical, as well as an economical control measure.

Many tests have been made during the past few years to determine the value of creosote as a larvicide. Metz, who has experimented with creosote states:

"Creosote may prove to have some advantages due to the fact that it is more lethal than kerosene and that it may be effective without forming a complete film. In addition to its direct action on the larvae, it is effective in reducing the larval food supply. The principal features of this method of control as revealed by the preliminary tests, are as follows: Refined or commercial creosote, of a dark color and a consistency slightly thicker than kerosene, is applied in the form of a fine mist spray. The application differs essentially from that of kerosene or crude oil in that the creosote oil is broken up into minute particles that float in the air like mist. Thus, only a small amount of this material is used, as compared with the ordinary method of oiling. The style pump used in the tests was of the automatic type that retains compression, so as to provide a constant mist. Such a mist will settle

over the surface of the water, into hoof-prints, etc., and will float in among plants or other obstructions, provided such obstructions do not form a complete canopy. A remarkably small amount of this material will kill anopheles larvae if properly applied. Apparently a film of creosote is not essential, as the lethal action is not brought about by suffocation, so much as by poisoning and the fine mist over the surface of the water suffices for this purpose. For treatment of small puddles, edges of streams, ponds, etc., and for handling a large territory where bodies of water are scattered and transportation is difficult, this method holds considerable promise.

Since creosote is poisonous to fish and other animals, it must be used with caution on water containing fish and on water used by stock. If a pond or stream is more than a few feet wide, fish are not affected by treatment of the edges. In small ditches with good current, fish do not seem to be affected unless a large amount of oil is applied, but in small puddles even a slight application is very apt to kill them. Owing to the irritating qualities of creosote, it is improbable that stock will drink water containing enough to do harm, but its use is not recommended in such cases except after careful trial.

The irritating effects of creosote are also felt by those who apply it if much is allowed to come in contact with the skin. For this reason, as well as to facilitate spreading the mist over the water, it is best, where possible, to apply it from the windward side."

The advantages of creosote as a larvicide are:

It readily kills larvae.

It is lethal without forming a complete film.

Reduces larval food supply.

One gallon will do the work of 5 to 6 gallons of oil.

The disadvantages of creosote are:

It is poisonous to fish and stock.

It is very irritating to the human skin.

It is costly.

Its use on salt pools is questionable at least my personal experiments were not conclusive.

In conclusion, petroleum as a larvicide is not entirely satisfactory, but in the absence of a more acceptable larvicide, it is the most practicable medium for larval destruction.

The destruction of larvae, as previously stated, is brought about by suffocation, due to the mechanical action of oil resting on the surface of the water in an even layer, but only where the oil completely and continuously covers the water surface.

The destruction of larvae on salt marshes, with their excessive vegetation, which interferes with the spread of oil, is a hit or miss process, resulting in little or no destruction, and a great waste of oil. To control salt marsh breeding, attention should be centered on the improvement of the drainage system, removing all standing water which makes oiling necessary. "Ditching won't do it, BUT DRAINAGE WILL.

On water surfaces that can be completely and continuously covered with a film of oil, some chemical, if found, which is readily miscible with oil, that will prevent evaporation and loss of surface tension, will in my opinion, solve the problem of destroying larvae by the mechanical action of suffocation.

My brief consideration of larvicides clearly visualises one fact—that the ideal larvicide does not exist. Nearly all the larvicides on the market at present have a limited use or obvious disadvantages, which make their use impracticable from the standpoint of economy and efficiency.

Mosquitoes, by natural choice, oviposit their eggs on the surface of water in which organic matter is always present in some form or other. Unfortunately nearly all commercial larvicides lose their toxicity in the presence of organic matter and unless they kill in a reasonable length of time, soon become ineffective and practically worthless for such destruction. This disadvantage, together with the fact that most larvicides do not readily mix with salt water, is the chief draw-back to larvicides in general.

The ideal larvicide should have the following characteristics:

It should readily affect and destroy larvae, preferably in from ten to twenty minutes.

It should be uniform and high in toxic power and non-toxic to man and stock.

It should readily mix with salt water.

It should reduce or destroy algae.

It should remain affective for a month or more, be convenient to handle and be inexpensive.

Finally, the ideal larvicide will result only after extensive study and research. It is to be remembered, that the physiological activity of the larvae and the effect upon the latter of such factors as habitat, temperature, light and food supply, are recognized variables for study and experiment.

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PRESIDENT RIDER: The next topic upon the program is "The Up-To-Date Salt Marsh Ditcher," twenty minutes, by Fred A. Reiley, Superintendent of the Atlantic County Mosquito Commission.

FRED A. REILEY: During the late war the force of laborers employed for ditching in the Atlantic County meadows was badly crippled by the draft and by the lure of war work paying large wages. As the able bodied men left, their places were filled by boys, and men too old to seek war time jobs.

It was natural to suppose that this type of labor could not turn out the work with the speed of those better fitted for heavy work, and it was especially noted in the footage of the machines that were used to cut 10x30 inch ditches. When prodded by their foreman the complaint was that the cable was too heavy for two, and it was impossible to handle the plow with four men as had been done in the past. The cry was for five and even six men to each machine. At the wages paid this was out of the question.

You are no doubt familiar with the plow then in use,—The Eaton plow. Those who have seen it work will recall that when the ditch has been cut to as close to the outlet as the power plant would permit, in order to get it out of the ditch, it was necessary to, first with a spade and hook dig out all of the cut sod in the plow that was possible to reach and then lift the plow bodily from the ditch and turn it on its side. This operation averaged 12½ minutes and in fact took so long that it was cheaper to cut the balance of the ditch by hand spade, than it was to start the plow again at the outlet and complete the cut by machine. It was this lifting of the plow that was too much for the old men and boys.

It was plainly evident that a new type of plow was the only solution, one that if possible could be handled entirely by the power plant, not only to move it to any desired position but to take it from a completed ditch with a maximum of three men and in a very much shorter time than was necessary with the old plow.

It seemed that with six or seven years of experience on the salt marsh and with a salt marsh plow that it would have been a simple matter to improve on this machine. So the writer thought,—and it was only after several weeks in the cellar with a piece of tin, a pair of tin shears and some solder that he decided it was not so simple. However, the time was not entirely wasted as the germ of an idea was developed for what was expected to be quite an improvement in salt marsh ditchers. This, of course was on paper, but looked good enough to try.

The main idea was to hinge to the skids all cutting and lifting parts that were normally in the ditch, in such a manner that they could be lifted by the power plant clear of the ground. First the necessary side cutting blades for cutting the top grass and roots were fastened by hinges in front and locked in position by hooks at the rear. These hooks could be released when a few feet from the end of the ditch, so that it would have a chance to lift from the ground in the forward movement. Next was the elevating board, which was hinged to the skid at the back or discharge end and suspended at the front or cutting end by two blades that were tied together at the top by a bar. The cutting end of the elevating board was provided with sharpened saw teeth for cutting the bottom of the ditch and the suspending blades were sharpened in order to cut the sides of the ditch to the extreme depth. The top tie bar extended through the blades for a distance of two inches on each side and rested in notches or hooks in racks that were fastened to the skids in an upright position. These racks had notches spaced about three inches apart. Hooking the bar in different notches suspended the forward part of the elevating board to any desired depth up to thirty inches.

By this arrangement it was seen that the full depth of the ditch would be cut in one operation and the resulting sod delivered in one piece, which, if delivered on one side of the machine would cause a strong thrust on that side resulting in throwing the machine out of line of the intended ditch. To provide against this a splitting knife was fastened to one skid that would cut the sod as it was passed along the elevating board into two ribbons of approximately 10x15 inches. These two ribbons were guided by mold boards or discharge chutes, one on either side of the ditch, as was done on the old plow.

To clean the plow of sod when the ditch was completed an "A" frame (see picture No. 3) was provided which stood on the front end of the skids; then the cable from the power plant was carried over the top of the frame and hooked to the cross bar on the side suspension plates. Then by winding in the cable the elevating board was raised with the entire mass of cut, but undischarged sod until it was clear of the skids, when a stick could be placed under it to hold it clear of the ground. Thus by lifting the top side cutting blades and the elevating board clear of the ground, it was only necessary to hook the cable to the draw bar of the plow and move on to the next ditch.

Before this plow was tried it looked like a sure winner and was

constructed in such a manner that it seemed the upkeep would be practically nil.

No efforts were made to select a special piece of meadow for its first test. There was no reason to,—it should cut anything to be found on the salt marsh. It was taken to the location of one of the power plants and started on a fairly good piece of window,—that is for about 200 feet. The performance on this 200 feet of good meadow was all and more than we expected both for cutting and for removing the plow from the ditch. Then our troubles began.

We have cut over 20,000 acres of salt marsh in Atlantic County but I never before encountered such meadow as we then attempted to cut. It was hard enough to walk upon and to cut it was almost impossible. We had not cut 50 feet before we were compelled to stop. First the sod buckled against the splitting knife and would have to be dug off, next the uncut grass and roots that passed the front side cutter blades would catch on the side suspension plates until the wads of grass became so big it would force the sod ahead the buckle and push the whole plow into the air. After the first day it looked like a forlorn hope, and after the recommendation given the members of the mosquito commission as to its possibilities, the case seemed serious.

During the next few days many minor changes were made in the suspension plates, and the elevating board shortened by three feet. This improved matters but not to the extent desired, the main fault being the collection of grass on the suspension blades. These blades would neither cut this grass nor would the grass pass on down the blades to the bottom of the ditch.

By concentrating on the main fault the remedy was found by combining the front side cutting blade with the suspension blade making it out of one piece of steel with cutting edges of two pitches. By making it in one piece the grass had no chance to double and catch on a second blade and also permitted the giving of more pitch to the suspension blade which would allow the uncut grass to pass down that blade to the bottom of the ditch.

The combined blades, then called the side cutting blades, were riveted to a frame slideably mounted on the skids with a bar across the forward end. This bar engaged a pin set in a guide on the skid. By moving this pin to any desired hole in a series of holes in the guide the depth of the ditch could be determined. We then had some difficulty in keeping the saw teeth on the elevating board free from roots and a sharp point was decided upon which led us into

further difficulties with the uncut grass passing down the side blades. This grass would pass down the blades and catch on the point. To overcome this, pieces were cut from the side of the elevating board just back of the point. This space left the front edge of the side blade clear and allowed all except the very long grass roots to pass down the blades.

By this time we had gotten through the above mentioned bad piece of meadow. We had cut about 20,000 feet of ditch which was accomplished only after the hardest kind of work by the men. Upon reaching firmer meadow we had a better chance to see what the splitting knife would develop. It was known when the knife was put on that there would be many places in the marsh where it would not be needed, as experience had taught us that meadow would be found where a rotten strata would occur from 10x18 inches below the surface and in such case the knife would be unnecessary to split the sod into two ribbons. (See picture No. 2). Imagine our surprise when we found the sod was delivered to the surface in two pieces. Then we realized that in shortening the elevating board we had caused the 30 inch mass of sod to take a very sharp bend upward. This necessarily caused a longitudinal strain on the upper and lower parts of the mass and a resulting shear that made the separation. This was very encouraging as the splitting blade was not very satisfactory and required continual cleaning to get results. The knife therefore was discarded.

The "A" frame was still in use, but it was made of wood and at times, if not set just right, would kick out and hit one of the men. This was changed to channel iron construction and hinged to the skids in such a manner that it could be used as a drawbar as well as for lifting the plow from the ground.

We have now almost reached the plow as it is today and a comparison of the old and the new plow will more clearly demonstrate the superiority of the new.

With the old plow we used a two-man spade to dig about 15 feet of 30 inch ditch into which we placed the plow by main force and awkwardness. This movement required from 15 to 20 minutes. With the new plow a ditch 10x18 inches and about 3½ feet long was dug by one man. This ditch could be dug between the skids and did not require man power to place the plow in the ditch, merely the dropping of the elevating board into dug ditch which did not take over five minutes. The cutting of the ditch took the same for both plows which was governed by the speed of the power plant. It is, of



course, impossible to cut a ditch by pulling the plow with cable to the extreme end, if that ditch empties in a creek or river. Therefore the cut is made as near as the power plant. It is, of course, impossible to cut a ditch by pulling the plow with cable to the extreme end, if that ditch empties in a creek or river. Therefore the cut is made as near as the power plant will permit when the plow can be taken out, turned around, placed into the creek or river and pulled to the ditch from which it was taken. With the old plow 12½ minutes were consumed in digging out and removing the plow from the ditch. With the new plow but ½ minute is needed to hook the cable to the "A" frame and pull the plow board from the ground, and with a properly placed anchor and snatch block the plow can be moved to the creek or river and the ditch connected in a much shorter time than was required to cut by hand spade. Consequently we discarded the two-man 10x30 inch spade.

To say the least we had greatly improved working conditions and the men no longer complained of the cable being too much for two men.

It now seemed a shame to waste a good plow on a slow moving power plant like the one we had used since 1914. To move this plant two heavy anchors had to be carried out and a cable dragged to the anchors. This operation was repeated to get the necessary 500 feet before the plow was pulled. A tractor could move without all this work therefore our thoughts were turned to tractors. At this time I would like to state that the Atlantic County Mosquito Extermination Commission was not alone in the idea of using a tractor in this work. Mr. Eaton was also in need of a power plant and we thought that we could both save money by pooling our ideas. As it turned out, Mr. Eaton was forced to carry the burden of the experimental work. These thoughts were not by any means new; the subject had been discussed for several years and we were on the lookout for a small caterpillar tractor that would do the work. The caterpillar type of tread seemed to be the only practical tread to use on the salt marsh, and a 1½ ton tractor was selected for trial,—and in competition a Fordson. The Fordson is a wheel type tractor and we did not consider it seriously, but were willing to be shown. Much to our surprise the demonstration proved beyond a doubt that the Fordson, equipped with extension rims, was far superior to the caterpillar type. Neither tractor had traction enough to pull the 10x30 inch plow and we found that to get one with sufficient line pull, it would weigh five tons and cost \$4,500. There was one

way to overcome this deficiency in line pull and that was to mount a hoisting drum on the tractor, but a drum with gears, cable and necessary frame would weigh 800 to 1,000 pounds, and if carried on the rear of the tractor in the form of a cantilever load would lift the front of the tractor from the ground and interfere with steering. One end of this frame was therefore hinged to the back of the tractor and the other end carried by a skid that dragged along the ground. To this end was also hinged a frame with two broad tines that would sink into the meadow when the cable was used, and prevented the tractor from rolling back with the line pull. This was necessary because the tractor has no brakes. The anchor could be raised and lowered from the driver's seat.

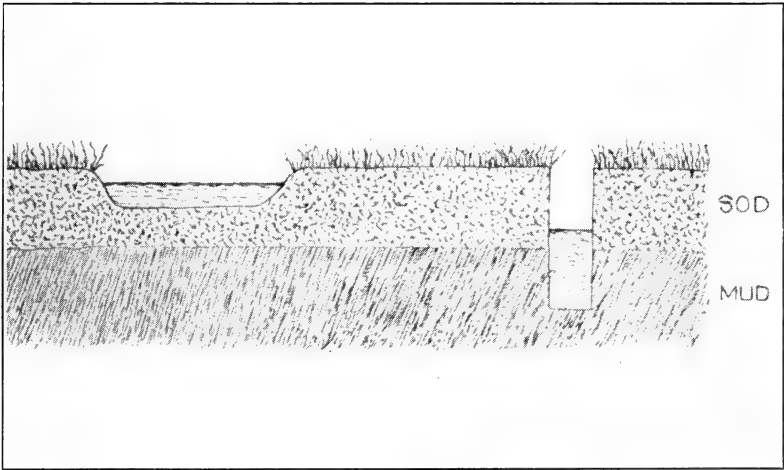
The Fordson tractor is equipped with a pulley attachment placed at the right of the machine just below the right foot of the driver. It was from this drive we got the power for the drum, through a silent chain to the jack-shaft on the drum frame. A square jaw clutch was also placed on the jack-shaft in order to disengage the drum gears when moving the tractor. Everything was arranged so that the driver did not have to leave his seat except to crank the engine.

We were now ready to combine the tractor with the new plow and start ditch cutting. For the first two weeks the meadow encountered was very poor and in fact so bad that the amount of work turned out was no greater than with the old machines. This showing was partly due to the unfamiliarity of the men with the new outfit. The first month they cut 50,000 feet in spite of the bad meadow. The second month 96,000 feet were cut and the third 125,000 feet were cut in 21 working days. The last month the tractor worked in competition with one of the old power plants with a new plow, which cut 62,000 feet. Our maximum footage with the old output was 6,500 feet of 10x30 inch ditches in 8½ hours. Our maximum footage with the new plow and tractor is 10,000 feet in 7½ hours.

This was speeding up the ditch cutting to the point where the small spur gang could not keep up; in fact they had hardly made a good start on the 1,200 acres that the machine had been working on.

The tractor could be handled so easily and so quickly that it occurred to us, why not cut the longer spur ditches by machine and leave the small ones and the hole filling to the laborers. This was tried with a small plow and proved a big saving in both time and money.

I have said that we had almost reached the plow as it is today. We are now about to reach that stage.



VERTICAL SECTION THROUGH MEADOW SURFACE

Where a ditch was to be started from the bank of a creek or river, the tractor pulled the plow to the point, turned it around and by pushing with the front axle on the "A" frame the plow was placed into the creek or river, the cutting blades and the elevating board dropped to a point where by being pulled with the cable would cut the ditch from the outlet. We still, however, had to use the small one-man spade to cut a starting ditch when that ditch started in the open meadows, as for instance, the head of a ditch close to the bottoms. The necessity for the use of a spade to dig even a small starting ditch still left something to be desired and to eliminate this five minutes loss, the question of a flexible point on the elevating board was discussed. Many plans were drawn and discarded as useless. Finally by resorting to more hinges the problem was solved. When the elevating board is resting on the surface the plow point points up at an angle of about 15 degrees. To make the point dig into the meadow from the surface the point should point downward about 15 degrees. To get the desired pitch to the plow point a frame was constructed of angle iron that would fit under the elevating board.

The bottom of this frame was hinged to the side cutting blades and the top hinged to the skids in place of the elevating board. The elevating board was then hinged to the side cutting blades at the same point as the underframe. The lower hinge of the elevating board is located 12 inches back of the point, so by raising the back of the elevating board the point will point downward. By holding the board in this position the forward movement of the plow will cause the point to dig into the meadow until it reaches a depth where it will dig without having to hold the back end of the board up and the board will come back into place by the weight of the sod.

The final change has been used on the small spurring plow and has proven satisfactory. It remains to be seen what it will do on the larger one. If successful, it will finally do away with all hand spades on a machine cut ditch.

PRESIDENT RIDER: Are there any questions to be asked of Mr. Reiley? We have one other number on the program of this session and that is, "A Mechanical Cleaner for Salt Marsh Ditching," by James E. Brooks, Chairman of the Engineering Committee on Ditch Cleaning Machinery.

JAMES E. BROOKS: In the beginning of mosquito control work on the salt marshes of New Jersey the drainage consisted almost entirely of digging ditches, but sooner or later every ditch dug requires to

be cleaned; and in varying proportions in the different counties the drainage of the meadows is changing from a ditch-digging to a ditch-cleaning proposition.

Before describing the development of a machine to clean ditches it may be well to illustrate the importance of cleaning them. In the Hackensack and Newark Bay salt marshes in the northeastern part of New Jersey a large proportion of salt marsh is protected from the inflow of high tides by dikes and tide-gates. It is to these diked areas that the following illustration applies.

There is a vast difference between ditching a meadow and draining a meadow. Figure 1 shows a meadow which has been ditched, but it is plain to be seen that it is not drained. Figure 2, on the contrary, shows a similar meadow area in which the ditch has drained the meadow. The significance of this difference is better illustrated by Figure 3, which represents a vertical section through a portion of the salt marsh. Grass is growing on top of the sod or peat, which latter averages about 18 inches deep. Below the sod is the meadow mud. To the right is shown one of the drainage ditches, usually ten inches wide and varying in depth from 24 to 30 inches. To the left is a hole or depression in the meadow surface, one of many thousands, which hold water for a longer or shorter period, depending on the rainfall, evaporation and drainage. These holes, if wet for a long enough period, will incubate a brood of mosquitoes. Because of the uncertainty of depending on evaporation to dry out these holes it is necessary, in order to control mosquito breeding, to provide other means of removing the water. Sometimes this is done by digging a small ditch, commonly called a spit, from the hole to the drainage ditch, but in many cases it is necessary to depend upon the seepage of the water from the hole through the sod to the drainage ditch. In either case it is very evident that the water in the drainage ditch must be at a lower level than the bottom of the hole. Just what this level should be is a matter now under consideration by the Committee on Standards, but for purposes of discussion a tentative value of 18 inches below the meadow surface has been agreed upon.

It does not take much argument to show that if the water in the ditches is to be kept down to 18 inches below the meadow surface, the ditches themselves must be clean and free for the flow of water to a depth of more than 18 inches. This means frequent cleaning. To do this by hand is very expensive. The great need of ditch cleaning machinery in order to reduce the cost has been recognized for

1000
1000



FIG. 5

several years. In the latter part of 1919 Dr. Thomas J. Headlee, the state executive in charge of mosquito control, called together a committee of engineers from the executive staffs of the various county mosquito extermination commissions, to devise power operated machinery for cleaning ditches. At the present time this committee consists of Fred A. Reiley of Atlantic County, Jesse B. Leslie of Bergen County, Wilbur M. Walden of the State Experiment Station and James E. Brooks of Essex County.

Previous to the organization of this committee the Essex County Commission had built an experimental machine for cleaning ditches. This machine, while not successful, demonstrated certain principles which were useful to the committee. At the last meeting of this association, held at Atlantic City in February 1920, the committee made a brief report which was published in the proceedings. It was felt at that time that there was a possibility that a machine could be constructed which would clean the ditches by being merely dragged through them. Early in 1920 a machine of this kind was constructed and tried on the meadows near Carteret, New Jersey. It was shown very quickly that the machine was greatly limited in its operation, and that a mechanical device for elevating the mud was needed. The committee proceeded to redesign the machine, using a link chain with scrapers and cutters to drag the mud up an inclined trough, this link belt being driven by an eight horse power Cushman gasoline engine.

Figure 4 is a longitudinal vertical diagram of the machine, as revised up to December, 1920. It is carried on long wooden skids, which straddle the ditch. In front is a pilot to keep the machine on the line of the ditch. By removing the rear bolt which attaches the pilot to the skids, the pilot may be swung around vertically until it is above the meadow surface. This is done when the machine is to be transferred from one ditch to another. Back of the pilot is the engine which drives the link belt conveyor. The conveyor is placed in an inclined steel trough, which trough is supported on trunnions, permitting it to dig to a depth of 30 inches below the meadow surface, or less, as may be desired, and also permitting it to be swung up until it clears the meadow surface entirely. By raising the pilot and the trough, the machine may be dragged across the grass from ditch to ditch. Figure 5 is a picture taken on Monday of this week on the meadow in Essex County, showing the machine at the end of the day's work.

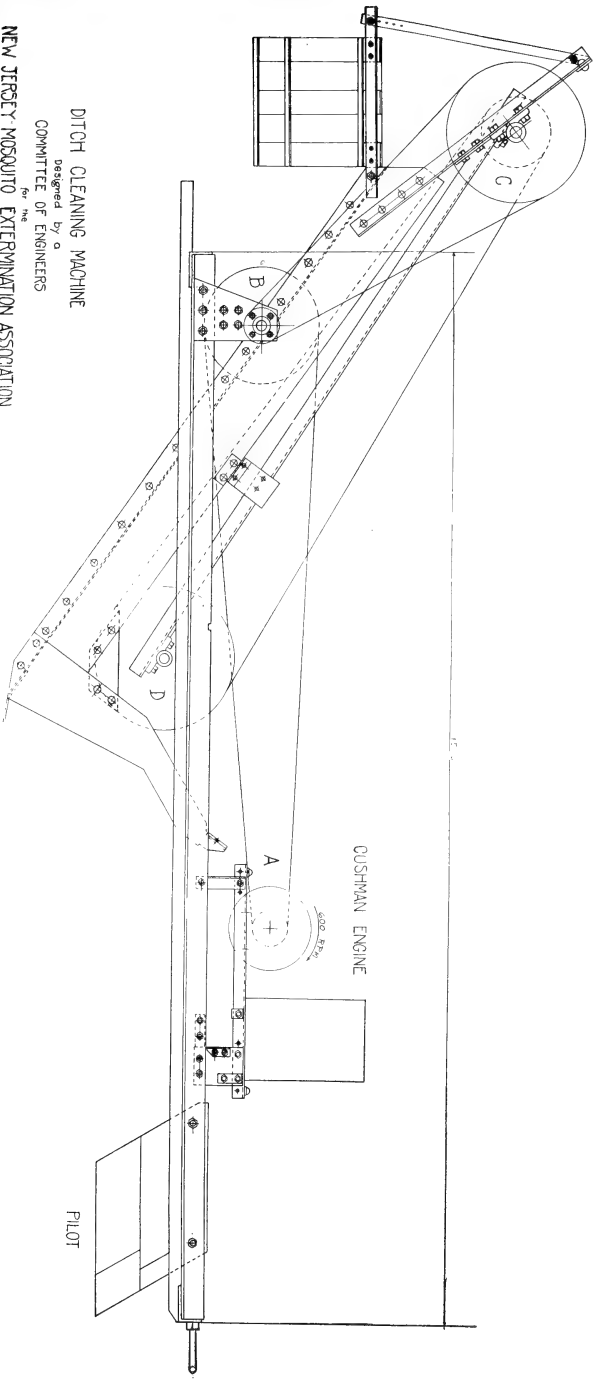
For the purpose of demonstrating the efficiency of the cleaning

machine, a temporary rig was devised for dragging it along the ditch, the motive power being a Fordson tractor. This tractor, with extension rims on the wheels, is shown in the background. The speed of the tractor being too great to permit of its dragging the machine by direct pull, the traction cable was anchored at one end, and after passing through a snatch-block on the front of the machine, was attached to the other end of the tractor. By this method the machine cleaned nearly two thousand feet of ditch the day this picture was taken. It is to be hoped that such a motive power will be available shortly.

Figure 6 shows the machine with the pilot and trough raised up to permit the machine to be moved to the next ditch.

PRESIDENT RIDER: I believe that concludes the program for the afternoon session. The evening session is set down for 8:00 P. M. If there is no objection we will now stand adjourned until 8:00 P. M.

DITCH CLEANING MACHINE
designed by a
COMMITTEE OF ENGINEERS
for the
NEW JERSEY MOSQUITO EXTERMINATION ASSOCIATION



LONGITUDINAL SECTION—FIG. 4

FRIDAY EVENING SESSION

(The meeting was called to order at 8:30 P. M. by President Rider).

PRESIDENT RIDER: We have with us Mr. Nyhen, of Brookline, Massachusetts, who is engaged in the work of dispensing with flies as well as mosquitoes; and the automobile has done so much for us in the way of destroying flies that we have less to look after. The horse and stable and stable manure that we used to have so much of is partly eliminated, and it would be an easy matter, if we could give the same attention to flies that we do to mosquitoes now, to get entirely rid of those.

MR. NYHEN: Mr. President and gentlemen of the New Jersey Mosquito Extermination Association: I am going to tell the old old story, that I have come to learn, come to hear what you have to say rather than to deliver any prepared report of what we have done up in Massachusetts. As I have sat here and listened to the papers which have been read the last two days it has struck me forcibly that I have little to tell you that you have not presented in a way which was so instructive to me that I can go back home, after twenty years work, with new ideas, with a renewed courage and feeling that New Jersey is leading the states of the Union in this particular kind of an anti-mosquito campaign.

It is refreshing to get down here and meet men who will work for a substantial appropriation that is worth while, who believe in the movement and know its value from an economic and health point of view. I look into your faces and see that you are here for business, that you are giving your time and paying out good money to get new ideas, to push this work for the benefit of humanity, and for the municipalities that you represent, so that your people may enjoy the health-giving pleasures and relaxation in the sunshine free from the mosquito pest. And it is worth while doing something good for your neighbors and your state.

I am going to bring back the history of this convention to Massachusetts; I am going to show the public at home that the people of other states and municipalities are thinking intensively and accurately about the solution of the mosquito problem.

Now the work that we are doing in Massachusetts may be considered under three heads; work done by the state, work done by the various municipalities, and work done by private individuals.

In 1916 Massachusetts passed a law which was to supersede the wet, rotten and spongy land act of 1860, a law enacted largely for the purpose of controlling the swamp land nuisances, offensive because of their alleged miasmatic condition. The act of 1860 gave the boards of health the power to condemn and declare swamp lands common nuisances, and the boards of health could go to municipal councils and ask for an appropriation not exceeding \$2,000, a sum which would become eventually a lien upon the property, for the purpose of affecting the drainage of the same.

The law of 1860 was superseded by the act of 1916, whereby a Drainage Board was formed consisting of members of the State Department of Agriculture and the State Board of Health. Very little was accomplished however, under the new law. The act was simplified in 1918. Now one member of the State Board of Health and one member of the State Department of Agriculture make up this Drainage Board, and they have authority under this law, upon petition by citizens who wish to have certain lands drained to form local drainage commissions of the petitioning citizens to execute the drainage law for the economic improvement of the land for agricultural purposes as well as for the protection of the public health.

The result has been that only a few citizens have awakened to the opportunities offered. However, there is a duty imposed upon this commission, for the state commission is directed to study the reclamation of swamp lands for agricultural purposes and this work is being now efficiently planned and executed, even if the citizens fail to avail themselves of the initiative by forming local district drainage boards.

Except from an educational standpoint, there has been very little else done by the state.

Now what have we been doing as municipalities? Brookline started away back in 1901, through the activities of Dr. H. L. Chase, who was the agent of the board of health at that time, and certain citizens who lived in one of the residential parts of the town.

These residents reminded Dr. Chase and the board of health of that time, that the early settlers had found mosquitoes very prevalent away back in colonial times when Brookline was part of Boston. And they petitioned that the mosquito nuisance be abated. Dr. Chase turned the matter over to the board.

The petitioners called the board's attention to the fact that we had a large number of cases of malaria since the arrival of Italian labor in town, and if the Italians were to be employed upon the



10" WIDE DITCH CLEANED BY MACHINE

construction of the park system, something ought to be done to safeguard the town from malaria. The proposition was then turned over to me. An investigation was started. I had very little to work on at that time, except the literature by Dr. Carroll, Dr. Ross, Dr. Reed, Dr. Lazear and our Dr. Howard and other American authorities in the United States and Havana and Cuba. I made a survey and located all the breeding places and began a study of the different species of mosquitoes found in the town. Professor Theobald Smith of the Harvard Medical School assisted us with valuable suggestions and advice.

It was quite an experience. We started an active field campaign in the spring of 1902 and I remember how the early advocates of mosquito suppression talked of what good work we could do for ridiculously small sums of money. We were to work miracles. By the simple waving of empty hands, the mosquitoes would disappear. That was very wrong but this notion has stayed with us even to the present time to the detriment of good field work. Our people expect to buy mosquito suppression for very little money and this is not possible.

However, the public spirit of the town was aroused and the men there are of a calibre who want to have all work done well. Yet they are good business men who want it done as cheaply as possible. From time to time, our appropriations have increased and we have carried on the work intensively and successfully for the past twenty years. We have had our ups and downs. The stories which have been told by the various men who have read their papers to you have been like my experiences. I listen to the speakers and think that I am in the past, going over the same stumbling blocks, the same trials, the same opposition.

This is the twenty-first year we have been doing it. I think we can fairly lay claim to being one of the pioneer municipalities in this part of the country in anti-mosquito work.

There have been other cities and towns in Massachusetts which have attempted to do anti-mosquito work during the past twenty years. Of these, Boston, Watertown, Cambridge, Newton, Revere and Winthrop are cities and towns prominently in mind. There have been many well-to-do residents in other cities and towns who have attempted to undertake the suppression of the mosquitoes on their premises and the areas nearby. These attempts have failed more or less for want of municipal and neighborly co-operation and the moral support of the public, as the result of over-expectation

when failure to obtain successful results was rendered futile by inefficient work and untrained field workers.

The element of cost again was considered discouragingly great to bear alone for the individual in a private venture where there was little in the way of financial gain.

Other causes obvious to those of you engaged in this work also tended to discourage these isolated efforts to carry on mosquito suppression in these last mentioned cities and towns.

In conclusion, I wish to state that the citizens of Massachusetts are fully alive to the need of caring for the mosquito nuisance throughout the state, but it seems to me the public regards the problem as a secondary one which may be deferred in order that the money may be expended on more pressing and important problems first.

In order to overcome this attitude of the public on this matter, it is necessary for us to point out to the business men that the economic values of real estate of natural value have increased one hundred fold wherever land sites for dwellings have been free from the mosquito nuisance, and that money invested for this purpose is money well invested.

Technical, scientific propaganda in aid of public health does not appeal to the average individual and is of questionable value when so used in anti-mosquito campaigns. It is well to discontinue it as an educational factor except where it directly points out increased monetary returns for the cash to be expended in suppressing the mosquito nuisance.

The public is willing to gamble desperately their health and their lives against pain, discomforts, disease and the mosquito nuisance, but the public will not gamble their money on social welfare problems except they have a chance to get back double the money on their investments. As a result, we have decided to follow public opinion, and our campaign has been one of taking care of all the small breeding places at the expense of the public treasury, except the larger problems where we have requested the financial co-operation of the people owning the land.

PRESIDENT RIDER: It now gives me great pleasure to introduce Dr. Lipman, of the New Jersey State Experiment Station, who is with us tonight.

Why Anti-Mosquito Work Has Not Become County-Wide in All Counties

BY J. G. LIPMAN

The success of anti-mosquito activities in New Jersey must depend on popular support. In so far as the presence of mosquitoes becomes a source of annoyance or discomfort, or even becomes a direct menace to health, public sentiment will be aroused and a more or less insistent demand made for remedial legislation and activities.

Under the conditions existing in New Jersey mosquitoes are of secondary importance only as a health factor. To be sure cases of malaria are not uncommon in the state. Indeed, epidemics of the disease occur here and there and there are localities where it has been endemic for a long time. But, in spite of the occurrence of malaria in this or that locality, public sentiment has never been aroused, or at least crystallized, to such a point as to result in county-wide anti-mosquito activities. A few years ago there were several hundred cases of malaria in Sussex County. This did not lead, however, to the organization of a mosquito extermination commission in Sussex County. More recently the number of malaria cases in the vicinity of Princeton increased sufficiently to cause much local comment. The matter was brought before the board of freeholders, and the mosquito extermination commission of the county, ordinarily inactive, was for the time being galvanized into life and lent its support and authority to the more or less effective solution of the problem. More recently still a portion of New Brunswick, in Middlesex County, developed a rather large number of cases of malaria. The matter was brought to the attention of the county mosquito extermination commission, but the latter was unable to develop sufficient popular support to allow of dealing with the problem in an effective manner. The point I am trying to make, therefore, is that, disturbing as may be the malaria situation now and then and in one locality or another, the public is not aroused sufficiently to bring the necessary pressure to bear on county officials and boards of freeholders in behalf of adequate appropriations for dealing with the problem.

It is quite different when we consider mosquitoes as a nuisance rather than a carrier of disease. As a nuisance the salt marsh mosquito attains the role of an important economic factor. The annoyance caused by it is sufficiently grave to discourage the influx of home seekers. Much of the suburban territory invaded by flights

of salt marsh mosquitoes remains unattractive. It gains in value for home building purposes very slowly or not at all. Real estate interests, boards of freeholders; our leaders in education and other activities, journalism, business and transportation are forced to recognize that the mosquito must be considered a factor of economic importance. They are forced to recognize that the salt marsh species, covering a large territory and spreading from the coast inland, retard the development of much of our suburban territory. The boards of freeholders responsible for appropriations for county purposes can not very well ignore any just demands that may be made upon them by the county mosquito commissions. The latter, on their part, have behind them the popular support and the popular urge, and are in a position to insist that certain measures be taken to free the entire county of a serious pest. As a result of this situation active mosquito extermination commissions exist in all of the coast counties. On the other hand, where the salt marsh mosquito problem is limited to only portions of the county, sufficient popular support has not developed in the past to make possible the organization and survival of active mosquito commissions. Camden, Gloucester, Salem and Cumberland Counties may be cited as instances in this connection. In Camden County there was at one time an active commission, but, because of the local rather than county-wide spread of the salt marsh mosquito, popular support was lacking and the board of freeholders refused the necessary support for county-wide mosquito activities. In Cumberland and Salem Counties the county-wide mosquito fight is beset with the same difficulties. Briefly stated, therefore, there is no instance in New Jersey where fresh water species alone have become sufficiently troublesome to make possible the successful maintenance of county-wide anti-mosquito activities.

Recognizing the situation as it is, we are not relieved, nevertheless, from the responsibility of extending to our inland counties such relief as could consistently be extended to them through state or county or local agencies. Early in the anti-mosquito campaign, the late Dr. John B. Smith recognized that local authorities are indeed a weak staff to lean on. It was because of this recognition that he urged the passage of new legislation that would permit the organization of county commissions. The history of these is well known to you and the record of their achievement has been discussed in this meeting and in the meetings of recent years. Our problem now is to find the means and to outline the methods that would so

strengthen our anti-mosquito machinery as to permit the elimination of local as well as of county-wide invasions. There is no excuse for the existence of malaria in New Jersey, no matter how few the cases may be. There is no excuse for the annoyance and discomfort caused by *papiens* in our towns and cities as well as in the rural counties. If additional legislation is needed, why not try to provide it? Is there not a way for creating active mosquito commissions in the inland counties and to invest them with the authority to bring the necessary pressure to bear on such of the local health officers in whose territory mosquitoes are more or less permanent and troublesome? We may see clearly why county-wide mosquito extermination activities are not carried on in all of the counties of the states. This should not relieve us from the obligation of strengthening the mosquito fighting force and machinery so as to give to the taxpayers of New Jersey the fullest measure of immunity and protection.

PRESIDENT RIDER: Is there anything to be said or any questions to ask Dr. Lipman? They will now be in order if you desire, or if you desire to discuss this paper. We are always glad to hear from Dr. Lipman. He always takes a broad view of the situation and we always get some valuable suggestions from him.

SECRETARY HEADLEE: The problem of getting started and getting far with the work in counties where the *papiens* lodge and the salt marsh fly is one that is a difficult one and one that requires a great deal of personal work. Under the present law any county in the state can have a county mosquito commission. It is easy to have that commission appointed. It is easy to prepare plans and estimates and a budget. But unless you can materialize popular support behind it you cannot get the money without utilizing the mandatory feature of the law and bringing to bear upon the counties that are working successfully under this law the danger of the elimination of that phase of the law under which they are working, through the means of a repealer. The only way that I see by which the thing can be accomplished is to devote a large amount of time to individual locations. For instance, in Sussex there is one and perhaps several places in which there is opportunity possible to organize a demand for locally supported work and get that work going. Now I do not believe that you can build from above down in the counties. You must start with particular plague spots and get the money from the local organization to do that work and at the same time tell

them, "Well if you want this thing in a more organized fashion and with better authority to carry on the work you must have an active county mosquito extermination commission appointed and you must give to that commission the needed support and then expect it to do the work for you."

Now I see a number of instances of movements starting that way, and it seems to me likely that that is the way that other counties of the state which are not now operating will be led to do, with the exception of Cumberland and Salem. Now Burlington may have to work out that way. Cumberland and Salem are in a different class altogether. Cumberland has 50,000 acres of salt marsh; Salem has 35,000 acres of salt marsh, and there is no question about the prevalence of mosquitoes from the salt marsh in those counties. You can travel through the bay coast region of those counties and consult anybody you care to who has lived there for a number of years and he will immediately say how very, very bad the mosquitoes are. The trouble that lies in Cumberland and Salem, more in Salem than in Cumberland, is this: the average individual in those counties does not believe that we can eliminate those mosquitoes by trenching the salt marsh. He does not believe it. There is a higher percentum of the population in Cumberland that believes it can be done than there is in Salem; and the reason there is a higher percentum there is because of the filtering process of information as to accomplishments coming from the lower counties on the Atlantic Coast that are now working. And that is the way the thing will start in Cumberland and Salem. Cumberland will start first and then Salem will follow suit.

But those two counties are not in the class of counties we are talking about. I refer to such counties as Sussex, I refer to such counties as Hunterdon, I refer to such counties as Warren and Mercer, such counties as Gloucester and as Camden. In those counties we have got to build from the ground up. We have got to spend a lot of time in individual location where there is a serious problem, and depend on the work there to reach outward and finally assume a county-wide form.

Now I doubt very seriously whether up in Hunterdon County there will come a time when county-wide mosquito work, as we understand it in these northeastern counties of the state, will come to be. On the other hand, I do think this is a very likely thing: that it will be possible to have a mosquito commission equipped with enough money to start and adequately prepare an experienced mos-

quito man who, as a farm demonstration agent does in agriculture, can go from one community to another that needs this work, organize the work, raise the money and put it on its feet and keep it going.

Now that is about the way this thing has shaped up in my mind, from a study of a number of years. I do not believe we are likely to get it through any other way.

While I am on my feet I would like to say that I admire a man who can work for twenty years in one spot without encouragement, without touch with other men who are doing work in a similar line, and succeed in that work. And I want to congratulate Mr. Nyhen for the work that he seems to have accomplished in Brookline and to say that there come to my desk during the year a very considerable number of inquiries from the State of Massachusetts, various points in the State of Massachusetts, as to what methods can be used to control mosquitoes in the localities from which these letters come. And had I known—I have been lamentably ignorant of it—had I known that there was a man in the State of Massachusetts who was doing the successful mosquito work that Mr. Nyhen has been doing I should have been referring these letters to Mr. Nyhen, to give him his opportunity. I do not know any reason why the State of Massachusetts should not have an anti-mosquito organization, and it seems to me from the letters I get from the State of Massachusetts that the material is there; it is a question of organizing it that will come about.

Now regarding Mr. Nyhen's statement of being able to sit on his porch for two weeks without being bitten by a mosquito, I am told that Dr. Darnall, in Atlantic City, keeps no screens in his windows, and that if ever a mosquito dares to enter that the whole mosquito fighting organization of Atlantic County is put out around that neighborhood in a defensive clean-up. Now since I know the continuity with which this mosquito fighting organization evidently is spread over the county meadows and is kept going during the summer, I figure that Dr. Darnall must be able to sit on his porch and sleep nights too all summer long with practically no trouble whatever. (Applause).

PRESIDENT RIDER: Dr. Headlee's talk on that matter comes very near home to me. My next door neighbor about the time our mosquito work began in our town, in Hammonton, had screens prepared for his porch. They have been put away in a storehouse and never been put up. They are in there yet. They have been there now for seven or eight years. We have screens on my porch but we do

not have them for mosquitoes, we have them to keep the flies away which are bound to come around while our neighbors, some have horses and some have cows, and we get the flies, and keep screens up for the purpose of keeping the flies out of the way. That is about all. My family and my wife have a great antipathy to flies. If one gets in the house she is after it.

MR. HULL: I would like to say at this time that I think Dr. Headlee has hit the nail on the head. From my own personal experience I believe that one man in any community who can be interested in the mosquito question where it has become a nuisance can absolutely convert that community to an anti-mosquito campaign. I think Metuchen is a fair example of what can be done. The people there are willing to do anything that is asked in the way of anti-mosquito work, and I think that is true of almost any community of its size and character in the State of New Jersey.

PRESIDENT RIDER: We have one number on the program that has not been completed, and that is, "Control of Malaria in Health Administration," by David C. Bowen, Chief of Bureau of Local Health Administration, State Board of Health.

MR. DAVID C. BOWEN: Mr. President, ladies and gentlemen:

Control of Malaria in Public Health Administration

BY D. C. BOWEN

*Chief, Bureau of Local Health Administration of the
State Department of Health of the State of New Jersey*

It was with considerable hesitancy that I consented to present at this meeting the subject that has been assigned to me. The reason for this was twofold. First, this association includes among its members men who are experts in everything that pertains to the winged insects for which New Jersey has been famous, or, more correctly speaking, notorious, in years gone by. Happily, however, the work that has thus far been accomplished by the able and earnest workers that have been identified with mosquito extermination in New Jersey has already done much to change the conditions which at one time justified these appellations, and this work, if continued, promises to make New Jersey one of the first states in the Union where the mosquito need not be considered when selecting a site upon which to build a home, or when deciding upon a place to spend a summer vacation in peace and comfort and without fear of contracting malaria. Second, I have never quite recovered from the

shock received at the time I first met Doctor Headlee, your distinguished secretary and treasurer. This meeting took place some years ago while I was engaged in making a mosquito survey in Sussex County. When I informed Doctor Headlee that we were finding *A. quadrimaculatus* in considerable numbers and in all manner of unlikely places in that mountainous region, he looked wise, and calmly replied that he thought I must be mistaken, as this particular genus of mosquito had hardly begun to take wing in the more southern parts of the State and could not therefore be expected so early in North Jersey. In the face of that statement, it is needless to say that I began to feel very doubtful concerning my ability to identify one kind of mosquito from another.

Malaria control is not so important a feature in public health administration in New Jersey as it is in many parts of the United States and some foreign countries. That it was at one time highly important, and that it must still be reckoned with here, I shall attempt to show.

A report of the Health Commission of the State of New Jersey for the year 1874 contains some exceedingly interesting information on the prevalence of malaria throughout the state at that time. That portion of the report devoted to "fevers" indicated that the disease was widespread and that practically the entire population of some communities suffered severely. It also shows that before the etiology of malaria was known to science, the drainage of marsh lands was recognized as a means of prevention.

While it is true that drainage, in these early days of efforts to control disease, was resorted to as a means of removing so called "Miasmatic" conditions, which were then believed to cause typhoid fever malaria and other ills of the human body, and not primarily to prevent mosquito breeding which in fact did result the purpose sought was accomplished in a manner not then understood. Little did he who wrote the 1874 report of the New Jersey Health Commission realize how nearly he recorded the truth when he said:

"Commending, and securing its virulence from some foul well or privy, or drain or cellar, or from some other neglect of hygiene precautions, it passes from its nest, and often *wings* its way to homes adjacent, which are not thus contaminated."

When this was written the malaria protozoan was not known and the winged insect that plays a necessary part in the life cycle of the parasite and its transmission to man was not even suspected of the

crime of which it has since been convicted and sentenced to banishment from inhabited areas.

At the risk of repeating what many of you have already read, I quote the following short paragraphs from the report to which allusion has already been made; namely, the report of the New Jersey State Health Commission:

"The fever, however, from which our state is common with other middle states, chiefly suffers, is that known as miasmatic, embracing the various forms of intermittent, or chills and fever so called, remittent, bilious, etc. It probably, more than any other one disease, interferes with our productive labor, and is not only like an epidemic but resident, inflicting an annual tax upon the industrial resources of our state, and upon the comfort of its citizens.

"In a review of the state medical records of the New Jersey Society for the last fifteen years, we find such statements as these:

In Warren County, the report says: 'Intermittent and remittent fevers have long formed a staple portion of the diseases of the Valley of Paulus Kill.'

"The report of 1871, referring to another part of the county, says intermittent and remittent fevers prevail so extensively through the summer and autumn, that they may almost be said to have become epidemic.

"In Hunterdon County, the reporter, speaking of his district, says: 'All diseases, among the inhabitants, are more or less influenced by marsh miasmata.'

"In Sussex County, the report for 1871 speaks of intermittents and remittents, as everywhere more common.

"The report for 1873 of Bergen County, says intermittents and other forms of malarial disease, prevail to a considerable extent.

"The Hudson County report says (1872): Malarial diseases seem to become more prevalent each year. The report for 1873 says 'We shall always have remittent and intermittent fevers, and all those insidious and indefinable forms of ill, resulting from miasm, so long as the vast tracts of marsh land, seen in the county, remain unimproved, or on a tide level.'

"Dr. Culver says: 'It is the ever prevalent fever throughout the county.' In Passaic county, the report for 1873 says: 'Intermittent fever continues to prevail in their due seasons.'

"In Essex County, Newark has at times suffered greatly from miasmatic fevers and dysentery. Reports in different years refer

to its prevalence in adjacent sections of the county. Even late this fall it was prevalent there.

"In Middlesex County the reports show: that it has prevailed wherever there were local causes found to produce it.

"The report of Mercer for 1872 says, we have a good deal of intermittent and remittent, and those most familiar with the Delaware River, will say of it, as of the Passaic, that it has much adjacent land which needs reclamation.

"Dr. Thornton, of Burlington County, says 'We are never rid of periodic fevers, and at all seasons the "ague struck" are to be found, both on the ridge-land and the fens.'

"These counties are not singled out, but so far as our records show, there is not a county in the state but that needs attention as to certain malarial districts in it. A careful review of the records of the last fifteen years shows an amount of evil upon us from this source which surely calls for abatement, if it can be reached."

In a later report of the State Board of Health, for the years 1881 to 1883, a very interesting account is given of a condition which then existed in Bound Brook, I quote briefly as follows:

"The people of Bound Brook and vicinity began to suffer from the groups of symptoms generally classed under the head of malaria, intermittent and remittent fevers and fearful neuralgia of different regions of the body, and this continued, under the use of quinine and the usual antiperiodic treatment and remedies, until, out of the whole population of Bound Brook, there was but one person known not to have suffered, and decidedly so, from malaria in some form. Let it be remembered that Bound Brook shows itself to have been a healthy place by its death-rate, and the remarkable longevity and robustness of its old families. Yet, in spite of all care and persistent treatment, it was impossible for the inhabitants to remain in the town or vicinity and be well. The population is between 1,000 and 1,300.

"Such being the condition of the health of the place, the citizens, with the advice and assistance of the State Board of Health and General Viele, of New York, presented the following indictment, and the case came up for trial at Somerville, Somerset County, N. J., during the September term of 1880, Mr. R. V. Lindaberry, Esq., now of Elizabeth and John Shaw, Esq., of Finderne, having charge of the case.

"The case was thoroughly sifted, many of the prominent physicians and sanitarians of the state being called to the stand, and the

verdict was rendered against the pond. The Judge's charge I am unable to send you but the parties owning the pond were 'ordered to abate the nuisance forthwith.'"

Compare this picture, insofar as it portrays the malarial situation in New Jersey during the decade from 1870 to 1880, with conditions that exist today. In the former period it was believed that the disease had its origin in miasmatic conditions arising from marsh lands, a stagnant pool and other impounded bodies of water from which noxious odors or gasses were borne on the air. By deduction, drainage was applied as the logical remedy. Today, since we know that a particular species of mosquito plays a necessary part in the transmission of malaria and that the propagation of this species is dependent upon such aggregations of water, drainage is still the most permanent if not always the most practical remedy, for the control of this disease. In the old days quinine was used to break the "chills and fever." It is still the therapeutic remedy in use today, the only difference being slight change or modifications in the manner of its administration. Continued treatment of the patient until his blood is free from the malaria parasite is now considered a practical means of breaking one of the triple links in the chain of infection. Screening of rooms occupied by infected persons during the mosquito season in an *Anopheles* infested region has also become a part of modern methods of control of this disease.

In 1889, it was recognized that the mosquito was a factor that must be taken into consideration in the control of malaria. Shortly thereafter the particular genus of mosquito was identified. This made it possible to attack this problem on a more scientific basis than before. Hindle states:

"Under present-day conceptions there can be no transmission of malaria under any of the following conditions:

- "1. Absence of *Anopheles*, by which infection would be conveyed.
- "2. Absence of infected persons in the community, from whom infection could be obtained by the mosquito, even if they were present.
- "3. The existence of adequate 'protection' by means of which either
 - a. The healthy cannot be bitten
 - b. The infected cannot be bitten."

Therefore preventative action depends upon bringing about more or less perfectly one or more of the conditions laid down by Hindle. Theoretically, any one of the three, if thoroughly carried out, would

suffice to prevent any transmission of malaria, and finally to exterminate the disease.

Unfortunately in practice it is usually possible only very imperfectly to reach the desired result by any one of these directions. It must be decided by the health officer in any given case which line of action is most applicable, or what combination of methods promises to be most effective.

The control of malaria in public health administration requires the reporting of recognized cases. In fact this is true in the control by any communicable disease. It may be stated without fear of contradiction that where there is poor reporting there will be found a lack of activities along the lines of enforcing preventative measures against the spread of diseases. This applies to all of the so-called preventable diseases. As a matter of fact, the completeness of morbidity reports may be taken as a fairly reliable index to the efficiency of the health department of any community. In diseases accompanied by any considerable mortality, indicated fatality rates, based on reported cases and recorded deaths, are commonly accepted as showing the completeness or incompleteness of morbidity reports. Where the indicated fatality rates are relatively high, morbidity reporting will be found to be correspondingly poor. Where they are relatively low, the reverse will be true.

In 1911 the State Board of Health of New Jersey publicly declared malaria to be preventable and especially dangerous to the public health. This declaration was made pursuant to a provision contained in an act of 1895 and automatically made this disease reportable universally throughout the state. Furthermore, malaria is made reportable under the provisions of a regulation contained in the state sanitary code. In this connection it might be well to emphasize at this time two specific provisions of the act under which the present State Department of Health was created. These provisions are—*First*, a requirement in the law which makes it the duty of the State Department of Health to enact a state sanitary code, the provisions of which code (to quote the law) "Shall contain such regulations as, in its judgment, will promote health and prevent disease." *Second*, a part of the same act which makes it the duty of all local health officials to enforce the laws (meaning all statute laws enforceable by public health officials) and the regulations of the state sanitary code.

One of the first chapters of the state sanitary code to be enacted (effective June 1, 1917) contained a regulation requiring physicians,

and, when no physician is in attendance, the householder to report cases of malaria. To what extent the law and regulations of the state sanitary code insofar as they relate to malaria have been obeyed by physicians, and to what degree enforced by local health officials is, in a measure at least, reflected in morbidity and mortality reports from this disease during the past nine years, 1912 to 1920, inclusive.

The accompanying table showing the number of cases of malaria reported to the state department of health from each county in this state, and the number of deaths recorded is due to malaria in each of these counties, from 1912 to 1920 inclusive. A superficial examination of this table is sufficient to show that cases of malaria are poorly reported in New Jersey or that the diagnosis has been erroneous in the case of many deaths attributed to this disease. In all probability, both are true. Therefore, in presenting this tabulation, no claim is made that it presents a true picture of the malaria situation in New Jersey for the years which it represents. The tabulation is, however, correct in respect to the number of cases and deaths officially reported and shows:

1. A substantial diminution in the number of both cases and deaths from this disease since the first year case reports were obligatory.
2. That the case rate has been relatively higher in some counties than in others.
3. That there has been an excessively high indicated fatality rate in certain counties.

In regard to the first deduction, i. e., that malaria has been growing less prevalent, particularly since 1914, it should be stated that this reduction may be more apparent than real. That this is true in some localities has been shown quite conclusively by surveys and special investigations conducted by the state department of health from time to time during the period over which the table extends. It will be noted that one hundred nineteen cases of malaria have been reported from Middlesex County during the past nine years, with two deaths. According to the federal census, the population of this county in 1920 was 162,334. An investigation made during the fall of 1920 in one of the largest municipalities in the county, in which the population is about 32,000 brought out the fact that malaria had been unduly prevalent there during the summer and fall for at least two years past. Estimates based on reliable information placed the number of cases treated by local physicians during

TABLE NO. 2
REPORTED CASES AND DEATHS FROM MALARIA BY COUNTIES IN NEW JERSEY

COUNTY	1912		1913		1914		1915		1916		1917		1918		1919		1920		Totals		Per Cent Fatality.	Average Annual Case Rate Per 100,000.
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.		
Atlantic	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	133.33	12.3
Bergen	6	3	4	1	6	1	13	1	1	1	1	1	1	1	1	1	1	1	1	1	3.50	6.6
Burlington	23	3	6	4	4	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	2.12	3.6
Camden	6	3	6	4	4	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	7.40	3.6
Cape May	6	3	6	4	4	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	16.66	9.0
Cumberland	35	3	57	2	65	1	74	2	71	1	43	1	52	1	41	1	27	1	1	1	1.72	9.0
Essex	6	3	6	4	6	1	6	4	6	1	6	1	6	1	5	1	8	1	1	1	25.00	1.2
Gloucester	6	3	3	3	7	6	6	4	6	4	6	1	13	1	5	1	8	1	1	1	41.00	1.2
Hudson	1	1	3	3	7	6	6	4	6	4	6	1	13	1	5	1	8	1	1	1	300.00	30.7
Hunterdon	13	1	84	1	158	1	81	1	13	1	13	1	8	1	10	1	11	1	1	1	0.76	30.7
Mercer	2	1	3	1	24	1	5	5	6	1	15	1	35	1	4	1	35	1	1	1	1.68	8.9
Middlesex	1	1	3	2	8	1	7	2	2	1	1	1	1	1	1	1	1	1	1	1	19.35	2.7
Monmouth	5	1	2	1	17	1	10	10	2	1	1	1	2	1	7	1	1	1	1	1	7.69	7.3
Morris	15	1	2	1	17	1	10	10	2	1	1	1	2	1	7	1	1	1	1	1	100.00	8.4
Ocean	3	1	12	1	18	1	40	1	20	2	13	1	57	1	14	1	6	1	1	1	183	8.4
Passaic	3	1	12	1	18	1	40	1	20	2	13	1	57	1	14	1	6	1	1	1	2.18	8.4
Salem	1	1	2	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	1	1	25.00	38.5
Somerset	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	1	1	3.18	38.5
Sussex	366	2	331	1	330	1	154	95	50	1	19	1	28	1	21	1	4	1	1	1	0.15	565.8
Union	15	2	10	2	46	2	24	2	13	1	3	1	17	1	3	1	3	1	1	1	4.58	9.8
Warren	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	4.58	9.8
Totals	483	22	546	12	771	14	457	15	323	10	156	5	277	12	124	2	106	5	3243	97	2.99	12.6

NOTE.—Malaria made Reportable Disease July 6, 1911.

the summer and fall of 1920 at about two hundred. Only three cases of malaria were reported to the local board of health that year, and only four cases during the nine years for which we have official records. Investigations conducted in other counties have shown much the same conditions to have existed in at least one county in the state. These are sufficient to show that a low malaria rate based on official reports on file does not necessarily mean a malaria-free locality in all instances. While it is unquestionably true that a clinical diagnosis cannot always be taken without question in the absence of a blood examination, in all probability the number of unreported blood positive cases will far outnumber those erroneously reported on clinical symptoms only.

In considering indicated fatality rates, based on reported cases and deaths, the Hudson County figures show conclusively one (or possibly both) of two things; flagrant disregard of the law requiring cases of malaria to be reported or, conspicuously erroneous death returns. A 40 per cent. fatality rate from malaria, which is shown in Hudson County during the past nine years, can hardly be considered seriously.

That the case incidence should be higher in some counties than in others is of course to be expected when the distribution of the *Anopheles* mosquito in this state is taken into consideration. Sussex County, the population of which falls almost entirely in the rural classification, shows by reported cases the highest malaria rate of any county in the state. These figures, however, are far from complete, as surveys in past years have shown. As a matter of fact malaria is known to be far more prevalent in parts of Sussex County than is indicated by reported cases. The marked falling off of the number of cases reported from the county since 1914 is very largely if not entirely due to the active anti-mosquito prevention work that was begun about six years ago by local officials in Franklin Borough. This work was immediately followed by a marked diminution in the number of cases of malaria in that vicinity and has practically eliminated the disease from what was believed to be one of the worst infected localities. If the work that has been carried on from year to year in Franklin Borough since 1914 was emulated by certain other sanitary districts, Sussex County's high malaria rate would soon correspond to the county's rating in other reportable communicable diseases, which is the lowest in the state.

In 1918 the United States Public Health Service conducted a malaria survey in a number of states, New Jersey being included

among them. At the close of each month during that year, a post card was mailed to each physician whose name appeared on the mailing list in the office of the state department of health. The card explaining the purpose of the survey was accompanied by a government franked card for reply. Each physician was asked to report the number of new cases of malaria occurring in his practice during the month preceding. The reports were also to show the types of infection and whether or not the diagnosis was confirmed by the use of the microscope. Cases reported in connection with this survey were checked against reported cases of malaria on file in the office of the state department of health, and where discrepancies appeared in the records, follow-up letters were sent asking the physician for an explanation. Cards were sent to 3,012 physicians each month during the year, with the exception of February. Seven thousand two hundred twenty-seven replies were received, reporting a total of four hundred fifty-six cases. Four hundred eight cards were returned unclaimed. During the year covered in this survey, only two hundred and seventy cases of malaria were reported to the state department of health by local officials, or about 60 per cent. As many cases were reported to the United States Public Health Service in response to a special appeal for the information and a monthly reminder in the form of a post card.

It is needless to say that physicians who reported cases of malaria to the U. S. Public Health Service but who had failed to report to the state department of health gave numerous and varied reasons in the way of explaining their omission to comply with the laws. These need not be enumerated here, other than to state that the number who claimed to be in ignorance of the fact that malaria was a reportable disease was surprisingly large. This signifies the existence of a lack of the kind of co-operation between practicing physicians and local health officials that is so necessary in the efficient control of malaria and other communicable diseases.

If I am correct in my impression, the county mosquito extermination commissions in New Jersey are chiefly concerned with the extermination of the salt marsh mosquito and securing improvements of a permanent character in localities where other species of mosquito breed in sufficient numbers to hold down property values and make life uncomfortable, rather than in mosquito extermination from a public health standpoint alone. Granting this to be the case, this association must recognize the potential danger of returning soldiers introducing new foci of infection in sections of the

state in which the *Anopheles* mosquito is known to breed, but which have been comparatively free from malaria in recent years. This has already occurred to some extent in other diseases and is quite likely to occur with respect to carriers of the malaria parasite. If it does, New Jersey's malaria rate may reasonably be expected to show a marked rise in the near future, unless local health officials become more active in performing the duties imposed upon them by the law; duties which include requiring physicians to report cases and to enforce accepted modern methods against the spread of this disease. Taking cognizance of this danger, might not county mosquito commissions well consider the advisability of giving more attention to the extermination of *Anopheles* than has been given heretofore? Members of the association should at least impress upon the minds of local health districts which they represent the necessity of using every legitimate means of bringing about more trustworthy morbidity and mortality statistics on malaria.

MR. BOWEN: If I can elucidate that rather simple chart, of course there is no rhyme or reason to it, why, for instance, Hudson County should have a twenty-five per cent. death rate in malaria. It simply means that the reporting is poor. Now if their death returns in the cases of death give the death returns as correct there must be some malaria in Hudson County.

MR. HULL: Don't you believe that with a county like Hudson there are many cases of malaria that the physician never sees until perhaps the fatal day, if there is a fatal day?

MR. BOWEN: No doubt many, but if they have twenty-five per cent. of deaths in that period there are many hundreds that he never says anything about.

DR. LIPMAN: How about the cases that are brought in? Hudson County has a large floating population and I dare say in quite a number of those cases the disease does not originate in Hudson County, though the man dies in Hudson County.

MR. BOWEN: In the Bureau of Local Health administration, that handles morbidity reports, they also receive from the Registrar of Vital Statistics Office deaths from reportable diseases. In making those charges we exclude cases that do not belong to the municipality fairly. That is, if a man comes in there with an infection from which he dies, we do not charge it to that county, because he did not contract it there. On the other hand, if he has been there long enough to have contracted an infection, that is, the incubation period

—we know what the period is—we do not charge it, nor do we charge them with the cases which come from outside of their municipalities into a hospital from which it is reported. We charge them back, we try to keep the balance going.

SECRETARY HEADLEE: Mr. Bowen, the question I asked you a little while ago was this: does the ordinary relation between the number of deaths and the number of cases hold for New Jersey, in your judgment, as it seems to in the south?

MR. BOWEN: Speaking of malaria?

SECRETARY HEADLEE: Yes.

MR. BOWEN: No, sir.

SECRETARY HEADLEE: How many cases do you count as opposed to a death? What is the ratio?

MR. BOWEN: I do not think that in New Jersey the type of malaria that we have here, that we have data enough to hazard a guess.

SECRETARY HEADLEE: I think the ordinary figures of the south are about five hundred cases of malaria to a single death.

MR. BOWEN: I think that would be multiplied very much here for the type of malaria we have.

SECRETARY HEADLEE: Suppose we grant there are a thousand cases, for the sake of argument.

MR. BOWEN: I think that would be very conservative. Let us see what the chart will show on that. Take Sussex County, 1,322 cases and two deaths, and that does not begin to represent the cases of malaria in Sussex County. Many spots in Sussex County we just collected that evidence from the physicians on three occasions there, and there is a hotel that nobody ever goes to and goes home without a case of malaria, and yet there is never a case reported from that region.

SECRETARY HEADLEE: That reminds me of another point that strikes me in this malaria situation as a possible foothold for developing an anti-mosquito campaign in various counties which are not now working on the problem. If the state department can get accurate data so as to show what places most seriously need attention so as to show us where to begin, we will start an anti-mosquito movement at those points. We are prepared to offer you that co-operation, if the state department can take it up.

MR. BOWEN: At the risk of being misunderstood now—I am trying to prevent a thought that I am trying to get something out of this organization—I have been thinking along this line since I came

in this evening and heard what has been said. The Bureau of Local Health Administration—I am speaking of the state department office, because that handles the morbidity reports and communicable diseases, will be only too glad to assist in any way in a movement to help this along. Because in exterminating mosquitoes we get rid of diseases that cost the state many thousands of dollars, because it can never be shown. I have been in communities in this state in the past six or seven years, five or six years, where I have been told that forty per cent. of the working men of the company, working when I was there, were out during the malaria season on account of the malaria. Now that has never come out. That has never been shown anywhere. To do work it needs men. The Bureau of Local Health Administration is always up to its neck with routine work on diseases that the people demand work to be done on. I have been endeavoring for two years, the state department of health has, on my recommendation and their own initiative, to get an appropriation to put into every county or every few counties, that is, grouping them together or otherwise, to divide the state into health districts, so that we can have a man representing the state department of health in each one of those districts, residing there and devoting his entire time to public health work. If that could be brought about we would know every malaria case that is out if we had just such a man in the field. And this year appropriations for six more men were asked for and we got one; and therefore the people who were instrumental in getting the money demanded it should be sent to their district, and they never have a case of malaria unless they are sent there.

Now any effort that will promote that effort in getting an appropriation to put these men throughout the state will be a movement that will help this commission, it will help every kind of state work, and I think it will be the best paying investment that the state can make for public health purposes. And I think this organization back of an appropriation of that kind, when it is asked for, would be a wonderful help.

PRESIDENT RIDER: It has occurred to me that there must be some lack of power in a law which permits such a lack of recognition of the duty of physicians to report the malaria cases.

MR. BOWEN: That deficiency would also be covered through this means that I am speaking about. That is, this again works with local boards of health. It is not the lack of power in the law, it is

the lack of initiative on the part of the local boards of health to use the power that is in the law, that is all.

PRESIDENT RIDER: I see Dr. Hunt has returned to us. He has a report to make, I think, before we adjourn.

DR. HUNT: I want to discuss this problem a little bit, but I will just make a report. I went over as the society wished me to and spoke to the women, heard a most delightful talk by Senator Edge, a good broad-headed talk on current questions, both domestic and foreign, a good level-headed talk, and I am very glad I was over there. My talk, I talked about four or five minutes, and I had to fire it sharp and quick at them. I don't know whether I got it across or not. But Mr. Jackson says, "I think so, I guess it is all right." I didn't like the task and I didn't thank the society for sending me over. I didn't like the job.

This problem here is a very interesting problem to me, and personally I do not feel that we have any right to predicate the campaign against the *Anopheles* mosquito in malaria without there being some criterion or diagnosis to go by. I have been a practitioner of medicine for thirty years and I have made a special study of this particular disease and I have fought them tooth and nail as far as I could. I do not believe I have had six cases in twenty years practice in a population of 120,000 people, without plasmodium in the blood. We know this matter in Sussex County, we know all about Franklin Furnace and all that sort of thing, and the Princeton epidemic. Those cases were proven up. But unless the board of health has some criterion of the presence of plasmodium in the blood, I do not believe those are worth basing an active campaign against the *Anopheles* mosquito.

One idea that you are going to eradicate in your care of the disease, probably twenty per cent. of those cases of death are tuberculosis, another twenty per cent. are sepsis of one kind or another, and so it goes on. The diagnosis of malaria used to be the diagnosis of typhoid fever. I just illustrate one point. In the Spanish-American War the best medical men we had on the field in Cuba and Porto Rico were diagnosing cases of typhoid fever as malaria. That occurred in over 5,000 cases. They were typhoid fever, they were not malaria. I remember as a boy—not as a boy, a young man in 1894, when I was an interne in the Maine general hospital in Portland, Maine, we had some men come up there from the tropics, the Spanish-American War. They came in there with disease. I remember the report of the pathologist. He said he found in the

blood some pigmented red cells; that is all he said; therefore they were malaria parasites. The patients got well, or at least got well under quinine. A case of malaria in a temperate zone, especially tertiary malaria, will not yield quickly, in three or four days, on quinine, and you must make a proper diagnosis, and malaria is very rare. And when you find cases that are diagnosed as malaria and treated with quinine, they do not get well with quinine, they do not respond to quinine. That is, I am speaking of tertiary. That is what we have in those conditions, imported from some tropical country. Those cases always respond to treatment. We do have a certain number of old tertiary malaria. There are very few cases that come from below the Mason and Dixon line or the tropics. They are very rare.

Malaria is a peculiar disease. It is a very peculiar disease. It is a disease which has a marked latency. One will go down with an attack of acute malaria and they will have chills and fever in this particular type twenty-four or forty-eight hours and sometimes two sets, and sometimes you will get a chill every other day. Then the quaternary type get it every third day. It is almost impossible to distinguish them sometimes without the presence of the plasmodium in the blood.

Now those things have all been worked out, and as I say, the malaria in this part of the country responds to quinine. Now there are many other diseases. Only the other day in my service in the hospital where I happen to be attending physician, three of the local men, some of the best men we have, made a diagnosis of malaria. The patient had fever and chills. At four o'clock every day the patient had a chill, showed 105, and then six or seven hours after in the day he would go down to 97, normal. I couldn't tell myself by looking at it that it was quaternary malaria, but the blood showed it was not. So it didn't prove to be malaria. But I say we have to be very careful in predicating malaria in the sense in which we are going to fight an epidemic or wipe out a pest, unless we are sure we have got malaria.

Now I think that Mr. Bowen's figures on this matter are all out of proportion, to my conception of the morbidity rate of tertiary malaria, absolutely. And every time those figures are published it always seems to me it is a kind of reproach to the medical profession, that they are not more careful in the diagnosis.

But I do not like the mortality rates there. I know about this epidemic in Princeton and I know all about this epidemic in Frank-

lin Furnace and Sussex County, and we have a little epidemic every once in a while up in Little Falls, along the Passaic River. We get out of that place up there I should say about thirty or forty cases in the county every year, tertiary malaria.

I am sorry I did not hear the whole of the Doctor's paper, because it is something I am very much interested in and I never fail to take a chance at discussion if I have it.

MR. BOWEN: The doctor is quite right in all he says, and I explained when the chart went up it was like a Chinese puzzle, difficult to understand. And what we want to bring out is the proving of your diagnosis by a laboratory test. And I want to say this in partial support of what I said, that I study the examination and analysis of the blood sent to the laboratory where plasmodium is found, when I find the report of a proven case is any better than shown on that chart. So of course I did not go into this detail, I did not think it was necessary, but it is true. But it is the one disease in which the report is so excessively poor. We study the laboratory records, that is, they come to the Bureau of Local Health Administration and we check them up against reported cases, and when we have the support of the laboratory reports I feel sure we know what we are talking about.

SECRETARY HEADLEE: I would like to add a word on the question of carriers of malaria. At Rutgers only about a week ago I stepped into the laboratory and saw one of my students sitting at a table. He turned around and said, "Come here and look at this." He had a count under that microscope as fine a case of plasmodium in a blood count as I have ever seen. I said, "Where did you get that?" "Why, So and So, a student here, let me take a sample of his blood." Well, I know that fellow. He was a big, robust, husky fellow and in apparently the finest sort of health. And yet with a single stab that boy had drawn out many red blood cells that showed the plasmodium. And that has occurred not merely once, it has occurred a number of times among our students. And those cases are cases of students that come to us from various points in the state; indicating to me that those carriers can be apparently healthy and well, but just as capable of infecting a mosquito as a man who was sick on the flat of his back.

Now I am led to believe, from the distribution of these men, that there are a lot of carriers now in the state. Now we have seen only one source, and I am deeply impressed with the possibility of carriers being well distributed over the state.

Now one or two other points regarding Mr. Bowen's record, relative to my doubt of his knowledge of mosquitoes, I desire to say that after that meeting with him in Franklin Furnace, I have entertained no doubt whatever as to his ability to distinguish between mosquitoes, because he had the proof there and he showed me.

SATURDAY MORNING SESSION

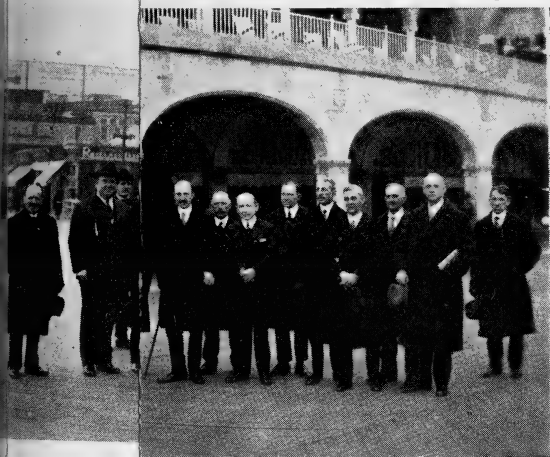
On Saturday morning at ten o'clock a ditch digging demonstration was made by Mr. Fred A. Reiley, Chief Inspector of the Atlantic County Mosquito Extermination Commission with the improved Eaton ditcher and Fordson tractor. Automobiles were furnished by the Atlantic County Commission which took those interested to the meadows on the west side of the Absecon Boulevard where the demonstration was given.

After a short talk Mr. Reiley showed how with the improved cutter blades on the sides of the plow, together with the new pointed bottom blade, a pull of the tractor automatically sunk the plow into the meadow. Heretofore it has been necessary to sink the plow by hand. He also pointed out how the "A" shaped frame on the front was used to pull the plow out of the meadow by the use of the tractor. This also had been done by hand previously. He then showed how a ditch can be cut directly into a creek by use of the "A" frame.

His next demonstration was that of a small plow modelled on the same principles as the large one and which is used for spurring. The large plow and tractor can cut 10,000 feet in seven and one-half hours which is a decided advantage over the old ditching machine which cut 6,500 feet in eight and one-half hours. The demonstration was ended by showing how the Fordson tractor could be run over any kind of the meadow bottom. The driver demonstrated hurdling sods, and how the tractor could pull itself out of a salt hole.

After answering questions by those present, the party returned to Atlantic City.









PROCEEDINGS

OF THE

NINTH ANNUAL MEETING

OF THE

New Jersey Mosquito Extermination Association

HELD AT

ATLANTIC CITY, NEW JERSEY

March 1, 2, 3, 1922



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1922

ACTIVE MOSQUITO EXTERMINATION COMMISSIONS OF
NEW JERSEY

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PROCEEDINGS

OF THE

Ninth Annual Meeting of the New Jersey Mosquito Extermination Association, held at Atlantic City, N. J., March 1—3, 1922

WEDNESDAY EVENING SESSION.

(The meeting convened at 8:30 P. M., President Charles Lee Meyers presiding.)

PRESIDENT MEYERS—As President of the New Jersey Mosquito Extermination Association, I welcome you to its ninth annual convention. It is an association composed of the mosquito commissions of ten counties and their staffs and over two thousand members. Each commission is composed of six members who receive no salaries, and who give their time and study, their abilities, and their best endeavors as a matter of civic duty and good citizenship. The state is to be congratulated on being able to obtain the services of these men who are so successfully grappling the problem they are determined to solve.

We are met here in serious earnestness of purpose and fixed determination to accomplish our object, the extermination of that menace to life and health and deterrent to prosperity of our state—the mosquito—and to interchange views and by their expression aid each other in the gaining of our common object.

Industrial Results of Mosquito Control.

My grandfather, David Lewis Meyers, was killed by a mosquito. He was in the early prime of his life, 40 years of age, a man of exceptional vigor and talents, a descendant of the Vikings, who he resembled in his splendid physical frame. A fine education had given him the mental vigor in keeping with his perfect health. He was the father of five children. On his way to Denmark, he sailed from New Orleans, and as the custom was in those days, the ship sailed to the Bahamas, then to the Azores, touching at various ports for fresh water and foods, as well as to discharge and receive cargo. While ashore at Nassau, in the Bahamas, he was bitten by a mosquito. Three days after sailing from there he developed yellow fever and died, and was

buried at sea off the Bahamas, a useless waste of a splendid life. My grandmother, after months of waiting, learned of his death, which broke her heart. She pined away, dying three years later, leaving five little children ranging from 4 to 13 years of age. They were well brought up and educated by their uncles and aunts, but these children were robbed by that mosquito of the loving precepts of a father and the tender care of a mother, of which nothing, however gracious, can take the place. My grandfather died among strangers with no loving face near him, viewed by all the crew and passengers as a deadly menace, and justly so. He will lie in the ooze of the tropical ocean bed until the last trumpet sounds and the sea gives up its dead. Slain by a mosquito! The palliation for this personal reference is, that I speak of a case of which I have personal knowledge.

Now the economic loss to the state in the loss of a human life is much greater than it seems at first glance. Suppose my grandfather's earning capacity, that is his producing capacity, which adds to the wealth of the state, had been only \$25.00 per week, which is putting it very low, or \$1,200.00 per year. If he had reached the scriptural age of four-score years and ten, he would have had normally thirty years of activity. There is every reason to believe he would, for he came of a family in which longevity was a fixed habit. Twelve hundred dollars per year for 30 years means that his death caused a loss of \$36,000.00. His wife, in keeping her family, in the economic sense, would have earned as much had she lived. This means, therefore, a loss of \$72,000.00 to the state. Multiply the value of the loss of this one life by the thousands of lives that have been lost as a result of infection with disease by mosquitos, and it only takes a few moments to see what fabulous sums of money this enemy of mankind has cost the state.

In 1914 in the State of New Jersey there were 771 cases of malaria. We now know that these were caused by inoculation by the *Anopheles*, the malaria-carrying mosquito. As the average period of incapacitation is two months, this means in each case \$200.00 of wealth-producing effort lost. It not only means that, but at least half as much again in the expense of medicines, nurses and physicians, or \$300.00, which is a very low estimate. Multiply this cost by the number of cases and you find that the economic loss from malaria alone was over \$231,000.00 for that one year. Multiply this by the years that have gone before and you will find the economic loss runs into many millions—millions that would have been added to the permanent wealth of the state,

a loss caused by the pestilent mosquito. If I seem unsympathetic in so calculating the losses without referring to the painful suffering of the patients and the misery and distress of their families, it is only that we lose sight of the economic value when our feelings of sympathy and concern for the sufferers are foremost. It is all so useless and unnecessary, for the mosquito can be exterminated.

There is not time in this short talk to give you the details of the success of mosquito control by all the commissions, but as the success of my own County of Hudson is typical of all, I shall take it as an example.

The Hudson County Commission has reduced the pest from 100 per cent. in 1914 to less than 5 per cent. (these are my figures) in 1921. Porch screens that were put up every summer on miles of streets are now discarded as unnecessary. I have hunted high and low to find a mosquito canopy and have failed. A mosquito canopy is a tent made of mosquito netting that hangs from the ceiling over the bed completely enveloping it. It was the custom to drive the mosquitoes out of the canopy before retiring, and many a night has the angry buzzing of thwarted mosquitoes outside the canopy kept one awake. The canopies were formerly an ornament and necessity in thousands of bedrooms. They have disappeared and seem to be as extinct as the diplodocus. They were not always effective, as the mosquitoes would "park" under the bed, and an unwary foot stretched out in slumber would let through the hungry horde.

The economic results are being seen in every direction. The great stretches of meadows from Bergen Hill to Arlington and Newark are being occupied more and more every year by factories. Why? Many of you have wondered as you crossed these stretches of meadows so near New York and so near Newark why, with two navigable rivers with direct outlets to the sea, they were not so occupied years ago. The cause was the presence of mosquitoes. Every attempt at locating an industry was abandoned simply because these factories could not keep their help. They were so fiercely attacked by mosquitoes both in going and coming to work that they could not and would not continue to go to work under such conditions. If you could have seen the thick clouds of mosquitoes swirl around a wagon and driver on the turnpike as I have, you would not blame the workers. All this has been almost entirely done away with by the work of this commission. There was no trouble last summer, and since the success of our efforts has been demonstrated as a definite fixed result, more and more enterprises are coming into these regions,

bringing literally millions of new capital into the county, and the workers can come and go in peace and comfort unmolested by the pest, safe from disease infection.

Since it has become known that Hudson County has been successful in mosquito extermination, strangers have been added to our population so rapidly that it has been almost impossible to house them. These newcomers are not confined to any one district, thousands are in parts of the county not served by the Hudson Tubes. To take care of this increase of population attracted by the mosquitoless conditions some five million dollars were spent in newly-built housings in 1921, thus adding that large sum to the permanent wealth of the county.

In all directions radiating from Summit Station, the property valuations have largely increased, properties doubling, trebling and in many cases more than quadrupling in value. This means increased assessments. These increases have nearly all occurred since the effective work of the Hudson County Commission has been a fixed fact, and has added literally millions of dollars to the total wealth of the county. The amount of the increased income to the county due to the increased valuations runs into hundreds of thousands of dollars. The small cost of the work so productive of wealth seems almost microscopic.

The tubes bring the people here physically, but what brought them to make their homes here is a mosquitoless Hudson County. If any one thinks that it is the tubes alone that brought this great increase of population, he must remember that the tubes were in operation for five or six years before this movement of residents to Hudson County started, and the strangers came there long after the tubes were running in full operation.

If the work of this commission should cease, you would find inside of a year hundreds of empty apartments along the Boulevard, Bergen Avenue and other streets where the new people are. People will not live any longer in mosquito-ridden places if they can get out of them, for it is now considered as uncivilized to have the mosquito menace as it is to have any other uncivilized or unsanitary condition.

The Department of Conservation and Development of New Jersey estimates an increase of five hundred million dollars would be added to New Jersey industrial values in the next twenty years if mosquitoes were eliminated. This, from what we have seen, seems rather an underestimate than over. You have seen that the mosquito caused a loss by sickness in 1914 of \$231,000.00 to the permanent wealth of the state by the malarial illness of 771

persons. Compare this with the results of our mosquito control work all over the state, which brought the number of cases down to 83 in 1921, or a loss of \$24,900.00. This saved for the state over \$200,000.00 in permanent wealth-producing power in 1921. In fact, it is more than this amount, as the population is larger in 1921 than 1914. The constant reductions in malarial cases from 771 in 1914 to 83 in 1921 have added not less than a million dollars to the permanent wealth of the state, and this has been accomplished only by the success of mosquito extermination work. I have not added the saving due to the control of the yellow fever cases, but it is definite.

The splendid results in Essex County showing an increase in the ratables of the meadows of that county of 3,117 per cent. between 1905 and 1918, as well as an increase in the county as a whole of 380 per cent. in valuations, as fully set forth in Bulletin 348, shows that the economic value of mosquito control work is vast and far-reaching and of first importance.

Gibbon tells us that the decline and fall of Rome was caused by the degeneracy of the Romans, but in his relation to the causes of the degeneracy he does not mention the chief cause. When his great work was written science had not advanced to that point where he should have known of the effect of the *Anopheles*—the malaria-carrying mosquito—on the human race. The Romans, after centuries of greatness, denuded the hills and mountains of their timber, causing the floods in the Tiber to overflow the plains around Rome, and when subsiding, to leave vast pools and marshes called the Campagna. The mosquitoes emerged from these pools in myriads. As a result the population was constantly afflicted with malaria, or Roman fever as they called it, so that generation after generation suffered from the disease inoculated by the mosquitoes. This so weakened them physically that their fighting spirit had almost disappeared, and after having been masters of the world, they fell an easy prey to Alaric and his barbarians, who owed their victory more to the harm done to the Romans by the mosquitoes than to the prowess of their own arms. You cannot, without some such cause, in four or five generations change the fighting spirit that made a nation great, into a spirit of almost abject surrender.

The question is—what do her mosquitoes cost New Jersey? It is not a question of the amounts the commissions and the Experiment Station are spending to clean up and exterminate this menace to human life. No, the question is asked in the same sense as of a man who runs a large and costly yacht, or maintains an extensive and expensive estate. What does it cost to run the

yacht or maintain the estate? What does it cost New Jersey to maintain her mosquitoes? It costs her the annual toll in human life and the resultant sadness and sorrows that it brings; it costs her the annual cases of malaria with all its misery and suffering with the economic loss ensuing; it is costing her far more than can be computed to maintain her reputation as a mosquito-ridden state, a stock joke of the press which has cost New Jersey millions by deterring people and enterprises from coming into our state. It is costing her the produce on thousands of acres that would be green in the summer sun with crops and fruits, but for the mosquito which prevents their development. It is costing her the increased values of these lands which is by far the greatest cost, running into hundreds of millions of dollars. It is costing her on her ocean playgrounds, where the finest summer hotels in the country have attractions to draw the multitudes and service for every purse, literally millions of dollars every year, by keeping away thousands of vacationists and guests who otherwise would go delightedly to these beautiful beaches.

New Jersey has had the mosquito habit for centuries to her great cost and suffering, and it is high time she got rid of it. She has been a mosquito addict, and on the basis of the estimate of the Conservation and Development Department it will cost her \$25,000,000.00 per year for the next twenty years unless she gets rid of the mosquito. I wish I had the power to put this truth and its vast importance clearly into the minds of all our legislators—perhaps they would then see that the state should do its part and increase the appropriation for this work to an amount commensurate with its importance.

I cannot close without referring in this meeting of earnest men and women, who are determined in all seriousness to put an end to this devastating enemy in our state, to the heroes who have given their best to relieve humanity of the awful toll of human life every year the mosquito exacts. I refer to the brave soldiers who lent themselves and their bodies to the experiments to ascertain the facts in yellow fever infection by mosquitoes, and I refer particularly to Dr. James Carroll who nearly lost his life, and to Dr. Jesse W. Lazear and Dr. Walter Reed and Dr. Howard B. Cross, who gave their lives that we might have the knowledge to carry on the fight. These are heroes of peace who should be no less renowned than the heroes of war. They truly gave their lives for the betterment of the human race and are to be honored of all men, and it is fitting that in this gathering of workers in the field in which they were pioneers, that your presi-

dent should so honor them by this mention of appreciation, for as the Great Master of us all has said, "Greater love hath no man than this, that he layeth down his life for his friend." (Applause.)

PRESIDENT MEYERS—At this point, in order that the business may run along in its usual form, I will appoint the following committees:

Committee on Nominations—Robert F. Engle, Henry H. Brinkerhoff, Lewis W. Brown, William Porter, Frederick W. Becker, Walter R. Hudson, Richard G. Savoye, Andrew J. Rider.

Committee on Resolutions—Edward W. Jackson, Reid Howell, Thomas M. Donnelly.

Auditing Committee—Abram H. Cornish, Watson A. Bogart.

Ladies and Gentlemen: It gives me very great pleasure to introduce to you, Mr. Robert F. Engle, a past president of this association. Mr. Engle has been working hard with the same object in view that we all have, and his heart is in his work. Mr. Engle will talk on

Resort Development as a Result of Mosquito Control.

When the first health and recreation seekers began to flow to the coast of New Jersey I do not know. The shell mounds found along the coast is positive evidence that the Indian made pilgrimages here, where he caught clams, oysters and fish and cured a great deal of his provision for the winter.

The white man naturally seeks the seaside for pleasure, cooling breezes, and health-building properties, and though, no doubt, many longed for the experience, no express fliers, or automobiles made the journey easy in those days and the seashore visitor was a persistent pioneer.

The first resort to attract Philadelphians was on Long Beach about twenty miles above here at the Mansion of Health situated near the middle of the island, and this dates back to 1822. Later Lloyd Jones had a place a little farther down which he sold to Thomas Bond, a New York jeweler. In 1851 he enlarged it and called it Bond's Long Beach House and it probably had about 25 rooms. Atlantic City came into being in 1853. As late as 1873, however, there was not much in the way of accommodations except what was to be found here, and you may be sure the assessed valuation of the whole was not very much.

We can all remember the "astounding development" as it was called, of the various seaside resorts between 1890 and 1900.

How Atlantic City, according to prophets, had reached her zenith every year and never would be any larger. Well all this "wonderful growth" had reached a valuation in 1899 of \$57,000,000, much less than half what Atlantic City is assessed for to-day.

I know you do not like to hear a lot of figures. I wouldn't either if I were in your seats. I did not like them at school and am not overfond of them yet. But figures do not lie, though Senator Sorghum says, "liars figure." However, a study of the assessors' figures for the last 21 years yields some interesting information.

When we speak of the valuation of seashore property of New Jersey, we mean the strip from Keyport on Raritan Bay to Cape May and include not only the cities and boroughs directly on the ocean, but also the parts of townships with their towns that front on the salt water of the numerous bays, for they are valuable chiefly because they are on the salt water and have capitalized that advantage.

We find we have transformed this region of sand and salt water from a comparatively worthless waste to a territory which in 1921 had an assessed valuation of \$296,838,000.00, or if the assessors had been a little bit more zealous we could say *three hundred million dollars*.

For convenience we have not considered the valuation prior to 1899, but taking the values then, as before stated \$57,000,000.00, we find that in the last 21 years the increase has been \$239,000,000.00, or 414 per cent.

Let us go into details a bit. We find that:

Monmouth County increased	207 per cent.
Ocean County increased	375 per cent.
Atlantic County increased	780 per cent.
Cape May County increased	612 per cent.

In contemplating this increase of the purely coastal part of the state, we naturally wonder what the rest of the state has been doing all this time. Let us call the roll. We will begin with Atlantic, because it is alphabetically and numerically on top:

Atlantic,	677 per cent.	Middlesex,	370 per cent.
Bergen,	432 per cent.	Monmouth,	172 per cent.
Burlington,	103 per cent.	Morris,	135 per cent.
Camden,	373 per cent.	Ocean,	234 per cent.
Cape May,	494 per cent.	Passaic,	301 per cent.
Cumberland,	94 per cent.	Salem,	137 per cent.
Essex,	303 per cent.	Somerset,	133 per cent.
Gloucester,	190 per cent.	Sussex,	124 per cent.
Hudson,	393 per cent.	Union,	551 per cent.
Hunterdon,	37 per cent.	Warren,	85 per cent.
Mercer,	249 per cent.		

So while the whole state, including the coastal region, increased 307 per cent. the coastal section increased 414 per cent. It may be retorted that a quarter-inch of adipose spread over the human body would not be very conspicuous but on the end of the nose it would be. The comparison has its lesson, nevertheless.

Every state has certain assets peculiar to itself, others in common with sister states. For New Jersey we would claim: soil and climate for agricultural development, opportunity for suburban homes, commercial possibilities based on location between two large cities, opportunity for port and harbor development, waterfront, having in mind the Hudson, Hackensack and Passaic rivers, Newark and Raritan bays.

Great as they are to-day, the possibilities have hardly been drawn upon. But when the salesman from New Jersey describes our ocean-washed shores with the long string of pleasure bays just behind them, connected the entire length with navigable water, which from nothing have grown to be worth \$300,000,000.00 with less than 10 per cent. of the ground even plotted, but which has grown 100 per cent. faster than the rest of the state, he is describing an asset as great, and with as many possibilities, as any of those above mentioned.

New York may have her Adirondacks and Niagara, Colorado her Rockies, Montana her Yellowstone, California her Yosemite, Arizona her Grand Canyon, but New Jersey takes no second place when she invites the world to come and play on her beaches.

I should like to know how this seashore playground asset compares with the others in growth, and I suppose further research would inform us, but enough has been said to indicate, I think, there is another candidate for Cinderella's slipper, and the sooner it is recognized the more complete and happy the family will be.

Now what has the mosquito to do with all this? Well, its mighty sure she hasn't helped any. What we have we have in spite of the mosquito. She has always been in the way and has obstructed every move, whenever the winds and restrictions of incubation permitted.

There was a time when our forefathers, who were natural pioneers, wanted to fish and bathe in the ocean so badly they would endure the ride through the Pines in the de luxe article of the times, whatever it was, and did not mind if the breaths of salt air were pretty well mixed with "*sollicitans*."

I do not believe that in 1870 many of the then palatial hotels were screened, and even when they were enough mosquitoes

were carried in on the clothing to equalize things, and a canopy-covered bed was a luxury supplied by very few. I know a captain who was induced to buy one of these canopies, and he often told of his first night's experience with it. He turned in happy and hopeful, but soon he had a bite, then another, and he said when all the mosquitoes got inside he got out and laid on the floor. Another night he took a hammer and clinched the bills as they poked through the canopy. I was talking to an old visitor to Bonds Long Beach House, which was the very first place to receive guests on this section of the coast, and he said there were no screens up to 1868. Think of it! He said they used to go around the halls with a smudge of grass, burning on a shovel to distract the insects' hungry impulses. Of course there were things that went on in some of these early hotels that helped some, so that the first part of the night the sleeper was so occupied with what he had taken before he went to bed that he did not mind the mosquitoes, and the rest of the night the apathy, or whatever it was, was transferred to the mosquitoes, so they got a good night's sleep after all. But the total abstainer just had to grin and bear it.

A person will stand being annoyed better when in pursuit of anything than pleasure and when the increasing number of visitors to our shores were bitten just as they were having a good time it made a wonderful and lasting impression, and he would tell his friends when he got home of how he was nearly "devoured" at this, that or the other place in New Jersey. So that is how and why so many American citizens think of New Jersey's emblem as a mosquito rampant instead of the three peaceful plows our forefathers adopted.

I know of one hotel not far from a railroad on one of our beaches where the hotel proprietor would appear at the station with a large straw hat covered with mosquito netting and draped over his shoulders, which would lead the visitor to inquire immediately when the next train left for home. Neither the hotel or its proprietor was ever prosperous.

There was once built a hotel by officials of the Pennsylvania Railroad Company called Berkeley Arms about 1885. It was one of the finest of the coast at that time and was at the end of a railroad to New York and one to Philadelphia and had the backing of the great company. There was a good beach and a magnificent bay behind it, yet it failed absolutely for no other reason than the guests would not stand the mosquitoes. It has since burned to the ground, but since that time the effective work of mosquito extermination in Ocean County has made it possible to create the two resorts of Seaside Park and Seaside Heights on

the very site of this hotel experiment, with an assessed valuation of \$1,800,000.

No one can estimate the number of people that has been driven away and kept away from the shore by mosquitoes. As the work of extermination has been gradual, so must it take time to convince the would-be visitor that his complete enjoyment will no longer be interfered with.

Coincident with what we know as wonderful results has come a sensitiveness to objectional things that is hard to overcome. The modern guest now makes as much fuss over six mosquitoes as they used to over six hundred. I think, sometimes, part of the joy will be taken out of a guest's visit if he or she cannot at some time during their stay display a welted face or hand before the sympathetic proprietor or have no opportunity to compare their children's stockingless legs that look like pepper boxes.

But fashions change, and perhaps the six modern mosquitoes meet with fewer obstructions than the six hundred used to, for we do not wear boots, nor high shoes, nor anything much now, and the moon still shines the same way, and maybe it is all talk anyway.

However, since Dr. Smith got the mosquitoes' number in 1906, and the county commissioners rung her up beginning with 1912, the value of seashore real estate of South Jersey took a new lease of life, with results as you have heard them expressed in assessed valuations.

Monmouth County, which has never been bothered much with mosquitoes owing to the absence of salt marsh during the period between 1899 and 1921, increased only 207 per cent. against an average increase in the other coast counties of 589 per cent. And we might as well credit some of this to mosquito work as well as to any other thing.

I should like to be able to tell you what each mosquito bite has cost us in blood and money, but we know it is enough, and it is high time this insect was in the class with others that well-bred people have gotten rid of.

It takes time, patience and money, and we have had too much patience and too little time and money. We can prove to our state representatives, if only by the figures showing the relative importance of our shore resort industry to other industries, how the valuation is nearly 10 per cent. of the total ratables, and that they are growing faster by 100 per cent. than the rest, and it is therefore good business to foster it, so we can use both hands to develop with, instead of using one to fight mosquitoes.

It seems as if the state cannot get enough revenue to give each claimant the share they think they ought to have; there is not enough to go around. The way to get more money is to produce greater valuations, get more property to tax. Let us not forget that very little of the capital represented in our handsome hotels and cottages is New Jersey capital, by far the greater part of it has come from without the state, and if the prospect for business gain or permanent pleasure is attractive enough, more will follow. Corporations will be formed, which will pay a tax on their capital stock directly to the state, and before the money accumulated from prosperous investments passes to heirs, a certain amount of it goes into the state treasury. Then as passengers and freight are carried as a result of this prosperity, railroads become more valuable and help to carry the state burdens. Perhaps there will be an accelerated demand for automobiles, though that doesn't help much, for what we pay for licenses is too small to call a tax, it's a privilege, a mere collection plate contribution which we ought to be ashamed to pay. We ought to pay somewhere near what good roads are saving us, and help the state that much.

I started out to prove something that did not need proof, like the man that said he was the "greatest flute player in Philadelphia." When asked how he was going to prove it, he said he did not have to prove it, he admitted it. The mosquito has got so much to do with the development of seashore property, both directly and indirectly, that we do not expect to stop to slacken until it is exterminated, or, accepting Dr. Headlee's amendment, brought under control.

PRESIDENT MEYERS—We expected to have Dr. Lipman discuss these papers, but Dr. Lipman is unable to be here. We have a telegram from him, which says, "Called to Washington, sorry cannot be with you."

We also expected to have ex-Governor Runyon with us, and I will ask the Secretary to read a letter which he has sent us.

SECRETARY HEADLEE—Mr. Chairman and Gentlemen: The Governor, when invited, felt that he wanted to come very much, but the duties in the Legislature this week he felt would become very heavy, but he said, "All right, it may be that the Senate will adjourn early enough Wednesday night that I can get down, and if I can I will be here and take my share." He notified us that he could not come, and said, "Will you please express my regret to those gathered there, and be assured of my warm interest in the success of the very valuable work which the extermination association has accomplished."

Those of you who know ex-Governor Runyon have an idea of what those words mean. I have never known him to use an expression that he did not mean. He is very earnest, and I think that we should take those words quite seriously, not as mere polite phrases, but as expressing ex-Governor Runyon's feeling in the matter.

PRESIDENT MEYERS—I should like to have any member present offer anything in the discussion of these papers which have been read.

If there is no further discussion the meeting stands adjourned until ten o'clock to-morrow morning.

THURSDAY MORNING SESSION.

(The meeting convened at 10:15 A. M., President Charles Lee Meyers presiding.)

PRESIDENT MEYERS—The first paper this morning will be read by Mr. Russell W. Gies, of Union County. Mr. Gies has accomplished considerable reduction in the number of mosquitoes in Union County, and is well versed in this subject:

Effective and Practical Methods of Education in Mosquito Control Work.

MR. RUSSELL W. GIES—Mr. Chairman and Gentlemen: This paper is very brief, and purposes to bring before the meeting some topics for discussion on plans and methods of carrying on educational work.

We need education in mosquito control work for two reasons. First, because in order to get the best results it is necessary to obtain the fullest co-operation on the part of the people living in the county, and there is therefore the need of educational work to obtain direct help from people in keeping their own premises free of mosquito-breeding places. Second, we need educational work to win the strong support and backing of the people in the county, for the commission, being a public servant, is depending on the people of the county for financial support to carry on its activities. The commission must convince the people that it is honest, competent, and it is spending the money for mosquito control work in the most efficient and economical manner possible.

Now, in order to thoroughly educate the people of our county so that they really understand what the commission is attempting

to do and how it is going about it, we must use all agencies and methods which are available. As practically everybody reads a newspaper nowadays, that is the most logical and necessary medium to carry on educational work, particularly as it combines direct education of the people in preventing mosquito-breeding on their own property, and also spreads a favorable sentiment toward the work.

Short articles appeal to the newspapers better than long ones, and are much more likely to be published. Stories of the drainage work carried on, plans of the commission, inspection trips and analyses of night collections, etc., as well as short articles of the life history of mosquitoes and their breeding habits, are usually welcomed by the newspapers. We have found much more likelihood of the stories being printed, particularly in the small communities where reporters are scarce, if the commission can prepare and write the story ready for publication, and not have the overworked editor of the paper write the story for the commission.

Another field of educational work where there has been distinct improvement during the last year is in the making of a new moving picture film. The one prepared under the direction of the superintendents of the various mosquito extermination commissions and the entomological department of the State Experiment Station is the best and most complete film that has been produced. It is anticipated that if the commissions use this film the entire state could be covered by placing it in all moving picture houses, as most moving picture managers are anxious to co-operate by showing a good film of this character. The movie film could be combined with short lectures before civic associations, taxpayers' associations, etc. It has been the writer's experience that the personal contact established by lectures at meetings of 75 or 100 taxpayers has been most beneficial to our work.

The State Experiment Station, through its entomological department, is also co-operating in educational work by preparing a state exhibit of the mosquito and its life history, which will be loaned to any of the county commissions who desire it for use at exhibits, agricultural fairs, health shows, etc.

Another advance has been made in effective and practical methods of education through the school children of the State. There has been prepared during the past year a mosquito manual, a twenty-page text book, which the State Commissioner of Education has endorsed and recommended to be used as a text book in the science and civics courses of the eighth grade grammar and high schools of the state. One hundred thousand copies of the

mosquito manual have been printed and will be distributed during this year in practically all schools in the state and a definite amount of time allotted in each school for the study of this manual.

It has occurred to the writer in connection with the study of this manual in the schools that it might stimulate interest if some sort of a prize were offered for a short essay written by pupils in the state on some subject in connection with mosquito extermination work. Many of you will recall the essay on mosquitoes and their habits written by Miss Elizabeth Culbert, of the Atlantic City High School, and read at our 1919 convention. A prize was offered by the Atlantic City Chamber of Commerce at that time. If we could get the schools in each county to compete with each other in producing the best essay, and then have the best county essays judged in a state competition, we would have a tremendous amount of interest, particularly if there were a small cash prize offered for the best county essay of say \$5.00 or \$10.00, and \$25.00 or \$50.00 offered for the best essay obtained in the state. Why couldn't this association offer such prizes?

The Union County Commission for a number of years has used small cloth signs such as this which we have placed along streams and ditches, particularly at the intersection of roads. We have found the signs not only a distinct help in preventing people from blocking ditches, brooks, etc., either intentionally or unintentionally, but we have found that they have considerable educational value also. They are seen by thousands of people daily along the highways, and show people just what work has been done by the commission in each locality. The signs are cheap, costing only about 4½ cents apiece, and we consider the money expended on them as well spent.

During the past year the commission has also erected a number of large wooden signs along the main highways of the county where drainage work has been done, and two along the railroads crossing the salt marshes. The wording varies on these signs, some stating that drainage work has been done at that point and others to the effect that living conditions have been made more comfortable in the county through the work of the mosquito extermination commission. The small wooden signs bear the inscription "No Stagnant Water—No Mosquitoes," which is the essence of the work that is being done. The signs have attracted considerable attention, as they are passed by tens of thousands of commuters and automobilists daily.

We have had some criticism of some of them in portions of the county, chiefly as to the use of the word "swamp-land," which

appears on the signs. In one community, which is located on a hill, there was considerable objection to the wording of the sign erected, which was to the effect that this and other swamp land had been drained in that community, although the sign distinctly mentioned that the swamp land *had been drained*. Some of the people of the town went so far as to state that there were no swamps in that community, although in 1912, when the commission began work, we found 108 swamps and pools in the town. An even 100 have been drained and the remaining eight are impossible to drain and must wait until fill is available. In cases like this a slight change in the wording of the sign has resulted in withdrawal of any objection to the use of the sign for educational purposes.

In closing, I wish to speak a word as to the good results following a couple of thorough inspection trips of the work in our county during the past year. Our commission invited members of the board of freeholders, editors of the fourteen newspapers in the county, and city officials of various communities to inspect the work done. A large turnout resulted, and it was surprising to see how much interest was taken in the work. Various kinds of drainage work were shown along the roads on the upland, the actual oiling of a roadside pool, the drainage of a woodland swamp, and another inspection trip to the salt marshes disclosed the dredging, ditching, diking and tide-gate work. The cutting of new ditches was shown, and a film showing the development of the salt marshes at Port Newark. It was the first time in many cases that the editors of the newspapers had been out in the field to see the actual work done, and, from the favorable tone of the stories of the trips that they wrote and the increased co-operation on the part of the city officials, etc., we feel that the results are worth far more than the cost of the inspection trips. It has resulted especially in our board of freeholders seeing the need of increasing our appropriation \$5,000 this year, and as obtaining money is one of the hardest parts of mosquito control work, I can recommend that the making of frequent inspection trips with the county and city officials is particularly apt to result in better knowledge of the work, the problems that the commission is faced with, and much more cheerful granting of appropriations for continuing the work.

PRESIDENT MEYERS—This paper is now open for discussion. I will ask Mr. Howell to lead the discussion.

MR. REID HOWELL—I think that Mr. Gies is to be congratulated on bringing before us again so ably this question of edu-

cation and of practical methods for getting the people of the state more familiar with our work. Mr. Gies is a past-master to some extent at this work. On different occasions, he has said many things that would be to our advantage if they could be adopted.

I remember on the first occasion that I attended meetings of the association, I referred to the short-story articles, two or three inches, in the newspapers, as against the lengthy ones, because the people will read the short type ones, and Mr. Gies has referred to it this morning.

There should be constantly present in the columns of the newspapers of our state, some reference in a brief way to the work that is going on, no matter whether it is in the summer-time, when the mosquito is a nuisance, or in the winter, when we have a chance to think about our methods of attack upon them. The question should not be allowed to die out. We cannot get anywhere with the sale of our wares without advertising, and that is just the position that we are in—we have something to sell and the public must know about it.

This reminds me of the tremendous program of advertising which we were planning a year or two ago and with which so many of you are familiar. We then contemplated having a publicity campaign at an expense of several thousand dollars. This idea has not been allowed to die out—Mr. Gies' paper revives it. It is the one thing that is essential to keep this movement from retrograding.

A more friendly intimacy must be established between this association and members of the boards of freeholders as they come and go. The personnel of these boards in the different counties changes frequently. The new members know but little about mosquito control work. By some method of publicity they should have a better understanding of this work before they become freeholders. The same thing is true also as to members of the legislature. Mr. Chairman, I doubt if this association would have any greater success with the present legislature if we went down there for funds than we have had in the past. Why? Just because such a large proportion of the legislature is made up of new men, and they are not informed on the subject.

Another method of publicity would be to get the boy scout organizations interested in mosquito control. These boys should be encouraged to become actively engaged in the work and educated so that they will grow up with a knowledge and experience

which will lead them to believe that mosquito extermination is no visionary project, but a thing that can be accomplished.

The best thing that Mr. Gies has set forth is this: in order to secure success in mosquito control work, the commissions of the various counties must interest the freeholders to inspect the tide-gates, pumps, filling, draining, and ditching that the commissions are using their appropriations to complete. The subject of Mr. Gies' paper is, "Effective and Practical Methods of Education in Mosquito Control Work." What he has had to say about the inspectors of the different counties taking out the freeholders and demonstrating the activities of the commission is very practical. This suggestion of Mr. Gies is commendable and advisable and practical as an advertising program. This last fall, the Bergen freeholders have been around with their superintendent inspecting his work. Mr. Leslie invited the board of freeholders, just as Mr. Gies suggests. There are so many people who think that the mosquito breeds in the grass and under bushes and trees, etc., that unless you state just how they breed—this story that they have to have two inches of water and that sort of thing—and unless you take them to pools and swamp-lands where you can get mosquitoes rising in clouds and show how that can be overcome, your efforts will be in vain. Mr. Leslie took us down to Little Ferry on the edge of the meadow and showed us a ditch some three feet deep and six feet wide—a splendid piece of workmanship with pick and shovel, with the earth from the ditch thrown up on one side as a dike and as straight as an arrow as far as the eye could reach. He showed us a tide-gate that cost in the neighborhood of \$3,300.00. These are some of the activities taking place in our county and we do not provide so much money either. I do not boast of it, but this year the Bergen freeholders gave the commission \$30,000 or more.

This trip of Mr. Leslie was a wonderful revelation to our newspaper men and to the board of freeholders. It was positively illuminating and successful advertising. The inspection was given publicity in all our county newspapers. Mr. Leslie showed us the dike with the water on one side a foot or 18 inches deep and with no water on the thousand acres of marshland and a thousand acres more of residential property that formerly were infested with mosquitoes, and now, by this method of ditching and diking, will remain unmolested in the future. That is effectual advertising.

Mr. Chairman, I must decline to go on. I should like to talk further but appreciate having had this opportunity of discussing the paper.

PRESIDENT MEYERS—Ladies and Gentlemen: In all honor and fairness, in order that the wrong impression might not be created, I wish to say that the speaker, sometime ago, with the foundation laid by the very able assistance of other members of the Hudson County Commission induced our board of freeholders to increase our appropriation 20 per cent. That having been accomplished, it encouraged the speaker to use every method that he could devise to induce the legislature to increase the state mosquito appropriation. It is only fair to say that they, in response to this movement, increased that appropriation 20 per cent. and that fact shows they were open to reason. It is a very encouraging sign to me because that same old appropriation had gone on from year to year and while I have made efforts in other years to have it increased, this is the first time it has been accomplished. I am in the position of wanting to thank the legislators for their opening wedge in this work.

MR. ANDREW J. RIDER—Mr. President, Mr. Howell has said about all I wish to say, so all I have to do is to second the motion.

I agree with Mr. Gies as to the value of judicious advertising. So long as one of the tribe is left, it will pay to let the public know we are after him. But this is a case where advertisement should not be permanent. Forgetfulness that such a pest ever existed would be the best advertisement.

Speaking of permanent advertisements reminds me of the story of the high price paid for a two-line ad in the colored church hymn book. Location to be at the option of the advertiser.

When the edition appeared, the first hymn read:

"Hark the herald angels sing, Beechams Pills are just the thing,
Peace on earth and mercy mild, three for an adult and two for a child."

The best advertising would be of an educational character which would bring the public into sympathy and add impetus to our work.

MR. ENGLE—As to this sensitiveness to the possession of mosquitoes there is no blinding ourselves to the fact that New Jersey has a reputation for mosquitoes, rightly or wrongly, all over the world. Nothing that we can do or say can obliterate

that fact. One thing we can do is to show the world that we realize it, and that we are going to make the situation better. We are making it better. The point brought out by the parable of the Prodigal Son in the Bible is the Prodigal's repentance which brought him home. I do not think we need be ashamed in New Jersey if we admit the situation. Whether it is as bad as any other place or not, the reputation is sufficient to keep a great many people away from us. People come into Atlantic City by the thousands and on looking out the train windows, they see miles and miles of strange looking ditches. They ought to be made to understand what they are for, so when they get back home they can say, "We have been to Atlantic City over the salt marshes and we weren't bitten by any mosquitoes, nor did we hear of or see any." Somebody will then say, "Why they have thousands of ditches, we saw them when we passed by."

You cannot get into Atlantic City without reading a few miles of advertisements for chewing gum and other things. Why shouldn't the people who come here from all over the world read some other signs. It's a little bit presumptive for me to come down here and tell Atlantic City people anything about advertising for if anybody knows the game, it's Atlantic City. When things get a little dull, they have a lady relieved of a \$20,000.00 engagement ring or at least that is what they say. My opinion is that any lady who has a \$20,000.00 engagement ring ought to have it stolen; but whether it was stolen or whether she had a ring or not, it makes no difference—that little item goes forth and is published in everything in the United States that has any printer's ink.

We need not be particularly sensitive. When people get educated to this mosquito work and get to know, as we want them to know, that standing water breeds mosquitoes, they will question as they pass any swamps or standing water in their automobiles whether that particular pool contains mosquitoes or not. Now it seems to me that some form of advertisement should be devised for these signs of Mr. Gies' are certainly good even if they do tell a painful truth. They will help convince a person so that he in turn can convince and educate someone else.

MR. WILFRED A. MANCHEE—I would like to ask Mr. Gies if he has any information to give us on the cost of the kind of publicity they have done in Union County. He has made more of a study of this intensive advertising than perhaps anybody

else and I wonder if he can tell us how much was spent last year and whether that has increased the appropriation from year to year.

MR. GIES—Mr. Manchee, last year the commission had about a thousand of these cloth signs printed. Now, as to the wooden signs we put up, they were of different sizes—some of them were 16 or 17 feet long, eight feet high, letters a foot or eighteen inches high on them. We put up two of these on the meadows where the commuters and people going down to the seashore can see them from the trains.

We also put up nine 5 x 8 foot signs, and spent a little additional money to make them artistic—a pagoda effect on top that cost a few dollars, but it is worth while. We had them painted in what the advertising people tell me are the most conspicuous colors—orange and black. You can see them a long distance, so that a person seeing a sign of that shape and color once, upon seeing it again, knows that it is a mosquito extermination sign. We have taken that distinctive style of sign and adopted it as uniform. Then we also put up about six small signs, 3 x 4 feet, with the words, in 18-inch letters, "No stagnant water, no mosquitoes." That is the whole essence of our work; if we can drive that home to the 3,000,000 people in New Jersey we will have no trouble to obtain our appropriation to get rid of mosquitoes.

The entire cost of these two large seventeen-foot signs, nine 5 x 8 signs and six of the "No stagnant water, no mosquitoes," type, erected cost about \$600. The commission this year is waiting to see the effect of the signs. They are satisfied so far that it is money well spent, but I do not know whether they are going to increase the number this year or not. They are also putting out 10,000 of these manuals in the schools. The effect of that will be felt ten years later, when those who are now high school boys and girls get out in later life and exert their influence to get civic betterments.

There are a number of other things we are intending to do that may take an increased amount this year, so I am not prepared to say just now as to what the commission will spend on educational work. Does that answer your question?

PRESIDENT MEYERS—Are your orange and black signs wooden signs?

MR. GIES—Yes, they are.

PRESIDENT MEYERS—How did you say they read?

MR. GIES—Some of them read, "This and other swamp land in Elizabeth has been drained by the Union County Mosquito Extermination Commission." Then we have some of which read, "Live in Elizabeth and be comfortable," with the name of the commission at the bottom; and the Elizabeth Chamber of Commerce will certainly appreciate any sentiment of this sort. In fact, any chamber of commerce will. We have some others reading, "No stagnant water, no mosquitoes."

Our salt-marsh signs read, "These salt marshes are being drained to make Union County an even better place to live in."

We first thought we ought to educate the people to the fact that at the point where the sign was located there had once been a swamp, and because of the Mosquito Extermination Commission's efforts that swamp had been drained. The first way to educate the people, the commission thought, was to point out to them that at a certain place a certain amount of work had been done. They can see it, as thousands of automobiles pass these points every day. We are going ahead with the repainting of the signs from year to year, and we will go on now with a different lettering of the signs, more on the lines I have spoken of, "Live in such and such a county and be comfortable."

PRESIDENT MEYERS—Is there any further discussion?

DR. LELAND O. HOWARD—I would like to call the attention of the members to the fact that the very best advertisements that you could possibly use are the results that have been accomplished. When people who come here year after year find mosquitoes growing less, and spread the news over the country, that is the best form of educational work you can use, particularly in your own state, and visitors and foreigners are learning it through the results of this association.

MR. HOWELL—Dr. Howard's statement reminds me of many things that I should like to have talked about when I was on the floor. I think that he has summed up the real goal that we should try to reach with our advertising. When I say for the town of Rutherford that its residents are now able to go to bed and sleep without the protection of canopies, a thing impossible to do for the past twenty-five or thirty years, and are able to spend an evening on the lawn in comfort, also to work in their gardens without annoyance from mosquitoes, you will see that the work of the commission has been splendidly effectual in this community where heretofore the mosquito has been a great pest. This is no dream; this is actually taking place in Rutherford now.

I have not much faith in Mr. Gies' muslin sign. This is no disparagement of Mr. Gies' project. As a freeholder, I come very closely in touch with the sign problem. There are signs along our highways in every direction; they are too numerous. I have reference particularly to the miscellaneous danger signs and not to those that point the way and give directions to traffic. These later signs are given attention, but the ones that have to do with dangerous curves and crossings often, if not usually, are overlooked. If this be true, Mr. Gies' muslin sign as to the drained swamp will receive little attention from the traveling public. However, I think it most commendable for local information to have such signs posted. The community in the neighborhood upon reading the sign will receive valuable information and education. In this way such signs might be very advantageous. If, for instance, the 3,000 pools and ponds of Bergen County that have been filled in or drained were posted in this way, and the facts of mosquito extermination were made known to people by this means, and that these ponds and pools had been drained by the mosquito commission with the result that the mosquitoes had been completely exterminated in this particular neighborhood, the people would be compelled to admit that the work of the commission had been successful.

PRESIDENT MEYERS—The next paper will be read by Mr. Jesse B. Leslie, superintendent of the Bergen County Mosquito Extermination Commission. Mr. Leslie has been for a long time interested in mosquito control, has had a wide experience and has done effective work. The title of his paper is:

The Need For, the Method of Carrying on and the Results of Locally-Supported Campaigns.

MR. LESLIE—Ladies and Gentlemen: When I was requested to prepare and present this paper at this convention, I rather demurred because I felt that I had been on the program so often especially recently, that I didn't have much that was new, either in form or substance to give you. But Dr. Headlee assured me that this year there was an entirely new plan on foot. They were to have an organized discussion and really the paper wasn't so important. In giving the paper I was simply to start something. Now ever since early youth I have had rather an unhappy faculty of starting things, but my objection was overruled and Dr. Headlee said, "Make the paper general and make it short." In fact the title of the paper is "The Need for,

the Method of Carrying on and the Results of Locally Supported Campaigns."

The word "co-operation" is used so often nowadays and so carelessly that one hesitates to employ it. And yet in mosquito control work in its truest sense it is so essential to the achievement of success that it is hard to apply a synonym with better effect. The value of system, organization and co-ordination has been and is constantly being demonstrated in our national, political, and domestic life. The Allied Army in the recent Great War affords a striking example. Occasionally a man plays a lone hand and wins. But to do so he must be a genius and the genius is still as rare as we hope some day to make the mosquito. The average mosquito fighter of to-day is not of the genius class and if he attempts to go it alone his chances of winning are small.

And why? Because although no one has yet been able to find a real reason for the mosquito and although many insist that this insect, with the painfully penetrating proboscis was a mistake, the fact undeniably remains that she is one of nature's children and as such entitled to and receiving Dame Nature's astute protection. And so, when man declares that the "Mosquito is an unnecessary pest" and "That the mosquito must go" he is challenging nature and the elements to battle and it behooves him to enter the fray not alone, but backed by a vast force of loyal, well-trained followers lest he be daunted and discouraged before the fight is really well under way.

I believe it was Addison that remarked on the instinct of animals and what a peculiar and wonderful thing it was. The writer is not sure whether it is correct to refer to the mosquito as an animal. If not, Dr. Headlee will doubtless append a foot-note in the printed proceedings so that no reader will be seriously misled. But whether the analogy holds or not the mosquito is surely a creature of instinct. Anyone who has had experience in actual field work and found mosquitoes breeding in all sorts of impossible places will corroborate the statement.

Now this may all seem irrelevant and beside the subject but it is not. It is because the mosquito is a canny insect clinging closely to the only law it knows—that of self-preservation—that its extermination is so doubtful and its control so difficult. How do you get rid of mosquitoes? By locating all places in which they breed and treating each place according to its peculiar needs. Sounds easy. But we have been ten years or more putting the theory into practice and although we have made great progress we are not yet ready to cry "Excelsior." And we will not be

until we are able to rouse the average citizen from his lethargy and stimulate him to activity. The mosquito breeds where? On the salt marsh—in pool, pond, salt hole, swale, rat-run, ditch, etc. On the upland—along stream edges, pond edges, in gutters, drains, puddles, etc. Around houses—in rain barrels, tubs, cisterns, cesspools, sewer catch basins, roof gutters, etc. Around factories in vats, tanks, barrels, etc., and so on ad infinitum. Now for economic mosquito control these places must not only be found, but permanently done away with. Can any county commission with a mere handful of inspectors hope to find all these places? And granted that they find them all, with the average appropriation how long would it take to drain or otherwise abate those places that present a practical problem for elimination? To most organizations who have asked themselves these questions the answers have been obvious and they have not hesitated to seek support locally for the eradication of certain known breeding places or extensive area by pointing out to the municipality in which such areas lie the immediate benefit to be derived by the carrying out of drainage measures on a co-operative basis. And the response in most cases where such aid has been sought has been prompt and effective. In seeking local support the most essential thing needed is a clear-cut, well-devised plan of action with a frank statement of cost attached. Your city father does not take a kindly attitude toward vague and ethereal suggestions with an elastic cost estimate. He likes to know what he will have to pay and how much he will have for pay for it. And there is no reason why a man experienced in mosquito work should not be able to prepare a map and cost estimate with sufficient accuracy to give an outside cost figure to the municipality with a guarantee as to the elimination of all mosquito breeding in the place under consideration. Such a plan means a considerable amount of engineering and preliminary work but tends to do away with hasty inefficient endeavors and to bring about comprehensive, well-executed drainage plans.

Drainage of the large places in this manner is one way then in which the burden can be lightened from the shoulders of the county commission. Another plan and one which has been used to good advantage is to reverse the above process. That is, under the plan just stated, the town pays part of the cost of the drainage in order that the county organization may have more money to devote to intensive inspection. The second plan is to have the community take over the actual inspection and oiling campaign under county supervision, thus lessening the

cost of this to the county and increasing available funds for drainage.

In either case, the town directly contributing has an added interest in mosquito work and an additional incentive to learn about and take a real part in this vast undertaking. That which you get for nothing, you value little. That which you have to pay for has intrinsic worth. Community interest in mosquito control is most desirable and most necessary and must be aroused and sustained if mosquito work is to continue. And perhaps it might be worth while to emphasize the second point just mentioned. That is, that local interest must not only be aroused but sustained. It is one thing to get people fired to enthusiasm on a proposition that presents a novel undertaking; to get committees appointed; and funds raised for mosquito control. It is quite another matter to sustain that interest over a prolonged period when disappointments, delays and set-backs ensue. It is not so hard to get local committees established and initial funds contributed. But to get those committees to function and to keep them keyed up and to get money for maintenance after the first work is done is exceedingly difficult. This is perhaps the most discouraging feature of attempting decentralized work in mosquito control.

To summarize then, the need for locally supported campaigns in mosquito control occurs because the work is so diversified that any one organization working alone is seriously handicapped and badly outnumbered. While it is suppressing the mosquito in one spot, she is wriggling to maturity somewhere else. The mosquito is a common enemy. As such it should not be opposed by a picked few, but by all, and the more quickly we can get that hypothesis accepted and adopted the more quickly will our hopes become realities. The method of obtaining and enlisting local support is largely a matter of discretion with the central body. Ways which have been found of practical advantage in actual experience have been outlined above briefly. They are by no means the only ones which are feasible. No commission is so well organized or so well established that it can get along without local support in its broadest sense and while they may not need financial aid they will need help of another character and it behooves them to work out a method of getting it, best suited to their own needs and that of the community they are serving. As to results obtained, it is measured in increased thoroughness of work done, for where a municipality is paying directly it keeps a closer check; in a shortening of the time requisite to carry out the permanent measures of drainage, which are a

condition precedent to economic mosquito control, and in broadening actual interest and knowledge in mosquito work among the members of your constituency. It has in many places heretofore been necessity which has prompted the solicitation of local aid. I believe such should not be the case but that work of this sort is so essentially important that it should have a certain definite place in the policy of every unit now engaged in mosquito control operations.

PRESIDENT MEYERS—This paper is open for discussion. I will ask Mr. Frank Miller, Chief Inspector of the Middlesex County Mosquito Commission, to lead the discussion.

The paper which Mr. Leslie has prepared and just presented should receive thought and careful consideration by all mosquito fighters. The locally supported campaign is one of the most effective and important features in mosquito control work and should not be neglected, for it is through these campaigns that mosquito work can obtain much-needed advertising and gain many friends. Mosquito warfare done with county funds gains but slight recognition among most people, but a locally supported campaign immediately interests many citizens in the community doing such work, and the results are closely watched for. For this reason great care should be exercised in enlisting local support.

Before approaching a community for such support, a thorough survey, a definitely conceived plan of action, and an adequate statement of funds needed, should be prepared. But, above all, be sure that freedom of the pest can be guaranteed by such control work within the municipality. The results of local campaigns can be entirely destroyed by the invasion of a brood from some nearby swamp or salt-marsh area lying outside the limits of the community. The average citizen does not know that these invasions are possible, and is only too willing to believe that the local campaign has not been a success. Thus mosquito control is placed on the defensive, a powerful weapon is placed in the hands of the disbelievers and "doubting Thomas's," unsatisfactory explanations are in order, and it is often with great difficulty that the municipality can be induced to continue its campaign. So, if it is found that such invasions are likely to occur, it is advisable to forego any requests for local work until such time as the outside areas may be made safe.

If, however, after a careful study of conditions, it is found that the mosquito nuisance in the municipality is entirely local, requests for local support can and should be made. The methods

of introduction vary. In Middlesex County we have found it advantageous to work through the local boards of health. In other places it has been deemed advisable to enlist support directly from the city fathers, in still others through civic organizations or women's clubs. Once support has been obtained, interest must not be allowed to wane. The people interested in the project must be kept well informed as to the progress of the campaign, and, if possible, inspection trips should be arranged in order that these reports of progress may be verified and the interested parties become better acquainted with the actual field operations employed to check mosquito breeding. Once a real active interest is inspired it will rapidly spread, and many new friends will be gained for mosquito work. The success of mosquito-control work in a county unit will depend largely upon the number of friends and believers that it has within it.

Mr. Leslie struck the keynote in his paper when he said: "The need for locally supported campaigns in mosquito control occurs because the work is so diversified that any one organization working alone is seriously handicapped and badly outnumbered. The mosquito is a common enemy. As such it should not be opposed by a chosen few, but by all, and the more quickly we get that hypothesis accepted and adopted the more quickly will our hopes become realities."

PRESIDENT MEYERS—As time goes on new things come into our experiences, and I am quite sure that all the members of this association who are here to-day will learn that a milestone in our career has occurred.

We are honored to-day for the first time by being addressed by one of the guiding sex. It gives me very great pleasure to introduce Mrs. Peter C. Olsen, President of the Women's Club of Perth Amboy, who will address us on the subject of

Civic Club Activities.

MRS. PETER C. OLSEN—I would like to say before beginning my paper that when Dr. Headlee let me know that he wanted me to speak on this paper, he didn't ask me to say a single word about mosquitoes, but asked me to speak entirely on club work, showing the men who are here what club women, organized, can do if they choose. So although my paper does not pertain to mosquitoes, it does pertain to club work, and perhaps you will see what organized women can do when they really try.

Nothing is more destructive than ignorance in work, and next to that indifference. All club leaders must make a supreme effort

to arouse *interest*, not only in local affairs, but in the county and state. When we are interested in a thing we talk about it, and usually our interest crystallizes into action. This great club organization in our country has living and vital interest, or the women, in these busy days, would not join. When I tell you that there are 2,500,000 club women in this country, with 35,000 in the State of New Jersey, you will realize that their influence is very marked in a community; multiply this by *three* of each family and you will see that the questions which interest these mothers, and that are talked of and discussed at home, will reach the ears of three times as many, or 7,500,000 people, in the United States.

Clubs are organized for all sorts of interests—some are for music lovers, others for those who wish to work along the lines of art, while some clubs hold civics to be the topic of interest and pursuit. Many clubs are called departmental, and in this combination art, music, literature, legislation, social and industrial interests, public health and civic work are *all* taken up by the same club.

There is a great national organization which includes all federated clubs in the country wishing to join. The national federation is made up of president, two vice-presidents, two secretaries, one treasurer and auditor, with a board of directors who take charge of all departments.

The New Jersey State Federation and all the clubs throughout the state are composed in the same way.

The state is divided into districts. This state has nine districts, each one covering three or four counties, and the clubs of those counties come directly under the jurisdiction of the vice-president of that district. The third district includes Middlesex, Monmouth and Ocean Counties and is under the supervision of Mrs. Prickett, of Metuchen, the third district vice-president. She reports to the state the work, interests and problems of her district. All local clubs have their officers and departments with chairmen, just the same as the state and national federations.

The joy of a departmental club is this: A member may have no interest in art or literature but is most happy to serve on the civic committee, and so each club member finds her place where she can serve most effectively.

The request which came to me from Dr. Headlee was to speak on the civic work of clubs, so I am going back several years and try to cover the ground somewhat telling the big things, and some of the smaller ones, which have been accomplished.

The state federation I will speak of first, as that includes the many clubs of the state, and whatever the federation does each club contributes its share.

1. The federation financed and took charge of the work in the Pines until the state finally took it over.

2. A large community house was purchased at Camp Dix, refurnished as a club for the boys, where they met and sang and talked and laughed and were made to feel at home by the good club women in charge. A cook was secured who, with his wife, made coffee, crullers, sandwiches and pie for the boys. The clubs paid for all this, and if you could hear the boys speak of the "haversack," as it was called, you would know the women did a great work toward making a little lighter the heavy, lonesome hearts the boys carried.

3. The MacDowell Memorial at Peterborough, Vt., was the next year's interest.

Musicians who wish more training and chance for composition request admission. The federation built a house and furnished it for New Jersey composers.

4. Last, but not least, in these past two years has the federation given to the state its new federation hall at the New Jersey College for women. I believe the hall is to be dedicated in June of this year and is to be used as a science hall.

Four great things done by the state federation in the immediate past. The work and the money all coming from the individual clubs.

5. Clubs have established day nurseries all over the state. When *our* club wished to start this work we secured the president of the federation of day nurseries to speak to us. She told us we must have \$1,000 before we could think of starting. This was a little discouraging to a new club, but, like *all* things, if the club women want a thing they unite and work for it. We secured the \$1,000 in two-dollar memberships, formed a board, hired the matron, secured and furnished a small house and started a day nursery. It has been a great success. We now own our own building, money secured to buy it by a drive in which the club women and their friends all worked for something they wanted.

It is now in a flourishing condition, with plenty of money to run it, secured by the women through a yearly drive the first weeks in May. Another great thing which the women have done through their efforts.

6. Another big work for the city is its playgrounds established and taken care of by woman's club. When well organized it was taken over by the city, but the club now furnishes the board

to decide upon the prizes awarded the winners at the final contests. The Burlington Civic League has sewing classes and a story-telling hour at their playgrounds, which the club women take charge of.

7. Community houses have been started where needed. The girls' societies meet. Lessons are given in English, cooking and sewing. We have a community Xmas tree at the house and a board made up of club women. The matron and maid paid by the club until recently, when the house has become self-supporting. A branch of the public library has been established at the house, thereby encouraging the girls to read good books.

8. Every year the clubs through the state conduct a sale for the blind. They secure the place, meet the blind people, conduct them with their goods for sale to an acceptable hall, serve them with lunch and buy their wares.

9. Most clubs have secured through the appeals to the city fathers

1. A police woman.
2. A visiting nurse.

10. This year the woman's club is represented in the

1. Board of education.
2. Library board.
3. Playground board.
4. Chamber of commerce.

11. The Anti-Tuberculosis League has every year conducted its great sale of Xmas seals through the agency of the clubs. If the clubs have not taken entire charge they have helped in every way.

12. Many thousands of dollars' worth of liberty bonds bought by clubs during the war.

13. School gardens planted and taken care of by children, the garden showing the best care, the largest vegetables, most proficient growth securing a prize given by the woman's club.

14. Baby clinics established throughout the state; babies weighed, measured, etc., and prizes given by woman's club.

15. Citizenship classes formed and conducted by club members.

16. Public markets established and maintained in the proper way by club women.

17. Two clubs report rest rooms and comfort stations under club supervision. Places where mother and baby may rest and get the much-needed care.

18. Lectures on current events. Lectures on parliamentary law.

19. Scholarships established in many clubs for girls to attend the Woman's College. One club gives \$100 yearly toward a class for retarded pupils. One club gives a scholarship for a course in business college to a deserving young woman of the town.

20. All clubs giving to Near East Relief, War Children's Relief, Devastated France, Hungarian Baby Relief, also many clubs sending garments to these charities.

21. Many clubs have established free public libraries, others help to maintain them, some give books every year, some have members who work a day a week gratis for the library.

22. Some give annual donations to the "shut-ins" each year at Xmas time.

23. A number of clubs have adopted a French war orphan.

24. Bridgeton club has formed an auxiliary to the chamber of commerce made up of club women.

25. The shade tree commission has found ready response in many clubs and have planted trees along the Lincoln highway.

26. Free lessons in canning given. Clubs giving a canner as a prize for the best display of canned goods.

27. Maintenance of room at the hospital. Other clubs maintain a bed in the children's ward.

28. The Wildwood club established a fresh-air house for children. One club maintains an hour for crippled children. Last year Flemington club gave \$200 for a community nurse.

29. One club (The Contemporary of Trenton) gave a wonderful Xmas party to 1,500 children. They played games, had their Xmas dinner, tree and stocking all through the efforts of the club.

30. One wide-awake club paid a boy's gymnasium dues and equipped him for the Y. M. C. A.

31. Cash prizes given to best student in high school for literature. Also for song.

32. One club donates a fine print each year to the high school.

33. Here is a great work. Forty children outfitted and sent to the seashore for three weeks, three mothers going with them. All expenses paid by the club.

34. Many garments made for the tuberculosis clinic.

35. Window boxes made and kept filled at hospitals.

36. Five hundred dollars given by one club to send tubercular children on an outing of four weeks.

37. Farmer markets established.

38. One club founded a housewives' league.

39. The woman's club of Camden reports organizing a club of foreign-born women.

40. Several clubs have established dental clinics.

41. Englewood Woman's Club secured a half-holiday on Wednesday, when all her shops are closed.

42. Dressmaking and millinery classes open to all in the community (taught by club women).

43. One club has established a club library. Each member gives two books a year, one for an adult and one for a child. It has been very much enjoyed and of great service to club members and their children where no public library exists.

44. All sorts of things, like rolling chairs, sickroom outfits, thousands of bouquets, baskets of Xmas dinners, delicacies for the hospitals, complete baby outfits, I will mention in passing through the great work done by the clubs.

45. Clubs are always raising money for charities by card parties, cake sales, bazaars and street fairs. This money is used in so many ways that it is hard to mention, but I will tell a few of charities for which we all work:

1. The home for the aged.
2. The home for the blind.
3. The day nursery.
4. The community house.

46. Story hour started at the library by club members and maintained by them throughout the year.

47. One of the biggest things ever done by a club was accomplished by the Perth Amboy Woman's Club.

At the time of the Morgan disaster it was the club which was first to organize its help. Those who remained in town opened their houses to care for and feed the motor corps girls who came from all about us.

Many of us ran regular hotels in our own homes for the girls' comfort. Following this came the establishment of temporary hospitals for all the refugees who flocked into war city sick unto death. The woman's club established a bureau where all who were willing to cook or nurse applied, and as fast as they came we found work for them to do. It was part of my own work to visit every hospital every day and find out what was needed in supplies and nurses, and then to get it. Some of us must have been needed, because in spite of standing with the dead and the dying every hour of the day, we were given the strength and health and courage to the end. This work could not have been accomplished but for the organization of the woman's club.

Women's clubs have wielded great influence both in Washington and in Trenton in urging action along health and welfare lines. This influence is entirely non-partisan and non-sectarian and has affected the legislation concerning women, children and the home while other measures prejudicial to welfare have been opposed.

The public health, social and industrial relations, education and the legislative departments of the federation and of individual clubs, work hand in hand for constructive legislation. When we fail in one session we are not discouraged, but rally for stronger effort next time.

Such a recital of matured civic effort in clubs must have convinced you of the willingness to aid, the ability to plan, the strength to influence, and the power to accomplish. If the club's sympathies be sought and her interest aroused the complete organization of this New Jersey Federation becomes a powerful ally to the commission.

PRESIDENT MEYERS—We have all enjoyed the able paper which we have just heard and the chair will entertain a motion of thanks to Mrs. Olsen for the presentation of this instructive and entertaining paper.

MR. SPENCER MILLER—I beg the privilege of offering that resolution for I have attended many of these conventions. I guess I am as old as any in this game, and to my mind it is the best news we have had—the fact that we can get organized club women as allies, and I know that we can get them because we have an interesting problem. I never have known an intelligent woman to fail to offer her services in the matter of mosquito extermination. Therefore, I move you, sir, that a vote of thanks be given Mrs. Olsen for her paper.

PRESIDENT MEYERS—You have heard the motion. All in favor please rise.

(The entire assembly arose.)

The motion is unanimously carried.

MR. DOBBINS—I move you, sir, that this matter be referred to the State Executive Committee to get the co-operation of the ladies' clubs of the State.

PRESIDENT MEYERS—You have heard the motion, gentlemen, do I hear a second?

(The motion was seconded.)

All those in favor please signify by saying "aye," contrary minded, "no." The motion is carried.

We were honored, as I said before, in the last speaker being a milestone in our career, but fate has dealt so kindly with us to-day that we not only have one milestone but two. The next speaker will be remembered as a mark of progress of our association; a lady commissioner of mosquito extermination work, a regular, right-down commissioner, just like all the rest of us. I think it is splendid to have the ladies working with us. They will probably set a pace that will be hard for us men to follow.

I take great pleasure in introducing to you Mrs. H. Boynton, of Woodbridge, a member of the Middlesex County Mosquito Extermination Commission. She will discuss Mrs. Olsen's paper.

MRS. BERTHA H. BOYNTON—Mr. President and Guests: I feel really as though I should go home and write my paper all over again, because I have learned quite a number of things since I came here last evening. I made several corrections, so I may not read it quite as clearly as I wanted to. When Dr. Headlee and Mr. Miller spoke to me about writing this paper I didn't know anything about mosquitoes. Since then I have attended one commission meeting, and I have learned a good deal since I came here yesterday. The work that I speak of is work that can really be done by the women of New Jersey if the commissioners will get behind our federation, and it can be very easily done in a systematic manner because there is organization back of these clubs.

To-day I feel somewhat at a disadvantage—to be one of two lone women among so many business men. After listening to Mrs. Olsen's paper, so full of wonderful things done by the clubs in our state, I know you are expecting much, and I am here to try to make you see what may be done by the women of New Jersey, if we, as mosquito commissioners, can get and hold their interest. No one can accomplish big results without a vision, and it is for us to give them the vision, and work it out along practical lines so that our dream of a land without the mosquito may come true. If the women of the state put their shoulders to the wheel they can do anything. You surely must begin to realize this when you have heard some of the things they have done. Nothing is too great for them to achieve. I fully believe that,

with the help of our clubs, in a few years you men, who have worked so hard to rid our state of the Jersey pest, will accomplish results. We may not be able to run drains through acres of meadow land, but we can arouse interest, and explain what these ditches will do. "The hand that rocks the cradle rules the world" is as true to-day as ever, and because women have gotten away from the petty things such as dish washing, how to make the best bread, etc., doesn't mean that she isn't a good wife, an understanding mother, and a good housekeeper. By virtue of these new duties she only does her work in the home the better. Each outside interest becomes a decided mental stimulus and keeps her abreast of the times. Many a problem in both home and club work has been solved by myself while working with my washing machine. I think more clearly when my hands are busy, and the young people of to-day need thinking, understanding, broad-minded, firm parents, and a good club woman is generally all of these and something more. (Applause.)

There are, as Mrs. Olsen has told you, 35,000 club women to-day in New Jersey. Each woman influences her family and her friends. So you can see the wide possibilities if each club woman's interest is aroused. Women who have done the work in the Pines, organized and run the Haversack, built the McDowell Memorial and our beautiful Science Hall in New Brunswick, surely can battle with as small an insect as our mosquito, and the war we wage will reach to the uttermost parts of our state, and the battle will be won.

During the coming year, as a mosquito commissioner, I would like to see a day on every club calendar set aside to be devoted to His Highness, the "Mosquito." How can this be done? One very effective way is to interest the vice-president of each district in securing a speaker who understands this subject and who can explain it in detail to club members. There are nine districts in our state, which comprise the twenty-one counties. The district in which Mrs. Olsen and I are most interested is the third, with Mrs. C. A. Prickett, of Metuchen, the vice-chairman. All district chairmen I feel sure would be willing to help, and would always be open to any suggestions made by you men of experience. In June we hold the national convention at Chautauqua. At this gathering will be women from all over the United States—ideas here might be exchanged, and a place given on the program. Of course, this would have to be done, if at all, through our state president, Mrs. A. B. Proal.

In looking over the federation year book, I see that in 1919 and 1920 work along lines in which you are interested was undertaken by a Bayonne Woman's Club. No statement, however, was made as to the work accomplished. At our state convention held at Asbury Park in May, 1920, there was an exhibition of hatching insects in glass tanks. There was some printed matter on mosquitoes, but no speeches were made or reports given. I have several ideas as to how our clubs could be of constructive help to you men. These I will mention. I wish you would take notes and be ready with suggestions or questions. We want, to-day, to impress upon you the power of our clubs to help, the willingness to serve, the unity and unselfishness which exist among the women of your state. Women are forgetting self, and our very wonderful state president, Mrs. A. B. Proal, says we are awakening successively to a town consciousness, to a county consciousness, then to a wider state consciousness, and finally to a national consciousness, the broadest and most comprehensive of all.

Most of our clubs are departmental and many of these departments could take up this work along their own lines in ways which I shall suggest to you. Of course, the subject could be gone into much more deeply than I have even attempted. I am simply skipping along, so to speak, and want to show you how my vision could be worked out and made real and practical.

Civic departments in clubs could do much work. They could go before classes in the schools, beginning with the kindergarten and tell the children where the mosquito breeds and lives, and ask them to find all stagnant pools, pails or barrels filled with water, which are so common everywhere. They should be urged to report these conditions to their teacher or the chairman of civics. As the child becomes interested in and talks about these things in the home, the parents will absorb much useful knowledge, without realizing it, and will begin to work along helpful lines themselves. All boys and girls love praise—give to the most active and wide-awake children as much publicity as possible; also distribute among the little workers some distinctive badge such as a small button or ribbon. You will gain hearty co-operation in this way. A suggestion to be used later is that we commissioners adopt some distinctive kind of medal or other badge to be used as a stimulus in this work all over the State. You have my assurance that this reaches the children, as these methods have been found effective in our work.

Literature departments should ask for stories or jingles about the mosquito. This would work out best in grammar or high schools, although it might be tried in the lower grades as well, and prizes should be given for the best story or jingle, such as a book, or gold piece of small value.

Art departments could ask for cartoons. Many children are very clever with their pencils and crayons. The best work should be placed in some prominent public place where all who "run may read."

Educational departments could get in touch with Commissioner of Education Enright at Trenton, and urge his putting into our schools Dr. Headlee's literature. This surely would be a move in the right direction, and is a suggestion made at a recent meeting of the Middlesex County Commission.

Our drama departments should see that mosquito film is shown at moving picture houses all over the state, as well as in our school buildings.

Last, but by no means least, I mention our legislative department. Here the commissioners would be able to get much-needed help. Mrs. Olsen has told you that we are not a political organization and recognize no political party or creed. We have our representative in Trenton, who keeps in close touch with all bills of interest to the federated clubs within the state. We are thus enabled to throw our support to any kind of legislation which is deemed worthy. The legislative department protects the interests of women, children, institutions and agencies, and all who are not able to care for themselves. As this mosquito problem is a health problem it is a matter of vital civic interest.

Organization means power, and the clubs throughout our state are a live, well organized, working body of women ready to "fall in line" when the signal is given.

Each club could be urged to support any petition sent out to our freeholders, asking that an appropriation be granted to our mosquito commissions throughout the state generous enough to enable them to do this work so important, not only to the comfort but to the general health and happiness of our people.

I am sure that all of my fellow commissioners will agree that all I have said is possible of attainment. Women working together for any good cause can always accomplish whatever they set out to do. The ideas which I have presented to you are only a few of the ways in which the work can be taken up among the

numerous clubs. With the commissioners behind the district vice-president, and each district vice-president urging the clubs within her district to set apart one day early in the year to our mosquito work, you should begin to see definite results. Rome was not built in a day—neither will all Jersey mosquitoes be killed within a year. The time will surely come when this work will be of common interest and gain more generous support of the people of the state.

As Mrs. Olsen has said, "When club women want a thing they work for it." You will all agree with me that if the men and women of this state work side by side in an effort to exterminate this pest, that the desired result will certainly become a reality.

MR. SPENCER MILLER—I want to call Mrs. Boynton's attention to the fact that the mosquito that sings is *she*.

MR. HOWELL—Mr. Chairman, these ladies will learn in time more about the mosquito. Before questions are asked or discussion is had, Mr. Chairman, I want now to move that a rising vote of thanks be extended to Mrs. Boynton.

MR. WILLIAM PORTER—I am rising to second this motion as my friend Mr. Howell has formulated it.

PRESIDENT MEYERS—You have heard the motion that a vote of thanks be extended to Mrs. Boynton for her able presentation of the paper. All those in favor signify by rising.

(The entire assembly arose.)

I would like to say on behalf of this association that the importance of what you have brought before us will not be lost. Mrs. Olsen has told us of the power that is ready to be put into operation through the women's clubs. Mrs. Boynton has told us of the method whereby we can use this latent power for the great extension of our work. I think it is the most important thing that has come before this association in its existence. Through Mr. Dobbins' motion it will be referred to the executive committee, which is a body of live wires, and I can assure you the plan will be fulfilled.

MR. ENGLE—I feel very much encouraged. There have been times when this mosquito question has been very discouraging. We know ourselves that it seems so long and hopeless to convince a great many others, but I have taken new heart with this report from the organized women. It reminds me of a little story

I told the ladies last night and which I think applies here. There was a colored lady who had five or six sons who were unusual. They minded the old lady. Somebody said, "Lizzie, how in the world do you raise these children so well?" "Why," she said, "I raises them with a barrel stave and I raises them frequent."

It looks to me as if the barrel stave were coming to this movement and it certainly is needed. We have not had as much trouble with the mosquitoes as we have with the human. I feel that the work of the women may be to mosquito control what the farm tractor is to the farm—it will bring a force that is immeasurable and tireless and which will work in a way that we men never have been able to do.

MRS. OLSEN—I just make this suggestion, it just occurred to me during this last speech: Why not ask the federation of clubs that is now making up its program for its big federation meeting to exhibit your mosquito film and have a good speaker at its big federation meeting held here in Atlantic City sometime in May—the first, second and third of May. I think the federation would be glad to do that, and see what the state is doing along this line.

PRESIDENT MEYERS—I have arranged for my office to call me, so I am going to ask the vice-president, Mr. Manchee, to continue the meeting in my absence.

(Mr. Manchee took the chair.)

CHAIRMAN MANCHEE—I understand we want more discussion on the paper of Mr. Leslie, as well as Mrs. Olsen's. There was not much discussion on Mr. Leslie's paper, so I would be glad to hear from anyone.

SECRETARY HEADLEE—Pursuant to the idea just advanced by Mrs. Olsen, I would like to offer a motion to the effect that this association appoint Mrs. Boynton a committee of one to see whether the arrangement on the program may not be made. I make that motion because I think that a request of that sort from this association, transmitted through a club member, would be apt to have better results than a direct communication addressed by the secretary.

CHAIRMAN MANCHEE—I understand Mr. Dobbins' motion referred the matter to the executive committee, and I presume that would be followed, Dr. Headlee, but do you think it would be better to have it come direct from the convention proper?

SECRETARY HEADLEE—I cannot see anything wrong with that scheme, and I was led to make the motion because Mrs. Olsen had made the suggestion. The method of an approach in a matter of this sort is sometimes of tremendous importance. The executive committee will probably get together at the close of this meeting or some time during the meeting, and a distinct motion from the association would carry more force than a request from the executive committee of the association.

CHAIRMAN MANCHER—Is the motion seconded?

(The motion was seconded by Mr. Edward W. Jackson.)

You have heard the motion; is there any discussion?

(The motion was unanimously carried.)

MR. SPENCER MILLER—I shall not be satisfied unless Mrs. Boynton is put on the executive committee, and I will explain why. The whole New Jersey movement to organize for mosquito control *began* with publicity. Dr. Howard's lecture in South Orange in May, 1901, was publicity. New York and Newark daily papers gave his lecture wide publicity. Dr. Howard told us that the job could be done and we wanted the world to know that it could be done, because we believed it to be an essential preliminary to getting work started and adequate funds appropriated. Something of the same sort must precede actual work everywhere, especially in the southern counties of New Jersey. And it must be maintained to keep people alive to the need for adequate appropriations.

In the little village of South Orange we tested out nearly every scheme of publicity suggested by Mr. Gies and proved its value; printed cards for every household; weekly notes in local papers; illustrated lectures before important organizations; glass jars containing larvæ in store windows with explaining cards. We had prize essays in the public schools. I supplied the prize money myself. Three prizes were given, \$5, \$3 and \$2. Dr. Howard was referee chosen to select the winners. Five dollars as first prize was all that was necessary. The winning student not only read his essay before the school but it was printed, filling three columns in the local paper. Three columns of news matter for five dollars—that's cheap advertising. Three columns on mosquito control. Why? It was a local essay; it was a prize contest with a victor. This boy became locally distinguished as

an essayist, and the local paper not only printed his essay, but his picture, too.

Our conference committee meeting with Dr. Smith in Newark was more for the newspaper notices than anything else. Ask Dr. Becker, Dr. Hunt, Mr. Dobbins. Publicity is one-half of our whole problem and we must never forget it. Advertising—education—publicity—it is not only a half of our problem, but it is the more important half.

My friends, we can begin to boast of our state-wide work when we are spending \$500,000 per annum. In the state to-day we are spending \$250,000 per annum, and we have been spending that amount for several years. Therefore, we are not making sufficiently rapid progress. We have done wonders in several counties, but in the southern part of the state we are in the doldrums. I especially want to see the Ocean County appropriation, now \$12,000, increased to \$30,000.

Speaking of women's organizations, I had enormous help from the women of South Orange, especially at the beginning of this work in 1901, 1902 and 1903. Through these state-wide women's organizations we have the machinery through which our publicity can flow to the whole state. And I want to see Mrs. Boynton on the executive committee to see to it that that very thing is done. She knows what to do, how to reach out, and how to get these women at work.

Now what do we want them to work for? Public opinion. Why? For larger appropriations. And let the goal for next year, or at least the year after, be a half million dollars appropriated for the New Jersey county commissions. After this money is expended we can do our boasting.

Thank you very much. (Applause.)

CHAIRMAN MANCHEE—We will have to limit any further discussion to just a few words, if there is any, because there is one more paper to be read, and it is getting late. I think everybody here realizes the importance of what we have heard, and as the matter is referred to the executive committee and as the members of the executive committee, in part at least, are present, I think they know what the orders of this association are—that they get the women on the job if it is at all possible.

MR. HOWELL—Mr. Chairman, I will only take a minute. I cannot resist the temptation, after listening to these women, of saying that these women are only samples. I am so proud to

know that my mother was a woman. (Laughter.) A year ago I brought to your attention that we had no women's organization in the mosquito-affected districts, nor interested women's auxiliaries of this association. Hit and miss methods of publicity still continue. We must interest more men of public spirit in affected districts, real estate operators and public officials and society clubs. I do not know whether my suggestion a year ago had anything to do with the invitation that must have been extended to these women to be present to talk to us to-day. However, we are delighted that they are here, and while we will discuss this matter in the executive committee and will hear all that is going on there, I want to call your attention to two or three things, these women have said and to the facts they have suggested.

First, the initiative of lending themselves to this movement. Do you get that? As they expressed it, do you notice that manifest willingness to come into this game, ready to fall in line when the signal is given, is one of the latter phrases of the poem that was read: "Do the job or die." Just splendid!

The suggestion made by Mrs. Olsen and also by Mr. Gies about the prizes and the medal or badge for a poem or jingle or something of that sort is a good one. As president of the Bergen County Historical Society, I am at the moment wholly absorbed and involved with a contest that is going on in my county. Our prizes are \$25 each, six of them, for no other purpose than to get our high school pupils interested in county matters. There is such a dearth of understanding on the part of seniors and parents of these pupils of the high school. I find that in every quarter of the county there is a lack of information relative to what is transpiring with the result that I have offered six prizes of \$25 each. One is for the best legend regarding a canoe, an Indian canoe that is in the museum of the historical society; one is for a romance entitled "A Romance in a Dutch Kitchen." That has to have for its inspiration a Dutch kitchen that exists in the museum of the historical society; another prize is for a historical poem which must be made up of historical events in the county; another one is the tragedy or detective story that must have its inspiration around the hangman's weight and the noose that was used in the last execution for capital punishment; and two other prizes of \$25 each for a portrait sketch of the Indian Chief Hackensackie and one of the Indian Sachem Oritany. That is what is on foot and it is going to be wonderfully helpful. Just within

this week we have received the warmest support from seven or eight of the principals of the high schools of the county and the sincere manifestations of their enthusiastic co-operation in this work.

Now let's have this prize-giving if it can be brought about. It will awaken an interest. I hope that we will consider that also in the executive session.

CHAIRMAN MANCHEE—We will take up the last paper now, "The Problem of Evaluating Mosquito Density and the Advantages to be Realized from Its Solution," by Dr. Headlee, and the discussion by Mr. Edward W. Jackson. I hope everybody will stay to this. It is not an academic question at all; it is very practical and it is going to be quite a good debate. Both these men are well able to take care of themselves and are not going to ask for any quarter.

SECRETARY HEADLEE—Before starting the paper I want to mention an opportunity for what seems to me excellent publicity. I would like to say that the editor of the Atlantic City Monthly, a paper published by the Atlantic City Chamber of Commerce and distributed widely over the state, including all members of the Legislature and all chambers of commerce, offers us a column a week if we will furnish the matter. There will be no charge to us outside of furnishing the matter. It struck me as a rather extraordinary opportunity of making our work known, and I wanted to mention it because the editor of this paper is one of the partners in the hotel where we are holding our convention.

MR. SPENCER MILLER—Can you guarantee to us that that matter will be furnished? Is that within your province?

SECRETARY HEADLEE—Well, if we can furnish the type of article that will satisfy the editor, we will surely do it, or if we can find anyone in our ranks who can furnish that type of article, it will surely be done, Mr. Miller.

The Problem of Evaluating Mosquito Density and the Advantages to be Realized From Its Solution.

The question that I am taking up here is largely a technical one, and, perhaps, I should apologize for presenting such a paper, but it seems to me it is one of considerable import in the successful carrying out of our work.

I do not expect that everyone here will agree that it is a matter of considerable import, but it seems to me that it is based on a good many years' experience, so I am willing to take the risk of setting before you something which may not entirely meet your judgment.

INTRODUCTION.

This paper, owing to the time limit, must necessarily be confined to general principles. Adapting these principles to operations in definite localities is a matter of much more detailed consideration.

NEED OF A MEASURE OF IMMEDIATE RESULTS.

It is a fairly well accepted principle that a unit of measure of some kind must be adopted in any line of endeavor in order that progress made therein may be expressed in some definite and clear-cut way. Mosquito control, the problem which we have come together in this convention to consider, is not an exception to this general rule, but a satisfactory sort of unit of measure peculiarly difficult to work out.

It is comparatively easy to determine how many thousands of dollars have been spent, how many feet of ditch have been cut, how many acres of swamp or salt marsh land have had the water removed from their surface, how many acres have been filled, how many gallons of oil have been used as larvicide, but it is difficult to secure a unit of measure which will tell us accurately the extent to which these efforts have been successful in mosquito reduction, and, after all is said and done, the first result to be measured is the reduction in mosquitoes which such work brings about. Later the effect of this work will appear in advances in taxable values, but some years must go by before even the beginnings of this type of result will make their appearance.

POSSIBLE KINDS OF MEASURES OF IMMEDIATE RESULTS.

The most natural way of attempting a measure of the effect of anti-mosquito work in terms of the reduction of the mosquito pest is to consult the experience of persons living in the territory where the reduction has occurred. Unfortunately all of the efforts of this sort with which the writer has been familiar have been unsatisfactory because the reports are of such an extremely variable character. It is probable that if everyone living within the territory could be consulted, at say an interval of every two weeks or even 30 days, a pretty fair measure of mosquito reduc-

tion might be obtained. Again unfortunately this is impractical because of the immense number of people concerned and the unwillingness of the average man to take the time and trouble to express an intelligent judgment.

The second method is to make mosquito collections. Unfortunately variable factors, such as mosquito habits, air movements, atmospheric moisture, temperature, light, precipitation, elevation, plant growth, difference in collectors as regards activity, methods and attractiveness to mosquitoes, are extremely difficult to eliminate or even to evaluate. Certain efforts have been made in the direction of eliminating or evaluating or both of these numerous variable factors.

THE VARIABLES IN MOSQUITO COLLECTIONS THAT MUST BE
ELIMINATED OR EVALUATED.

All common species other than *Anopheles quadrimaculatus* apparently are most active during a period beginning at dusk and ending about 9 o'clock, standard time. The common salt marsh species, such as *cantator*, *sollicitans* and *taeniorhynchus*, fly and bite vigorously during the day, and the same may be said of the common fresh water swamp mosquito *sylvestris*. On the other hand, the salt marsh mosquito *salinarius*, the house mosquito *pipiens*, the secondary fresh water swamp mosquito *perturbans*, the woodland pool mosquitoes *stimulans* and *canadensis*, are troublesome almost exclusively in the period first mentioned. *Anopheles punctipennis* is commonly troublesome in the evening, while *quadrimaculatus* is apparently rarely so. What time during the night *quadrimaculatus* attacks most vigorously is not well known. With these differences of habit in mind, it is obvious that where collections of the three chief salt marsh forms and of the primary salt water swamp form can be made during the day under favorable conditions, the collections of the house mosquito, woodland pool mosquitoes, *salinarius* and *punctipennis*, must be made during the evening, between the oncoming of dusk and about 9 o'clock. Collections of *quadrimaculatus* must be made within the houses or shelter, and not in the open.

It is a well-known fact that a breeze exceeding 10 miles an hour causes the mosquitoes to cling to vegetation and prevents them from being troublesome, and that either still air or wind not exceeding 5 miles an hour is most favorable for mosquito activity. Furthermore, it is well known that while an atmospheric moisture between 70 and 96 per cent. is most favorable to the mosquito's activity, actual precipitation renders them inactive and not troublesome. Furthermore, it is also well known that while a tem-

perature of approximately 80 degrees F is most favorable to the mosquito activity, a temperature of 60 degrees F or below and a temperature of 95 degrees F or above renders them relatively inactive. Furthermore, it is also known that heavy plant growth forms a harbor or shelter for most of the species, and that collections taken in localities where growth of this sort exists will catch a far larger number of mosquitoes than where it does not exist. The variable of elevation seems to operate mainly through air movements, temperatures and moistures, and the conditions of these factors which are most favorable hold at various elevations. Most mosquitoes are negatively phototropic to strong light and positively phototropic to weak light, consequently mosquitoes are less active during the day and also less active during night than they are at that period of the 24 hours when the day is passing into night. The lower temperatures and that period when night is passing into day are primarily responsible for the much reduced activity of mosquitoes as compared with their activity at the corresponding period in the evening. The variable of the human collector is probably the most difficult of all the variables to handle, because the activity, the methods used and the attractiveness of the individual collector has at least as many variations as the number of collectors employed.

**CONDITIONS UNDER WHICH COLLECTIONS MUST BE MADE IF
RESULTS ARE TO BE RELIABLE.**

All things considered on the basis of the conditions set forth in the preceding paragraph, it would seem that the method of determining mosquito density over an area of country is best served by making mosquito collections in the largest practicable number of stations within the limited period at the same hour of the evening, in places which, from the standpoint of plant growth, wind movement, light and atmospheric moisture, are primarily the same; nor does it by any means seem impracticable to secure localities that are very similar in these respects.

The elimination of the three variables mentioned in relation to the collector is a much more difficult matter, and it is only by utilizing a carefully selected and trained body of men, whose differences in activity, methods and attractiveness as bait have been evaluated, that a reliable result in the way of mosquito collections can be obtained. In practice in this state there are very few, if any, instances in which the conditions just specified have been complied with. Lack of understanding of the requirements for successful collections and scarcity of collectors have been primarily responsible for this failure to meet the necessary condi-

tions, and the degree to which these conditions have not been met measure the extent to which the results have been unreliable.

PURPOSE OF COLLECTIONS.

At this point it is well to examine the purposes of these collections to see whether certain of these purposes cannot be met without completely complying with the above specifications. In general the purposes of these mosquito collections is to evaluate in terms of mosquito density the immediate results of the anti-mosquito work and to enable the anti-mosquito chief to trace sources of the mosquitoes which are found on the wing. It has been definitely shown that nearly all species of mosquitoes will move more or less from the area in which they were bred and this fact means that the collections must be made with sufficient frequency to detect the presence of these mosquitoes before they have moved from the point where they were hatched and especially before they have moved far enough to have broken the connection. Perhaps the meaning of breaking the connection of the breeding place needs illucidation. As a brood of mosquitoes emerges it does not escape all at once but the emergence covers a considerable number of days. Indeed under most conditions the writer believes the first ones to emerge have moved from their breeding places for considerable distances before the last are out. In time, however, all have moved and all evidence of a connection of a swarm and its breeding place has disappeared. In the early stages of this movement there seems to exist a constantly increasing density from the vanguard of the brood to the breeding place from which the rearguard has not yet moved and in many cases not yet emerged. If the collection stations are sufficiently numerous this increasing density will be obvious by the number of mosquitoes of a certain species caught at each of the different stations and it may very well be that if the source of breeding is within the area itself examination of the collections the following morning will probably locate the source of breeding within a very limited locality within which inspection for breeding places a brood can still be found in process of emergence. If on the other hand the brood has not been bred in the area under control definite evidence of it as an invasion will make its appearance and collections of succeeding evenings in the direction of increasing density will surely point to the source from which the invading brood came.

THE COLLECTION WEB.

This plan contemplates the establishment of a web of collecting points over the area to be protected. The size of the meshes of this web must depend upon the type of information desired. A very large meshed web will answer for the detection of invasions and for the detection of extensive and intensive breeding within the area, but an exceedingly small meshed web will be necessary to detect the presence of intensive breeding on very limited areas. The large meshed web is probably the only one which is practicable under present conditions in county-wide work because the number of reliable collectors required would be so large as to carry the expenses beyond the point where the effort would be worth while. In dealing with the problem of protecting a very densely populated area the minute web might justifiably be used.

SUBSTITUTION OF A MECHANICAL APPARATUS FOR THE HUMAN COLLECTOR.

The two factors in the utilization of a minute web which are most difficult to solve and the one factor in the utilization of a large meshed web which is most difficult to solve are evaluation of the collector on the one hand and the provision of a sufficient number of competent collectors on the other hand.

With the idea of substituting for the human collector a mechanical apparatus sufficiently cheap to permit the utilization of large numbers, an investigation of the substances which attract the mosquito to man was undertaken during the latter part of last summer by the Bio-chemist in the Department of Entomology of the N. J. Experiment Station. Since the mosquito is attracted to and induced to fly across considerable distances it is evident that the attractive force is something which passes through the atmosphere and inasmuch as the heat of the human body would not appreciably increase the temperature at points as distant as those from which the mosquito is attracted to man, it is evident that heat is not the essential attractive agent. The emanations which serve to attract the mosquito are in all probability odors or something of a similar character. Odors of the human body are the results of its excretions and secretions. The breath, the sweat, the sebaceous secretion, the urine and the feces must one or all be playing a part in these attractive emanations. It is a well-known fact that all of these secretory and excretory products in their final decomposition result in the forma-

tions of carbon dioxide and ammonia. The first substances to be tested were, therefore, these two end products of the decomposition of all the secretory and excretory products. The investigation during the past summer has been limited to experiments on *sollicitans* and *cantator*. It was found that carbon dioxide and ammonia with a particular temperature and degree of moisture such as to reproduce the conditions of the breath was highly attractive.

The gross secretions and excretions such as sweat, urine, sebaceous secretions, feces and breath were experimented with and it was found that none except breath were attractive.

The idea that possibly the intermediate decomposition products of these secretions and excretions other than the breath might be attractive even though the gross secretions themselves were not, occurred to the investigator and an examination of the literature bearing upon the decomposition of these gross secretions was undertaken. The principle intermediate decomposition products of these secretions and excretions insofar as they could be secured were then tried out. Of the decomposition products of urine and perspiration, phenylamine, alanine and asparactic acid were more or less attractive. Of the intermediate decomposition products of the sebaceous secretions, cholesterol, benzoic acid and a combination of oleic acid and benzoic acid were more or less attractive. Of the intermediate decomposition products of feces none were attractive. Blood itself was not attractive, although warm beef bouillon was. Hemoglobin was attractive. Since the intermediate decomposition products of peptone would include the ones found primarily attractive in preceding studies, peptone itself was given a thorough trial and was found to be at body heat exceedingly attractive.

Evidently the only gross excretion of the human body that is attractive to mosquitoes is the breath in which we find both carbon dioxide and ammonia as well as a high percentage of atmospheric moisture. Certain of the intermediate decomposition products of the other gross excretions and secretions are also attractive and the ultimate or final decomposition products of all the gross secretions and excretions are attractive.

Thus it appears that we have found what it is in the emanations of man that are attractive to the mosquito, but the problem is to produce them in such quantities as to simulate their production from a large animal like man. With the opening of the mosquito season it is planned to continue these studies and to attempt to solve this problem. It is planned to extend the results obtained from a study of *sollicitans* and *cantator* to the other

economic species of mosquitoes occurring within the limits of the state. It is thought that this study will result in devising a mosquito trap which may take the place of the human collector and be cheap enough that its use in large numbers will be practical, thus enabling us to set up a minute collection web on a practical basis wherever a thing of this sort seems to be needed.

INFORMATION THAT PROPER COLLECTION SHOULD GIVE.

That invading broods of salt marsh mosquitoes can be recognized and traced to source by either daylight or evening collections has been demonstrated a number of times. That broods of house mosquito (*pipiens*) emerging from intensive and extensive breeding places can be recognized and traced by evening collections has been demonstrated. That broods of the fresh water swamp mosquito (*sylvestris*) emerging from intensive and extensive breeding places can be recognized and traced to source has been demonstrated. That small broods of the house mosquito (*pipiens*) can be recognized by the minute web by evening collections has been demonstrated in Passaic County. That the utilization of the minute web by evening collections on a county-wide basis is practical has not been demonstrated, and there is a good deal of evidence to indicate that the procedure costs more than the results are worth. That the study of the emanations of the human body attractive to the mosquito opens up the possibility of substituting mechanical appliances for the most difficult variable factor, the human collector, in making mosquito collections cannot be denied. That this substitution might solve the problem of utilizing the minute mosquito collection web and thus render the evening collection an excellent detective measure for broods emerging from very limited but intensive breeding, seems entirely within the range of possibility.

IMPORTANCE OF INFORMATION COMING FROM MOSQUITO COLLECTIONS.

The importance of information which may be obtained from mosquito collections is difficult to overvalue, for the mosquito chief who knows the mosquito fauna in this territory is not working in the dark. Striking an enemy which is not seen is a sure way to waste money. Some of you may say that, after all, we know mosquitoes breed in water and in water only, and if we search out these breeding places by inspection systems and eliminate them either temporarily or permanently as mosquito breeders, we have done all that it is possible to do, and there is no par-

ticular benefit in knowing just what mosquitoes are on the wing. You must, however, recognize the fact that there are breeding places which will be overlooked, that there are breeding places lying outside the protected territory from which mosquitoes might migrate into the protected territory, that broods of mosquitoes do not emerge within a period of a few hours, but that the emergence of a brood may cover a period of a number of days. Without a knowledge of the mosquito fauna within the territory to be protected you may be spending every ounce of energy in finding and eliminating breeding places and yet mosquitoes may be exceedingly prevalent. Your best work may be a failure from the standpoint of the people of your territory unless you know the sources of mosquitoes which are troubling them, because you may be putting your time and money on efforts of comparatively little importance.

CHAIRMAN MANCHEE—Mr. Jackson, will you discuss this paper for us?

MR. EDWARD W. JACKSON—Mr. President, Ladies and Gentlemen: It is only right that I should make an explanation of my reason for being here and assuming to question the practical or economic value of night collections.

For some time I have been helping the mosquito commission in Essex County in the classification of this night work, and, from the results obtained and reported to the commission, I came to the conclusion that night collections, as carried out in Essex County, were of very little value. I am still of that opinion, and so stated to the mosquito commission.

It came to Dr. Headlee's hearing and he invited me here to present my views on this subject.

I desire to say that these views are personal. I do not represent the Essex County Mosquito Commission and I do not know what their ideas are. This matter is brought up simply because Dr. Headlee felt that, as there was someone who had a different viewpoint on the subject of night collections, it might be well to have it presented at this convention.

Night Collections—Do They Help in the Extermination of the Mosquito?

THE FACTS.

It has been the practice of the Mosquito Extermination Commission in Essex County to collect adult mosquitoes on the wing on designated nights during the early hours after sundown. These collections are called "night collections."

The catches or collections are made in the usual manner at certain agreed-upon stations, where, as far as possible, similarity of conditions exist. The specimens thus taken are turned in for identification, and each station is credited with the result of the findings.

The purpose of these catches was to ascertain the kind and number or quantity (technically called density) upon the theory that the findings would serve as a guide in the work and as a basis for computing the percentage of the different prevailing species. The new thought appears to be that with this knowledge breeding places can be located and future breeding prevented. Doubt has been raised as to the efficiency of this new thought, and the intention of this presentation is to show that night collections, except for scientific purposes, are neither practical nor economical.

THE THEORY.

Water being necessary for the propagation of mosquitoes, it follows that so long as favorable conditions exist it is probable that these insects will escape periodically, and because it is not always known where these breeding places are, it is suggested that "night collections" would help to solve this problem. The belief is that these insects fly from a given point in a fan-like manner and that by tracing back through the process of eliminating the catch of stations showing the lesser density, there would finally remain but the one station showing the greatest number. This final station, like the base of the fan, would indicate the breeding place from which the mosquitoes escaped.

So far as is known there are no references in the existing text books to this method of locating breeding places of the mosquito, yet that is no reason why this idea should not be recorded in the text books of the future, for Shakespeare says, "There are more things in heaven and earth, Horatio, than are dreamt of in your philosophy."

HOW THE THEORY WORKS OUT.

There must necessarily be some cause for the theory to work upon, otherwise there is no reason for its being. So, we find at the various "night collection stations" adult mosquitoes on the wing, having escaped from some unknown breeding place. If, perchance, it is an invasion of great density, it will be all the easier to find the place whence they came. But, what about the mosquitoes that have escaped? Here they are and everywhere. With these conditions, what is to be expected? Fault-finding and

criticism! And, why not? The mosquitoes are present. They *must* be or the theory won't work. We will admit it does work. The obnoxious place is discovered and made immune against further trouble. But the facts are that biting still continues and naturally explanations are in order, so ideas, systems and theories are served out to the public, but it won't down for long, for "as sure as shooting" someone will ask this question: "Tell us, Mr. Theorist, if it was possible to find those breeding places after the adult mosquitoes have escaped, why was it not possible to find them before they escaped, and if it is possible to make such conditions immune against future breeding, why was it not possible to do it against past breeding?"

It is difficult to imagine what the answer to this question would be if attempted by the advocates of the night collection scheme.

To admit the place was likely to contain breeding, and no attempt made to discover it, no matter for what reason, is to invite censure, especially so, if, when rediscovered under the night collection system, the place is then made immune; and, unless it *is* made immune, there does not seem to be any reason for the discovery to have been made or for the system to exist.

To plead ignorance of the breeding place from which mosquitoes have escaped, is to admit negligence, and to acclaim the night collection system a success, is to again acknowledge negligence, because, unless mosquitoes have been allowed to escape and are in evidence to be caught, the system will not operate. There must be grist in the mill or the mill won't grind.

After all, what advantage would there be to find the locality, if, when found, there is no more breeding. Most certainly, if you were making a collection of bird eggs you would not make much headway with the collection, even though you were able to identify the birds flying about, if, when you had discovered the place where the eggs had been laid, you found nothing but empty nests.

If we assume that such discovery is an advantage, then, in order to obtain it, it must follow that the system is to operate with unerring precision, but what would be the answer if the system failed?

The idea seems to be that when an escape has occurred, the next best thing to do is to find out the locality where breeding took place and then to apply a remedy against any further mishaps. How like the old story of the stolen horse and the lock on the barn door!

But, in all fairness, it must be kept in mind that the thought is new, and most any new thought, whether it be that of Dr.

Einstein's Theory of Relativity, or Dr. Headlee's Theory of "Night Collections" as a detective agency for locating mosquito-breeding places, will always produce interest, although, perhaps, difficult to understand; and, if you happen to be from Missouri, you will have to be shown. As a fact, can it be shown?

THE REAL ANSWER TO THE PROBLEM.

The object of the mosquito extermination work is to prevent the escape and to destroy the breeding of the insect. To accomplish this, divers well-recognized methods are employed. Also, from a scientific standpoint the identification of the mosquito is a great factor in determining the methods to be pursued in their control and extermination. Quoting from the introduction of Vol. I of Mosquitoes of North and South America, by Howard, Dyar and Knab, the authors, referring to the different habits of the various species, write, "It is necessary to distinguish carefully in this respect. Only those species that are harmful to man, or as annoying by their bites, need to be considered in economic work. Much useless labor and expense can be avoided by an accurate knowledge of the habits of the species." As no better authority exists, it is certain that the catch and examination of mosquitoes should be made in order to carry out intelligently the work of extermination. But, this does not mean to apply to adults alone. The identification of larvæ is just as important and just as certain of being established as is the identification of the adults and because the larvæ are taken and kept alive, there is the advantage of their being constantly under observation. They can, if necessary, be forced to the adult stage ahead of those remaining in the breeding place. The identification of the adult would, in this event, serve as a check on the first larvæ identification, and thus where it is found that larvæ, if allowed to mature, would produce adults to "carry disease or to annoy by their bites," the breeding could be quickly destroyed by oil spraying.

That the identification of larvæ is expected and intended to be made is certain for our authors say "the commonest mosquito during the summer months in the Northern States is *Culex territans*. * * * We know that this species does not annoy man," etc. It is therefore, self evident that unless discovered through identification of the larvæ it may never be found. To destroy these, however, would serve no purpose.

As has been said, the ultimate object of both systems is the same, namely to prevent and destroy breeding. The larvæ identification plan requires constant water inspection and analy-

sis with the view of effecting an immediate remedy upon obtaining proof of the need. The night collection theory presupposes failure to inspect, and in consequence an escape, and when the locality of the escape has been decided upon, it will receive the same remedy as that of the former plan. But, no matter which of the plans is put to use, an examination should be made of the larvæ to ascertain if, as adults, they will "carry disease or become annoying by their bites" before any "useless labor and expense is incurred." The water inspection plan requires this examination.

The night collection plan should also approve it, because to blindly destroy right and left, no matter what, is contrary to our authority. Manifestly, therefore, the night collection plan must include the examination of larvæ in order to intelligently accomplish its purpose, and as the remedy, when applied, is the same in either case, it must follow that the *time* of applying the remedy, being the essence of the undertaking, is the factor which must aid in determining which of these two methods is the most effective as a means of prevention.

A proper designation of these methods would be to call the constant water inspection plan "ante-escape remedy" and that of the night collection, "post-escape remedy."

The former has the advantage of having a fixed policy established with a minimum chance of escape and of having its cost definitely ascertained in advance, while the latter with all the difficulty of evaluating correctly the many factors necessary to obtain results, even though reliable as a medium of detection, would, it is believed, entail greater cost with less effect, especially so when the preventative remedy is applied after an escape.

On account of the limited amount of money obtainable for extermination work, it would seem fair to conclude that the method of destroying the mosquito before it has had an opportunity to get in its deadly work, is more effective as a nuisance preventative and more in the line of a measure of extermination.

SECRETARY HEADLEE—The only thing wrong with Mr. Jackson's idea, as I see it, is that he assumes that it is either one type of effort or the other. As a matter of fact, from my point of view, these two schemes are not opposed in any way. They are complements of the same scheme. Our common practice is to inspect, by a body of men, the territory which we are trying to protect and to find all breeding that is there, and destroy it of course, where it is found. That is a primary basic procedure.

Now Mr. Jackson brings out the idea that some of that breeding may be unimportant, especially of mosquitoes, not worth the time and trouble to get rid of. As a matter of fact in my experience, the number of times that you find *territans*, solid *territans* breeding and no economic species among them, while not entirely infinitesimal, is pretty nearly so; and that the advantage which Mr. Jackson pointed out to be obtained from the identification of larvæ is of comparatively little practical value.

The scheme of the night collection is nothing more than a check on the fundamental inspection work that locates the brood. I would recall to Mr. Jackson's mind and to yours that there was a time in the County of Essex when, with all the careful inspection work that was being done, mosquitoes were held down until about the middle of July, and then all at once, over night, there would be an enormous brood come into Essex County, and nobody could more than nearly guess at their source. It was the collection method used in tracing those mosquitoes that told us where those mosquitoes came from, and finding where they came from has been followed by measures of eliminating that breeding. My whole point in this thing is that the night collection is a checking scheme. It gives us more information, information that we need. It is not substituted for by the identification of larvæ. The identification of larvæ is important in the beginning of mosquito work in a given locality, until we know that as a rule 999 times out of every thousand the mosquitoes found breeding in that water are economic species, and then we kill every bird we can find; the night collection method is a check up of the results of that killing and to indicate to us not only what those mosquitoes are—that is only a step—but possibly where they came from. Maybe we have gotten an invasion from another territory; maybe we have a large breeding place within the territory.

I point out a second occurrence within the County of Essex and the County of Union. There was a time that North Elizabeth and the Weequahic section of Essex was badly infested with *pipiens* for weeks on end, summer after summer, and nobody could more than guess at the cause. The area was a large sewage-charged piece of salt marsh and inspectors worked around it, and, perhaps in some cases, through it, although that was difficult, and the breeding was not found; but by a system of night collections, by tracing down increasing density, it was found that the heavy density was at the edge of that salt marsh, and within two days of that time we sent one of the inspectors into that territory and he found breeding in immense quantities.

Now there are two separate cases where the collection scheme has done the business. (Applause.)

MR. JACKSON—It is hardly necessary, Mr. President, to reply to our esteemed friend.

PRESIDENT MEYERS—Well, you will be heard in rebuttal.

MR. JACKSON—I have not raised the question of the feasibility of these collections in my brief. I can readily believe that if you are standing on the edge of a pond where wrigglers can be seen, and you are willing to wait until they mature and get on the wing and they are then taken by your night collectors, you no doubt will conclude and say they came from that pond. My idea is that if you now know that they came from that pond (through night collectors), you should have been able to destroy them before they got out, through inspection.

SECRETARY HEADLEE—Mine, too.

MR. JACKSON—Put your energy and your expense on ascertaining where these things *are* before they become a nuisance; do not wait until they become a pest and then try to find out where they come from, with the idea of applying a remedy against further escape, which remedies you should have applied to destroy the larvæ in the first instance.

That is the substance of my view, that where your remedy is going to be the same, in any event, whether you find them before they get out or after they get out, then I say you might as well apply it first and be done with it.

THURSDAY AFTERNOON SESSION.

(The meeting convened at 2:45 P. M., President Charles Lee Meyers presiding.)

PRESIDENT MEYERS—I have purposely delayed the meeting so as to give all the members a chance to get something to eat.

The next paper will be read by Mr. Joseph A. Le Prince, who needs no introduction to this audience, so I shan't make any remarks except to say that Mr. Le Prince is the man who, under Gorgas, cleaned up the mosquitoes in the Panama Canal Zone, and is now in charge of the anti-mosquito work of the United States Public Health Service.

I take pleasure introducing Mr. Le Prince, who will talk on

Interesting and Important Phases of the Anti-Mosquito Work of the United States Public Health Service.

MR. JOSEPH LE PRINCE—Mr. Chairman and Gentlemen: When we started to do our work in this country we thought we

were going to do *Anopheles* work only. We found out differently, so we are interested in mosquito extermination as well as you.

About eight years ago Congress made an annual appropriation of \$17,000 for malaria investigations in the United States. Scientific studies have been made of methods of control, habits of *Anopheles*, the collecting of statistics, etc., and the work is being continued.

During the past year one hundred and eighty communities in the malaria belt of our country were doing malaria control work, which cost about \$270,000. The studies and demonstrations extend southward from Virginia, Tennessee and Missouri, and during the present year Missouri and Southern Illinois will undertake *Anopheles* control. In the northern States we have numerous cases of "man made" mosquito nuisances, and in the southern states too much "man made malaria." Many engineering schools are interested in this matter and a recent inquiry showed that twelve out of forty technical schools are teaching the relation of *Anopheles* mosquitoes to engineering construction costs and to health conditions in areas where construction operations are under way. The schools of the South are more interested than those of the North, but the northern engineering schools should at least point out to the senior students the distressing conditions caused by certain changes of topography that we might properly term defective engineering. You may be interested to know that where federal funds are used for highway construction, it is now required that borrow pits, fills and culverts must not increase mosquito production.

Recently the state highway engineer of one state notified his assistants that if they can't arrange to prevent increasing mosquito production, that he can find somebody else who can. It is rather a step in advance when the prominent people of the country are taking much interest in mosquito control.

The St. Louis Southwestern Railway, which covers a large, rich territory from Missouri to Texas, has an efficient department of sanitation which has been concentrating on malaria control work since 1917, because it has found such a policy is sound and profitable business for a progressive railway system. The Central of Georgia Railway has started similar work, and the printed report of malaria control operations of the St. Louis Southwestern Railway is well worth reading.

Many railways should be more interested in mosquito control than they are, and those of you who are directing field operations will find interesting information in the pamphlet I have just referred to, published by the St. Louis Southwestern Railroad.

These railways are encouraging the communities along their lines to undertake and maintain mosquito elimination campaigns and the industries and the citizens as well as the railroads profit thereby. Those of us who are engaged in mosquito control operations have seen a vast change in public opinion in recent years. The public is becoming more convinced that the mosquito nuisance is preventable and unnecessary. The manager of a large firm manufacturing mosquito screening states that the industry is growing rapidly and that to-day the public is paying \$25,000,000 a year for screen in the roll. Unquestionably this indicates a strong desire on the part of citizens to keep the mosquito out of houses.

Assuming that half of this screening is for fly nuisance and the other half for mosquito nuisance, with money at 4 per cent., the public is paying interest on \$312,000,000 annually for a partial relief from pestiferous mosquitoes. This figure does not include the cost of installation of the screen wire. As far as *Anopheles* are concerned, it is safe to say that over 50 per cent. of the present screening against *Anopheles* is ineffective.

Wire that will keep out *Aedes sollicitans* will not keep out *Anopheles*. The screen work must be good to be effective.

There is no question about the public being willing to pay. The big question before us all is how to make the people desire more satisfactory and more permanent results at a lower cost to show them how to get more for their money.

In some towns and villages we have two problems: The *Anopheles* problem and the mosquito pest problem. Some years ago we thought that people in communities having a high malaria sick rate would be willing to undertake a strictly *Anopheles* control campaign because of its lower cost. Experience has indicated, however, that when malaria work is undertaken the public demands that considerable mosquito elimination accompany it, and unless the mosquito pest control is satisfactory, they lose interest in malaria reduction. The public pays the bill and is entitled to what it demands and is ready to pay for it.

We have had the same difficulties you have had in obtaining public consent and approval for supplying funds for this work.

Although the financial loss from malaria in the states of the malaria belt was known to be millions of dollars for each state annually, yet previous to 1914 all those states were taking no action. No state health department was attacking the malaria problem, although in some counties over 25 per cent. of the population was infected with malaria. You have your bad mosquito pest years, and to the south of your state they have their high

malaria sick rate years. Where statistics have been gathered it appears that the physician sees about one out of every five cases of malaria. In one state malaria reported by physicians ranges from 100,000 to 150,000 cases per year with from 500 to 1,000 deaths. The other cases are not recorded. I have been told in Ohio, as well as in New Jersey, that you have no malaria problem. That may be true, but you have a financial problem related to the states in the malaria belt. When we have a high malaria rate in the South we grow less and sell less, and we send smaller orders to the manufacturing centers of New Jersey, Ohio and other states, and less of our people come to your summer resorts to spend their money. This annual loss of millions of dollars affects the business interests, manufacturing interests and workmen of many of our states, whether in the malaria belt or out of it. This is a national problem.

During the past few years large progress has been made by the state health officers of the southern states. Some of them now have small but continuous appropriations used for malaria control. The children in the public schools are being taught the cause of malaria and the methods of prevention, and later will support the energetic health officers in solving the local health problems.

In Alabama the state health department is establishing all-time county health units. The full-time county health officer is directing *Anopheles* control measures in the towns and villages of his county, and as the farmers are taking up this work in rural areas, the outlook is decidedly favorable.

In towns and villages in many of the southern states malaria surveys are being made by the state health departments. Estimates of cost for drainage and mosquito control maintenance are made, and, when desired, the state health departments supervise operations during the first year. They do so in order that the work may be done correctly and economically, and also arrange for its maintenance by the proper local officials in succeeding years. During 1920 forty-five new communities undertook this work at a cost of \$155,000. During the war all the towns at southern cantonments undertook malaria control work to protect enlisted men from malaria, and most of them have continued it since. We knew, when war was declared, that with the same camp malaria infection as in the Spanish-American and Civil Wars, we should have lost over 5,000 enlisted men with malaria fever. The southern towns subscribed funds to get work under way at once and the results speak for themselves. There were

only thirty-one deaths from malaria with about 2,000,000 men in southern camps.

The work of mosquito control of stock ponds is being extended, and fish hatcheries (*Gambusia affinis*) are being established in or near many county seats. Large signs are being erected near these hatcheries to encourage the population to use the fish.

Yellow fever is yet present in the oil fields on the coastal plain of Mexico between Tampico and Vera Cruz, within thirty-six hours travel of the Texas border. The travel from Mexico to Texas is mostly through the border towns of Laredo and Brownsville. In those cities the wells, cisterns and water barrels are kept free from mosquito larvæ of the yellow fever mosquito by means of this same top minnow with satisfactory results.

Those of you who are interested in *Anopheles* control measures would probably find points of interest in the Proceedings of Malaria Field Workers, Bulletins 104 and 115, United States Public Health Service. Each year many malaria field workers meet with the Southern Medical Association and exchange ideas. The next meeting will be held at Chattanooga, Tennessee, in November, 1922. At the last conference an interesting paper on "Arsenic as a Larvicide for *Anopheles* Larvæ" was presented by Dr. M. A. Barber. It contained this formula: "One part of commercial Paris green thoroughly mixed with 100 parts by volume of road dust." This treated road dust is thrown into the air and carried by light air currents from twenty to forty feet.

As you go along a dusty country road if you get on the leeward side of a Ford as it goes by, you will find yourself sprinkled with dust. Well, it is merely the application of that principle. If in that dust we had 1 per cent. of Paris green you would also be sprinkled with the Paris green. The *Anopheles* larvæ take in the dust with the Paris green, apparently spit out the dust and retain the Paris green. This is just what we want them to do.

It should be applied on a sunny day after the dew is off the grass. With Paris green at 25 cents per pound, it costs about seven-tenths of a cent to treat 1,000 square feet of water surface, and is especially useful in wet places containing vegetation or other obstacles when such water bodies cannot be easily drained. By the barrel, Paris green costs 22 cents per pound. Six-tenths of a cubic inch of it with 100 times its value of road dust will treat about 1,000 square feet of grass-covered water surface. This treatment is non-poisonous to mosquito larvæ other than *Anopheles*, and does not harm fish or other aquatic life—it most certainly destroys *Anopheles* larvæ.

You will find a description of this Paris green as a larvicide and its use as a means of control of *Anopheles* larvæ in the public health reports, which you can get.

Here in New Jersey, with more population than we have in the South, of course you can get entire counties to take up work, but we have to work rather slowly and conservatively in the South, but we feel that when a town does good work, extends its radius of action because of the satisfaction with work in the town, and then the entire county gets sufficiently interested to have a survey made, with a view to having county-wide work done, we consider that successful for a sparsely-settled region.

It has not been easy for field workers to obtain reports of the progress that is being made in malaria control operations in other countries, but fortunately abstracts are now being made and included in Public Health Engineering Abstracts, U. S. Public Health Service, Washington, D. C.

One of the most successful of the recent malaria campaigns was conducted at Jacksonville, Cherokee County, Texas. The county medical association, the woman's club, the town authorities and business organizations gave their active support, and at the end of the first year's campaign, it was decided to extend control operations to a distance of nine miles beyond town limits. The county authorities became interested and an *Anopheles* survey was made of the county. At the present time, it is planned to extend the work over the entire county. Such work when carried out will have an important bearing on the rapid development of the coastal plain of Texas.

PRESIDENT MEYERS—Mr. Le Prince, in the information which you have given us with regard to the screen, it might be valuable if you have made any calculations as to the number of apertures per square inch that would keep out *Anopheles*.

MR. LE PRINCE—16 mesh is satisfactory. I understand that some of the manufacturers to-day are using a gauge of wire of larger diameter which reduces the size of openings in their 14 mesh to the same size as the 16 mesh, so we have got to be a little careful in specifying what size of wire, but the standard 16 mesh wire on the market is satisfactory for *Anopheles*.

The point I wanted to make was that the public in general, throughout the country, are under the impression that *Anopheles* has not half as much sense as we have and those of us working in the field know the *Anopheles* has a lot more sense than we have. Openings left under doors, screens broken, and openings in the floors give plenty of opportunity for *Anopheles* to enter

houses. Because other mosquitoes don't find the way in, many persons are under the impression the *Anopheles* do not, but they do. We can find them in the houses.

PRESIDENT MEYERS—That is very valuable information. Anybody who desires screens wants to know how many apertures to the square inch are necessary.

SECRETARY HEADLEE—May I ask the speaker what effect, if any, the Paris green had on the top-water minnow?

MR. LE PRINCE—The men in the field have looked for dead or sick minnows, I might say, for weeks after the application of the Paris green and can't find them. To date we have not been able to find any. Experimental work is being continued and if we find any we shall let everybody know right away.

PRESIDENT MEYERS—The next speaker has been coming to these conventions from year to year to speak to us and to add to our information the results of his department. No speaker who comes before us holds a warmer place in our hearts than Dr. L. O. Howard.

DR. L. O. HOWARD—Mr. President, Ladies and Gentlemen: One of Mr. Le Prince's closing remarks suggests to me that it is important to emphasize the fact that the common *Anopheles* are really partially domesticated animals; that is to say, having associated with man for so many years, *Anopheles* have learned his ways and have accommodated themselves to his environment. Although, as Mr. Le Prince says, the *Anopheles* are not sagacious, their instincts are developed to a point which almost reaches sagacity.

A Canadian newspaper man, writing about the warfare against insects, recently said that man, relying upon his intelligence, has made a mess of things in this world, and that if insects, with their sure instincts, are able to prosper as they do, man would better turn the world over to the insects. That is a pessimistic view, however, which I am sure we do not share.

Mr. Le Prince and I have attended your meetings for several years, but have never talked about the New Jersey mosquito problem. It seems that your own intense interest in mosquitoes here in New Jersey has been so great that it has made you interested in all mosquito work, but I am greatly pleased to see that Mr. Le Prince has brought out for the first time that the work that is going on in other parts of the country has an immediate practical importance for you here in this state. He has shown that the prevalence of malaria in the South reduces the

orders for machinery and supplies from your New Jersey factories, and that this same prevalence of malaria in the South reduces the attendance at your summer resorts of people from that region.

As to the paper which I am to present, Mr. Chairman, I have spoken to this association on several occasions about the work which the Bureau of Entomology is doing at Mound, Louisiana. This work is agricultural, economic and biological, and the idea is to find out what malaria costs the big plantations of the South, how it can be prevented, and thus save the enormous expense which it brings about.

I did not write the paper which I am about to present; it was drafted by Capt. D. L. Van Dine, who has charge of the work at Mound, and it deals with only one small aspect in the big problem which he is trying to handle. Captain Van Dine began this work before the war. When this country went into the war he volunteered his services and was put in charge of the sanitation of the large concentration camp at San Antonio, Texas—Camp Travis. There he worked hand in hand with Mr. Delaney, of this association, who had charge of the work of the public health service in the region, three miles wide, bordering the camp. After the troops left San Antonio, Captain Van Dine was transferred to New York where he was engaged in delousing the troops coming back from Europe. While he was absent from Mound the work there was not actively continued, but after the close of the war he returned and the work is now being prosecuted.

This particular paper is an abstract of a report on impounding the water in a large bayou to control the breeding of *Anopheles*.

Abstract of a Report on Impounding Water in a Bayou to Control Breeding of *Anopheles*.

D. L. VAN DINE,

Entomologist, Bureau of Entomology, U. S. Department of Agriculture.

The bureau of entomology has completed an investigation relating to the question of controlling the breeding of *Anopheles* mosquitoes in a bayou by clearing the vegetation and impounding the water. The work was located on Hecla plantation, at Mound, Madison Parish, northeast Louisiana. The following is an abstract of a report dealing with the natural conditions of the bayou

before the work was done and with the changed conditions brought about by the work. Special reference is made to the breeding of mosquitoes, and there is a discussion of the impounding of water in a bayou from the standpoint of plantation economy.

The bayous, or streams, of the delta region of the lower Mississippi valley are characteristic of those found in all delta accumulations. The bayous flow away from the main stream, the Mississippi river, and there is a gradual slope from their banks to the swamp lands that lie on either side. The bayous are not connected with the lakes peculiar to the region except at seasons of high water. There is a slight fall in the beds of these streams. The swamp areas and the channels of the bayous are attended by a rank growth of vegetation, consequent upon the fertile nature of the soil and the prevalent moisture which, with the resulting sediment and vegetable debris, promotes an ideal environment for the development of certain species of mosquitoes. The situation becomes increasingly emphasized by reason of the imperfect drainage. Among the mosquitoes *Anopheles* are found to thrive, and the disease which they convey is prevalent among the inhabitants of the region.

The roadways of the delta country follow the bayou banks wherever it is practical, as the ridges along these streams are higher than the surrounding lands. The land is cultivated under the negro tenant system, each tenant living upon the land assigned to him for cultivation. It is therefore logical to find the homes of the tenants on a roadway along the bayou, where one of these streams bounds or sections a property. The houses thus located are in the higher and more open portions of the plantation, and usually maximum distance from the swamp areas on either side. It is evident that such location of the habitations is favorable in respect to distance from the breeding areas of *Anopheles* mosquitoes, with the exception of the mosquitoes that originate in the bayou itself.

Of course, complete drainage is the logical method for the disposal of surface water in *Anopheles* control, where that method applies, but in the absence of a drainage outlet, and in the presence of surface water, favorable for breeding throughout the season, other means must be given local consideration. In any consideration of drainage in the delta it is necessary to note that the bayous flow away from the river, that the slope of the land is from the bayou banks towards the swamp areas on either side, and that the fall in the bed of the bayou averages less than one foot to the mile.



Fig. 1.



Fig. 2.

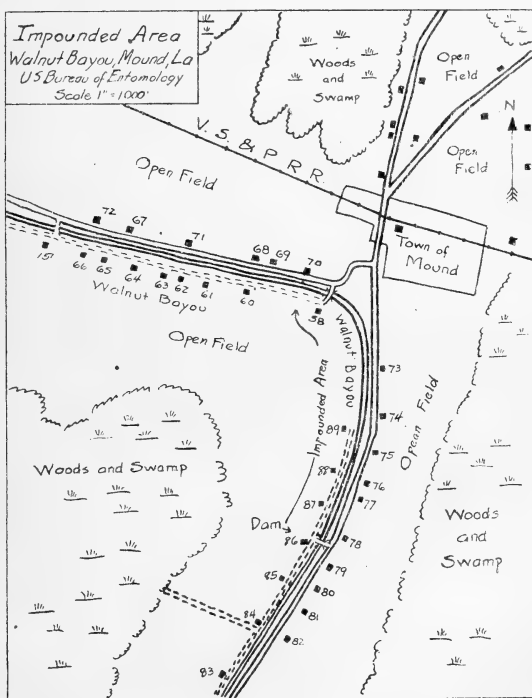


Fig. 3.



Fig. 4.

The idea of impounding water to suppress mosquito breeding is rather foreign to the general conception of the effect of impounded water upon mosquito production. The relation which impounded water will bear to mosquito production depends altogether upon the conditions under which the work is done and the changes brought about in comparison to the natural conditions. In the question of impounding water in a bayou we must consider the natural character of such a stream and the relation of the stream to the roadways of the plantation and to the habitations of the people who cultivate the land. The banks of the bayou are the logical location for the houses of the tenants, and it is important to control breeding of *Anopheles* in this nearby source. The bayou under natural conditions is productive of these mosquitoes, while the change from swamp-like to lake-like conditions does not favor such production. The change in conditions is brought about by the preliminary clearing of the vegetation and by the provision for a permanent level of water sufficiently high to suppress the growth of aquatic and semi-aquatic vegetation. Following these operations the maintenance of a clean margin is all important.



The work of the bureau on impounding water was done in a section of Bayou Walnut, which quarters the southwest portion of Hecla plantation. This bayou runs a very irregular course, the distance from the point of origin to its junction with a larger stream being in an air line only seven and one-half miles. However, the bayou travels in its course a total distance of thirty-one and one-half miles. The section of Bayou Walnut in its course through Hecla plantation is shown on Map I. The average fall of the bayou in this section is six-tenths of a foot to the mile.

During 1914, in the survey relating to *Anopheles* breeding in a bayou, it was observed that under natural conditions there was practically no breeding in certain restricted sections of the bayou where open water occurred, where the bed was free of vegetation, and the margins clean. On the other hand, breeding was found in those portions of the bayou where the margins were grass-grown or supported a growth of overhanging trees and vines; where the water surface was covered with the resulting vegetable debris or "floatage"; where the water was shallow enough to permit the growth of aquatic vegetation in the bed of the stream; where the channel was blocked by brush, trees, logs and stumps; or where the bed was partially dry, thus permitting isolated pools, and water in the hoof-prints of animals and in mud-cracks, which were maintained by summer rains. The more typical conditions of a natural bayou are shown in figures 1 to 4.

The collections of *Anopheles* larvæ in the general survey work during the years 1914 and 1915 indicated general breeding throughout the course of the bayou under natural conditions, including the portion of the stream which was later cleared and in which the water was impounded.

The distance covered in the impounding experiment was 1,600 yards, nearly a mile. The plants collected from this section of the bayou, before clearing and impounding the water, are listed in Table I. The plant determinations were made by the bureau of plant industry of this department.

A survey of the fish of this region was made by the U. S. Bureau of Fisheries in co-operation with this work. This survey was intended to cover the distribution of the top-minnow, *Gambusia affinis*, in this region; the possible presence of other fish useful in mosquito destruction; the presence or absence of fish valuable as food in the deeper and permanent areas of water; the survival of *Gambusia* in the impounded area in Bayou Walnut; and the possibility of establishing in the impounded area fish that would be of value for food to the tenants on the plantation. This work was accomplished by Mr. F. M. Barnes, of the U. S. Bureau of Fisheries, during 1916 and the early part of 1917.



Fig. 5.



Fig. 6.



Fig. 7.



Fig. 8.

TABLE I.

PLANTS FROM BAYOU WALNUT, 1915.

Species.	Common Name.	Location.
<i>Spirogyra</i> sp.,	Algæ,	Submerged.
<i>Lemna valdiviana</i> ,	<i>Lemna</i>	
<i>gibba</i> , <i>Spirodela polyrhiza</i>		
and <i>Wolffia columbiana</i> , ...	Duckweed,	Floating on water.
<i>Jussiaea diffusa</i> ,	Aquatic plant,	In water, roots in bed.
<i>Zizaniopsis miliacea</i> ,	Aquatic grass,	In water, roots in bed.
<i>Cephalanthus occidentalis</i> , ...	Button-ball,	In water, along margin.
<i>Salix nigra</i> ,	Swamp willow,	Margin, overhanging.
<i>Bignonia radicans</i> ,	Trumpet-creeper, ...	Margin, overhanging.
<i>Brunnchia cwrhosa</i> ,	Vine,	Margin, overhanging.
<i>Persicaria opelusana</i> ,	Smartweed,	Margin.
<i>Phytolacca americana</i> ,	Pokeberry,	Margin.
<i>Echinochloa colona</i> ,	Cockspur-grass,	Margin.
<i>Asclepias perennis</i> ,	Milkweed,	Margin.
<i>Ampelopsis arborea</i> ,	Shrub,	Margin.
<i>Euphorbiaceae</i> ,	Spurge,	Margin

A point of special interest in connection with the natural conditions of the bayou is the fact that the top-minnow, *Gambusia affinis*, is found in connection with general breeding of *Anopheles*. The breeding of these mosquitoes in the presence of comparatively large numbers of this minnow is accounted for by reason of the protection afforded the mosquito larvæ by the aquatic and marginal vegetation and the vegetable debris upon the surface of the water. Further, the bayou under natural conditions is partially dry at certain seasons of the year, and in these dry sections there are isolated pools, mud-cracks and hoof-prints of animals, which become filled with water by the rains, and to which these fish do not have access.

A comparison between the numbers of *Gambusia* in the natural bayou and in all other places shows an average of 25 specimens in the bayou for each collection and an average of 63 per collection for all other classes of surface water. These figures indicate that these little fish are very abundant and very generally distributed in the region. The larger numbers for all classes of water, as compared with the natural bayou, is explained by the fact that certain collections in the general survey were made at the season of the year when the surface water was at a low stage, which found these fish highly concentrated in some localities.

The clearing of the bayou was done during August, 1915. It was accomplished at that time of the year for the reasons that the water in the stream was at its lowest level for the season and the

plantation had finished its cultivation of the crops but had not as yet begun to harvest, giving a supply of labor for the work without interference with the plantation operations. The smaller undergrowth was removed first, piled along the banks and burned when sufficiently dry. The trees, logs and stumps were then removed and placed upon the banks in suitable lengths for hauling away for use as firewood. In many instances the roots of the larger trees and old snags could not be removed without an amount of effort which would have added greatly to the cost of the work. These were sawed off even with the bank or bed of the bayou and allowed to remain. They might have been removed rather cheaply by the use of dynamite had the facilities for that work been available.

The height of the water, at the dam required to raise the water to a reasonable depth over the section of the bayou to be impounded was gained by running levels along the banks above the site of the dam. The dam was constructed to give a depth of four feet ten inches at the floor of the spillway. When one recalls that the fall in this section averages only six-tenths of a foot to the mile, it is seen that the level at the dam was carried back over the course of the stream for a considerable distance with only a slight variation in depth. The completed dam, with bridge over the spillway, provides a roadway to the section of the plantation lying on the opposite side of the bayou. The fill and spillway of the dam are shown in figures 5 and 6. After completion of the dam, at the onset of winter rains, the water began backing up over the bed of the bayou. Following this first rise quite an amount of debris was floated to the surface, and, as the height of the water level increased, this floating material collected along the margins. This was cleaned out with rakes and burned.

The only maintenance work, in so far as vegetation is concerned, was the clearing of the floatage along the banks following the first rise of water over the bed and cutting back a comparatively small amount of second growth, mostly willow shoots and grass, *Zizaniopsis miliacea*, that found their way to the surface of the water the following spring. These shoots were removed by the use of a boat and a curved knife on a long handle. Maintenance work has been required by reason of the work of crawfish, *Cambarus* sp., about the spillway in the dam, and this difficulty, as well as the effect of the work of the crawfish on the water level above the dam, and in turn the effect of the change in water level on the marginal vegetation, will be discussed later in the report.

A comparison of the *Anopheles* breeding in the impounded area and in the natural bayou is shown by the collections in the general survey work for the years 1916 and 1917. From these collections it is seen that *Anopheles* breeding is confined to the section of the bayou below the dam and to the backwater above the impounded zone. No specimens were collected in the general survey work in the impounded area proper. The section of the bayou above the impounded area was clear for a distance of about a half mile, and the backwater gave favorable conditions for non-breeding in this distance with the exception of a limited area just above the impounded zone, where a ridge crosses the bed of the bayou and where the aquatic grass, *Zizaniopsis miliacea*, persisted. The maximum depth where this grass survived was about one foot. Below this point to the dam, a distance of nearly a mile, an average depth of three and one-half feet was maintained, which was sufficient to suppress this grass as well as all other vegetation in the channel of the bayou. Other *Anopheles* breeding found above the impounded zone was some distance above the growth of grass mentioned, among willows and other vegetation characteristic of natural bayou conditions.

The survey of the fish in the impounded area in Bayou Walnut shows that the top-minnow, *Gambusia affinis*, finds no difficulty in establishing itself under the conditions of deeper and open water. The fish collections in this water also show that the larger fish of the region, those of value for food, have found their way to the impounded area in some numbers. The most valuable of these are the crappie or "white perch," *Pomoxis annularis*; the calico bass, *Pomoxis sparoides*; the large-mouth black bass or "trout," *Micropterus salmoides*, and the warmouth bass or "goggle-eye," *Chaenobryttus gulosus*. These game fish are largely predacious, and, of course, take their toll from the *Gambusia*, but this feeding of these larger fish upon the little top-minnows must not be view so much in the light of the reduction of the mosquito-eating minnows as from the standpoint that the patrol work which they do serves to keep the little fish in the shallow water along the margins. In the open water of the impounded area there is no mosquito breeding, and since the salvation of the little fish depends upon their remaining along the margins to escape the larger fish, the value of the larger fish as an indirect aid in the mosquito control is seen.

There was an average of 14 specimens of *Gambusia* taken in each collection in the fish survey of the impounded water. In these collections, taken in comparison with the collections from

the natural bayou and from all other classes of surface water, we must consider the effect of great dilution. It is sufficient for the practical results of the work to note that *Gambusia* survived the effect of impounding in important numbers, and that the presence of the game fish in the area serves the purpose of keeping them along the margins where they are useful in the marginal control of mosquito breeding.

The non-breeding of the *Anopheles* in the impounded water is due to a number of factors which have not as yet been definitely measured. In general, as has been stated, the important difference between the impounded section of the bayou and the natural bayou is just the difference between lake-like conditions which do not favor the development of *Anopheles* and swamp-like conditions which do favor such development. The lake-like conditions of the impounded section are shown in figures 7 and 8. The factors which are considered to operate against mosquito development in the impounded water are the greater freedom for action on the part of the predators, the fish and the aquatic insects; wave action; depth of water which influences the temperature; absence of the vegetable shelter along the bayou which operates against the concentration of adults and consequent oviposition; and the depletion of the larval food of *Anopheles* furnished by the decaying vegetation and the low forms of aquatic life, both plant and animal, common to the swamp-like conditions of the natural bayou.

The work of maintenance at the dam due to the action of the crawfish has been mentioned. The crawfish burrowed through the fill below the level of the water above the dam to the lower side of the fill. This injury occurred about the boxing of the spillway. The action of the water through these openings in carrying away the dirt of the fill caused serious leakage which resulted in a decided lower level of the water above the dam. In several instances the level of the bayou was lowered materially before proper repairs in the dam were made. This damage was not serious the first year following the completion of the dam but during the following years, up to 1920, considerable expense was involved in preventing the leakage in the dam due to the work of the crawfish. In 1920 a double course of sheet piling with overlapping joints was driven below the fill, leaving an opening for the spillway, the boxing of which was carried through and over the sheet piling. This served to prevent the crawfish working to the outside, below the fill, and to hold the water above the dam at a permanent level.

An important biological observation was made in connection with the variable water level caused by the leakage in the dam due to the crawfish. It was found that when the water was lowered, after remaining at one level for a period, the water found a clean edge free from debris and grass and, further, that the drying out above the new level served to destroy the aquatic and semi-aquatic vegetation that had gained a foothold. Then when the leakage had been repaired and the water level raised to its original height, it rested against comparatively clean margins. The growth of marginal vegetation was thus discouraged by this variable water level which explains the lack of any maintenance work on marginal control in the impounded area. Thus was the expense in the maintenance work on the dam offset in part by the saving in the work on the margin.

The experience with the crawfish suggests two improvements to be considered in any further work on impounding water in a bayou in this region. The first point is the prevention of injury to the fill in the dam on the part of crawfish. This can be accomplished by a core-wall extending below and to each side of the spillway box in the center of the fill. The second point is provision for controlling the water level above the dam. The object of this is to make use of the effect of a variable water level on the marginal vegetation and marginal mosquito breeding. This is obtained by a change in the height of the water from time to time which can be accomplished by a sluice-way through the fill below the level of the floor of the spillway. The flow of water through the sluice-way can be controlled by a gate. If the sluice-way is placed at the level of the bed of the bayou, in the center of the fill, it would act efficiently in lowering or raising the water level above the dam, and, also, the current of water through the sluice-way at this point, would flush out and away the mud and sediment that tends to accumulate in the bed of the bayou immediately back of the fill.

Advantages of the plantation from the impounding work, apart from the control of *Anopheles* breeding in a nearby source of these mosquitoes, are a permanent supply of good water for live-stock during the dry season; and extension of the land available for pasture and the pasturing; in turn, aiding in the suppression of vegetation along the stream; the deeper and more extensive water of the impounded area offers a favorable place for game fish and thus furnishes a source of food for the tenants; and the lake-like body of water offers recreation to the plantation people and adds to the attractiveness and the value of the property.

The writer wishes to acknowledge his indebtedness to Mr. George S. Yerger, owner of Hecla plantation, for his interest and co-operation in the work; to Mr. Alexander Clark, manager of Hecla plantation, for the supervision of the work of clearing the bayou and the construction of the cross-levee and spillway of the dam; to Mr. Haw Kirkpatrick for the photographic work in connection with the project; to Dr. R. E. Coker, Dr. A. F. Shira and Mr. F. M. Barnes, of the U. S. Bureau of Fisheries, for the co-operative work on fish; to the U. S. Bureau of Plant Industry for the plant determinations; to the U. S. Geological Survey for the topographical maps of the region; and to Messrs: H. H. Kimball, A. H. Jennings, E. Foster and F. H. O'Neill, formerly of this bureau, for assistance in the survey work.

MR. GIES—I would like to ask Dr. Howard how often the water was raised and lowered in the impounded area and the amount of drawing off or raising of the level of the water which was done.

DR. HOWARD—I am sorry I cannot answer that question.

SECRETARY HEADLEE—Mr. Chairman, I would like to bring to the attention of the men that at Lake Carnegie, near Princeton, in the course of some anti-malarial work, this scheme of lowering the level of the lake was tried, I think about five years ago, and the results are just as Dr. Howard describes it for this impounded bayou in the South.

As most of those things are, it was discovered by accident. It happened that along about the time the students left the university, someone removed a board in the dam and dropped the water level one foot and exposed a smooth, clean beach all around the entire lake which is rather large and the shore mosquito breeding was cut out by that completely.

PRESIDENT MEYERS—We will now go into the business meeting of the association. I will call for the report of the secretary.

Report of the Secretary.

SECRETARY HEADLEE—Mr. President and Gentlemen of the New Jersey Mosquito Extermination Association, your secretary has, with the aid of the assistant secretary, edited the pro-

ceedings of the last annual meeting and caused them to be printed and distributed. Fifteen hundred copies were printed and distributed as follows:

Atlantic County Mosquito Extermination Commission,	150 copies
Bergen County Mosquito Extermination Commission,	150 copies
Cape May County Mosquito Extermination Commission,	100 copies
Essex County Mosquito Extermination Commission,	200 copies
Hudson County Mosquito Extermination Commission,	200 copies
Middlesex County Mosquito Extermination Commission,	85 copies
Monmouth County Mosquito Extermination Commission,	85 copies
Ocean County Mosquito Extermination Commission,	100 copies
Passaic County Mosquito Extermination Commission,	100 copies
Union County Mosquito Extermination Commission,	150 copies
Office of the Secretary,	180 copies
	1500 copies

He has collected and caused to be bound 22 additional sets of the first seven annual proceedings, making a total of 70 bound copies. On authorization of the executive committee the following distribution of the bound volumes has been made: one to each of the ten active mosquito extermination commissions, one to each officer, past presidents and executive officers, one copy to Dr. Frederick L. Hoffman, Dr. Jacob G. Lipman, J. A. Le Prince, Dr. L. O. Howard, Alfred Gaskill, the Philadelphia Board of Health, New Jersey Historical Society, U. S. National Museum, Societies of Red Cross of Switzerland, Princeton Library, Rutgers College Library, N. J. Experiment Station Library, Entomological Department Library, Newark Public Library, Jersey City Public Library and Atlantic City Public Library, leaving a balance of 29 copies.

He had made the necessary preparations for the present annual meeting, including the securing of speakers, arrangements for the place of meeting, the printing of the program, etc.

Respectfully submitted,
 THOMAS J. HEADLEE,
Secretary.

PRESIDENT MEYERS—The report of the secretary will be received and filed.

We will now listen to the treasurer's report.

Report of the Treasurer.

July 27, 1921, to February 28, 1922.

RECEIPTS.

1921.		
July 27.	From Thomas J. Headlee, retiring Treasurer,	\$107 60
Aug. 13.	Hudson County Commission, assessment,	138 00

Sep. 7.	Bergen County Commission, assessment,	\$125 00
7.	Union County Commission, assessment,	125 00
8.	Essex County Commission, assessment,	138 00
16.	Ocean County Commission, assessment,	75 00
16.	Atlantic County Commission, assessment,	125 00
Oct. 19.	Cape May County Commission, assessment,	70 00
31.	Passaic County Commission, assessment,	75 00
Dec. 8.	Monmouth County Commission, assessment,	50 00
31.	Interest on deposits October/December,	1 91
1922.		
Feb. 17.	Middlesex County Commission, assessment,	50 00
23.	Interest on deposits, January,	66
	Total Receipts,	<u>\$1,081 17</u>

DISBURSEMENTS.

1921.		
Aug. 20.	Margaret L. Schlosser, V. No. 1, clerical assistance copying proceedings eighth annual convention, 9 ds., at \$3.00,	\$27 00
20.	The E. E. Morris Printing Co., V. No. 2, printing 50 index sheets for bound volumes of proceedings of the first seven annual conventions,	12 00
Oct. 11.	The E. E. Morris Printing Co., V. No. 3, printing 1,000 letter heads,	8 00
11.	Wilbur M. Walden, Asst. Sec., V. No. 4, postage sending out 22 bound volumes of proceedings,	3 00
Dec. 6.	The E. E. Morris Printing Co., V. No. 5, printing 50 index sheets (2d lot) for bound volumes of proceedings,	12 00
19.	John C. Sheller, V. No. 6, binding proceedings of the first seven annual conventions, 22 volumes, at \$2.80,	61 60
19.	Wilbur M. Walden, Asst. Sec., V. No. 7, materials used in mounting geologic map of New Jersey for use at next annual convention,	8 53
1922.		
Feb. 3.	William Keib, V. No. 8, 8 hrs. services reading proof of the proceedings of the eighth annual convention, at 50 cents,	4 00
17.	W. R. Reed, V. No. 9, furnishing mimeograph paper and envelopes to secretary,	13 30
17.	Wilbur M. Walden, Asst. Sec., V. No. 10, 400 two-cent stamps used in sending tentative programs and invitations to freeholders, boards of health, chambers of commerce, etc.; 2,100 one-cent stamps to be used in sending out programs to members of association,	29 00
		<u>178 43</u>
	Balance March 1, 1922,	\$902 74

Accounts Receivable—None.

Bills Payable—None.

I, Abram H. Cornish, chairman of the auditing committee of the New Jersey Mosquito Extermination Association, do hereby certify that the receipts and expenditures, the bank deposits and checks have been properly examined to date and found correct.

ABRAM H. CORNISH,
Chairman, Auditing Committee.

March 2, 1922.

PRESIDENT MEYERS—If there is no objection, the report will be received and filed.

We will have next the report of the executive committee.

Report of the Executive Committee.

SECRETARY HEADLEE—Mr. President and Gentlemen of the New Jersey Mosquito Extermination Association, your executive committee has held two meetings, the first being at the Carteret Club, in Jersey City, and the second being at the Hamilton Club, in Paterson.

At the Jersey City meeting the printing of fifteen hundred copies of the 8th annual meeting was ordered and their distribution specified as follows:

Atlantic County Mosquito Extermination Commission,	150 copies
Bergen County Mosquito Extermination Commission,	150 copies
Cape May County Mosquito Extermination Commission,	100 copies
Essex County Mosquito Extermination Commission,	200 copies
Hudson County Mosquito Extermination Commission,	200 copies
Middlesex County Mosquito Extermination Commission,	85 copies
Monmouth County Mosquito Extermination Commission,	85 copies
Ocean County Mosquito Extermination Commission,	100 copies
Passaic County Mosquito Extermination Commission,	100 copies
Union County Mosquito Extermination Commission,	150 copies
Office of the Secretary,	180 copies
	<hr/>
	1500 copies

Assessments were ordered as follows:

Atlantic County Mosquito Extermination Commission,	\$125 00
Bergen County Mosquito Extermination Commission,	125 00
Cape May County Mosquito Extermination Commission,	70 00
Essex County Mosquito Extermination Commission,	138 00
Hudson County Mosquito Extermination Commission,	138 00
Middlesex County Mosquito Extermination Commission,	50 00
Monmouth County Mosquito Extermination Commission,	50 00
Ocean County Mosquito Extermination Commission,	75 00
Passaic County Mosquito Extermination Commission,	75 00
Union County Mosquito Extermination Commission,	125 00

The committee adopted the plan of having the treasurer pay all bills when the same were submitted to him on voucher approved first by the person contracting for the work done and secondly by the president.

The committee endorsed the idea of a moving picture form of publicity and instructed the secretary to obtain full information on costs and report at the next meeting. It also authorized the secretary, in the event of the possibility of having a picture made without charge to the association or the mosquito commissions, to act with power.

The committee endorsed the mosquito manual and recommended the same to the various mosquito commissions as worthy of their consideration.

The committee decided that preliminary to any other action in the matter of the suggested bond issue, a publicity campaign be undertaken through the above-mentioned film and manual.

The committee instructed the secretary to send a letter to each commission asking them to appoint a member for the committee on mechanical means of drainage and maintenance of the salt marsh as proposed at the last convention.

It ordered the printing of 1,000 letterheads.

It instructed the secretary to distribute bound volumes of the proceedings as follows: one to each of the ten active mosquito extermination commissions, one to each officer, past president, and executive officers, one copy to Dr. Frederick L. Hoffman, Dr. Jacob G. Lipman, Dr. L. O. Howard, J. A. Le Prince, Alfred Gaskill, The Philadelphia Board of Health, New Jersey Historical Society, U. S. National Museum, Societies of Red Cross of Switzerland, Princeton University Library, Rutgers College Library, N. J. Experiment Station Library, Entomological Department Library, Newark Public Library, Jersey City Public Library and Atlantic City Public Library. It further instructed the secretary, in view of the extreme importance of additional bound copies for future use to secure as many complete additional sets as possible and have them bound.

The committee authorized the secretary to prepare a program for the coming meeting but laid the time and place of the convention over until the next meeting.

The committee authorized the treasurer to open a checking account with the New Jersey Title Guarantee and Trust Company, Bergen Branch, in Jersey City, N. J., and further authorized the treasurer to sign all checks withdrawing funds from the said account.

In the meeting held at Paterson the committee examined the moving picture film entitled "Warfare Against the Mosquito in New Jersey," which was prepared on the authority delegated by the committee at its meeting in Jersey City.

The committee heard the report of the treasurer in the course of which it was shown that all the assessments, other than the one from Middlesex, had been collected and that disbursements to the amount of \$132.13 had taken place.

The tentative program presented by the secretary was considered, modified and accepted, and the secretary was instructed to go ahead with the preparation of the final program. The

Hotel Chalfonte at Atlantic City was selected as the place for the ninth annual meeting and the dates of March 1st to 3d inclusive were adopted.

The secretary reported that all orders for the mosquito manual had been received from the mosquito commissions and that a total of 119,000 would be printed at a cost of two cents a copy. The secretary also reported that the State Commissioner of Education Enright had written a formal endorsement, which would be sent to each county and city superintendent of schools.

The committee endorsed the mosquito film and recommended it to the mosquito commissions for earnest consideration.

The secretary was instructed to investigate the status of feeling among the women's clubs toward the mosquito problem and to report when, in his judgment, the time had arrived for the formation of a women's organization to push the anti-mosquito work.

The committee requested Mr. Reid Howell to see what could be done toward interesting the freeholders' association of the state in the problem of anti-mosquito work.

Respectfully submitted,

THOMAS J. HEADLEE,
Secretary.

PRESIDENT MEYERS—If there are no corrections or amendments, the report will be received and filed.

The report of the associated executives will now be read.

Report of the Associated Executives of Mosquito Control in New Jersey.

SECRETARY HEADLEE—Mr. President and gentlemen of the New Jersey Mosquito Extermination Association, the organization of associated executives, which had existed unofficially for several years previous to the last annual meeting of the New Jersey Mosquito Extermination Association, was at that convention recognized and through resolution recommended to the different mosquito commissions as an agency for anti-mosquito work worthy of support. All mosquito commissions, except Cape May, have accepted the word of the association and provided the necessary travelling expenses for their executive representative. The meetings have been held regularly once a month and certain definite lines of endeavor have been undertaken. Two of these lines are now well along, and the results are ready for submission to the association. Both are concerned with publicity.

The first is a mosquito manual, which is a simple, short state-

ment of the New Jersey mosquito problem and of the means taken to solve it. This manual is intended for use by pupils in the eighth grade and in the four years of the high school. It is recommended by the state commissioner of education to the county and city superintendents of schools for inclusion as a regular part of their course in biology. The executives, in considering this matter, felt that this form of publicity would reach the young people who are soon to become citizens, and would tend to form in their minds the proper conception of the mosquito problem. Many difficulties had to be overcome in the preparation of this manual. It was first necessary to get it written in a way which would be easily understood, and at the same time sufficiently informing to insure that the pupil should get the right conception. After it was written it then became necessary to find a publisher. Finally the New Jersey Agricultural Experiment Station agreed to publish the manual and to take 30,000 copies for its own use, provided the mosquito commissions would purchase from the printer the copies necessary for the school children in the counties where they are working. The plan of distribution of the manual involved the idea of making it the property of the public schools, in order that it might not quickly be thrown away and disappear. This idea seemed very welcome to the State Department of Education, and is the one which has been adopted. All active mosquito commissions have now ordered a sufficient supply of the manual for the school children of the grades mentioned within their counties, and the Experiment Station has ordered 30,000 copies. The total number of copies printed is 119,000. Samples of the manual have been brought to the convention and are available to any or all of you for examination. The manual is now ready for distribution.

The second effort was the making of a moving picture of the need for, the work of and the results of anti-mosquito work. The principal problem here was the question of finance, because a considerable sum of money was obviously necessary to have such a picture made. The associated executives, through the agency of Mr. Albert St. Peter, found a public-spirited citizen, Mr. Arthur T. Dear, of Jersey City, who was willing to undertake this proposition as a private venture. The plan finally settled on included the right of the mosquito commissions and the Agricultural Experiment Station to purchase it, if they so desired, at a cost of $6\frac{1}{2}$ cents per foot. The photographer and the materials were to be furnished by Mr. Dear, and the associated executives were to prepare the scenes and furnish transportation to the photographer to the points where they would be taken. The associated executives were also to furnish the oversight of the

arrangements of the pictures and of the titles. Mr. Wilbur M. Walden was designated by the associated executives as the man to select the scenes and to furnish the transportation, being promised, wherever necessary, help by the executive in whose county the scene was being taken. The picture has now been completed and was the one just shown. It was the thought of the associated executives that the moving picture would appeal to all ages of people, and through the medium of the moving picture houses in general should carry the information to three-fourths of the people of the state.

In addition to these projects that are now well under way, the associated executives are working upon the problem of standardizing and improving the methods of salt marsh drainage, and also upon the problem of standardizing mosquito control statistics.

Respectfully submitted,
 THOMAS J. HEADLEE,
Secretary.

PRESIDENT MEYERS—The report will stand approved as read, if there are no objections.

The Committee on Resolutions will now report.

Report of the Committee on Resolutions.

Your Committee on Resolutions reports to the ninth annual meeting of the New Jersey Mosquito Extermination Association held at Atlantic City, N. J., March 1-3, 1922, that it recommends the following:

1. WHEREAS, Since the last meeting of this association Mr. Howard B. Vannote, president of the Bergen County Mosquito Extermination Commission, has passed away; and

WHEREAS, Mr. Vannote was a pioneer in mosquito work in this state, a member of this association, and one of the most interested, competent and tireless anti-mosquito workers we have ever had;

Therefore, be it resolved, That this association express its sorrow in the loss of Mr. Vannote and its appreciation for the many years of loyal service and patient endeavor that Mr. Vannote gave to make mosquito control a reality in New Jersey.

2. That we make known to the management of the Hotel Chalfonte our sincere appreciation of the manner in which we have been received an entertained and to their employees for their courtesy.

3. That we appreciate the faithful efforts put forth during the past year by our officers and committees, and we are sure that by reason of their work the cause for which we have been striving has been greatly advanced.

4. We are more than ever convinced that the mosquito can be practically exterminated, and municipalities of this state are perfectly justified in the expenditures of money for this object.

5. We heartily commend the work of the State Experiment Station and appreciate the faithfulness of Dr. Lipman and Dr. Headlee in their tireless assistance to us.

6. That we extend our thanks to Dr. L. O. Howard, Chief of Bureau of Entomology, U. S. Dept. of Agriculture; Dr. Thos. J. Headlee, Executive

Officer in charge of mosquito work of the N. J. Agricultural Experiment Station; W. H. DeMott, Chief Inspector, Nassau County Mosquito Commission; Eugene Winship, Sanitary Engineer, of New York City Dept. of Health; Mrs. Peter C. Olsen, President of Women's Club, Perth Amboy; Mrs. E. H. Boynton, Middlesex County Mosquito Extermination Commission; Edward W. Jackson, Essex County Park Commission; Joseph A. Le Prince, Senior Sanitary Engineer, U. S. Public Health Service; Peter H. Woodward, General Passenger Agent, Long Island Railroad Company; Samuel T. Sealey, Assistant Entomologist, Connecticut Agricultural Experiment Station, and all others who have participated in our meeting and have brought before us the result of their investigations, and who by reason of the presence and co-operation have made us more than ever determined to continue our work.

PRESIDENT MEYERS—The report will be accepted and filed.

The nominating committee has given me this report which I will read.

Report of the Nominating Committee.

For President—WILFRID A. MANCHEE.

For First Vice-President—W. H. RANDOLPH.

For Second Vice-President—DR. JULIUS WAY.

For Secretary—THOMAS J. HEADLEE.

For Asst. Secretary—WILBUR M. WALDEN.

For Treasurer—LEWIS E. JACKSON.

Executive Committee—

CHARLES LEE MEYERS,
ANDREW J. RIDER,
ROBERT F. ENGLE,
REID HOWELL,
WILLIAM E. DARNALL,
BERTHA H. BOYNTON,
WALTER R. HUDSON.

PRESIDENT MEYERS—Are there any other nominations? If not, a motion to have the nominations closed is in order.

MR. LEWIS E. JACKSON—I move the nominations be closed and that the secretary cast a ballot.

PRESIDENT MEYERS—You have heard the motion, gentlemen, what is your pleasure? All in favor, signify by saying, "aye"; contrary minded, "no." The motion is carried and the secretary will cast the ballot.

The meeting will now adjourn to Vernon Hall across the street, where a moving picture will be shown. It is entitled "Warfare Against the Mosquito in New Jersey" and has been prepared by the Associated Executives of Mosquito Control in New Jersey.

(The members assembled in Vernon Hall and the moving picture was screened.)

THURSDAY EVENING SESSION.

(The meeting convened at 8:15 P. M., President Charles Lee Meyers presiding.)

PRESIDENT MEYERS—The meeting will please come to order. The first paper at this session will be read by Mr. Peter H. Woodward, General Passenger Agent of the Long Island Railroad Company, who has been very much interested in mosquito control. The same problem we have had is his problem in Suffolk and Nassau Counties, Long Island.

I take great pleasure in introducing Mr. Woodward who will speak on

The Value of Mosquito Extermination Measured in Dollars and Cents.

MR. WOODWARD—Mr. President and Gentlemen: It is quite an honor for a railroad man to be allowed in such a circle as this circle of experts and crusaders, I will say; in other words, a council where you plan for war.

The magnitude of the work done by the New Jersey commissions and the work they are doing is a great revelation to me because I am unacquainted with what you are doing. I have lived on Long Island a good many years and have always thought it was a necessary part of living to be pestered by mosquitoes. I didn't know, however, until the other day that in Suffolk County where I live we had the king stinger and the king bee of all these different kinds of mosquitoes I have heard of. I learned that from one of your own associates, Mr. Dobbins, of Essex County. He told me that out in Suffolk County the other day and I believe it.

The paper that I have prepared is very simple and will hardly be interesting, I am afraid, to most of you, because you are experts and technically interested, but it is from the standpoint of dollars and cents, as I put it. That is the view that I am taking of it, as a passenger traffic official of the railroad; and this is what I prepared in connection with this meeting.

The medical profession, the skilled drainage engineers and experienced commissioners from various counties in New Jersey and neighboring states, will tell the members of this association of the wonderful results from their work in the extermination of the mosquito. They will dwell on the work from the standpoint of health and general happiness.

Malaria and kindred diseases disappear, and the coast towns that depend on happy and contented summer boarders thrive and smile when they compare present comforts with the days of the past, when mosquito was king. The county commissioners and engineers are proud of their skill and their achievements in digging trenches, ditches, etc. Naturally the keenest kind of competition has sprung up among the various counties of New Jersey, to see which county organization can do the most effective work with the least money.

A passenger traffic official on the only railroad serving a territory almost as big and with more coast line than New Jersey, quite naturally looks at the mosquito question from a dollar and cents standpoint.

In New Jersey you have 21 counties, and I understand that more than half are now controlled by a mandatory law. On Long Island, we have only two counties, outside of Greater New York. One of them—Nassau—has been operating under such a law since 1916. The annual tax levy is limited to a maximum of three-eighths of a mill on each dollar of assessed valuation. Our other county—Suffolk—is still outside of the up-to-date methods employed by Nassau and the dozen or more counties over here in Jersey. The legislators from Suffolk insist on looking at such a law as a tax burden, when, as a matter of fact, it is a money raiser for the county.

The railroad company I represent is the largest taxpayer in the county. We are willing to go along and take our chances, because if the mosquitoes can be exterminated along the water fronts, the increase in summer residents, building of summer homes, etc., will increase the assessed valuation to such an extent as to keep down the taxes to the farmer, the railroad and the local voting population.

In Nassau County the amount of money spent by the commission in 1916 was \$44,000. In 1921 it was \$69,000, and the most wonderful results have been obtained. Nassau County residents are proud of their mosquito commissioners, and if anyone should suggest a repeal of the law, they would surely get into trouble. However, so long as the neighboring county is making no efforts to drain the breeding places in that county, Nassau gets swarms of mosquitoes from that quarter and this will continue to be the case until Suffolk County enacts such a law.

We have every reason to believe that such a law will be enacted at this present session of the legislature. Our senator and assemblymen are slowly being converted. They have been

shown that with an assessed valuation of \$125,000,000 the maximum expense when limited to three-eighths of a mill per dollar of valuation could not exceed \$48,000 per year. They have been shown that the cost to the farmer cannot exceed \$1.87 on \$5,000 valuation. They have been shown that the *expenses* of the county are not affected by the summer residents, that is, they are just as much whether one or one thousand summer residents come to that county. However, the summer resident *pays* a large part of the taxes, and the elimination of the mosquitoes will improve and enhance the value of his property. Many more people from the cities will come to the sea-shore resorts and build homes if the pest is gotten rid of. Therefore, it is easy to see that the permanent voting population of a county like Suffolk will actually profit by the elimination of mosquitoes, thus improving the attractiveness of their particular section for the summer resident.

Some years ago I remember reading a news article from a New Jersey paper, to the effect that "wherever the drainage had been completed and maintained, the thoughtful residents speak of the great relief afforded, and as a direct result property values between two certain points had increased nearly six million dollars. In the residential section the increase ranged from 25 to 300 per cent. And further it had been figured out in that year that there would be a direct return to the State of New Jersey in taxes of over four million dollars upon an expenditure of \$300,000 of the State's money."

So I am sure I am right, and acting in the interest of the railroad company I represent, when I work for the enactment of the County Commission Mandatory Law in Suffolk County.

I find that in spite of the many years that anti-mosquito work has been carried on in Kings and Queens and Nassau and also in Suffolk (to say nothing of the great work you have done in New Jersey) there is still a feeling of skepticism in some quarters. The native Long Islander has been scourged so long and so unmercifully, that probably without the mosquito he would not feel at home. The newcomers, however, are gradually converting or crowding out the old timers and their out-of-date notions.

I have gone so far as to sound a "Call to Arms" in Suffolk County, based on the fact that Jersey was getting ahead of us, and if we do not wake up, we will be held accountable for all the mosquitoes that are seen east of the Delaware River.

There is great competition and rivalry between the sea coasts of New Jersey and Long Island. We boast of being the only

sea coast the great Empire State actually owns, and, of course, Long Island must not be left behind in anything, particularly when it comes to the mosquito problem.

When we can point to the actual results obtained in New Jersey, and in Greater New York and Nassau County, and the great results obtained by Uncle Sam in Panama, it would seem as though the most pessimistic old-timer would give up and join our ranks.

PRESIDENT MEYERS—The next paper is by a gentleman from whom we are always glad to hear. We have heard from him at previous meetings, and I know we are glad to hear from Mr. Eugene Winship, who will tell us about the

Recent Development of Mosquito Work in Greater New York.

Mr. Chairman and Gentlemen: Pursuant to a request for a paper on the recent development of mosquito extermination work in Greater New York, I have the honor to present for your consideration the following. With the exception of a brief resumé, it is my intention to confine myself to the development of the work as we found it during the year of 1921.

Since the inception of the work in 1903 to the present time the City of New York has been extremely active in the crusade for the elimination of the mosquito. Taking into consideration the difficulties encountered, financially and otherwise, it gives me extreme pleasure to submit the following facts:

From 1903 to December 31, 1921, we have dug in our salt marsh and fresh water swamps 14,207,665 feet of ditches and maintained same by an annual and per diem force of laborers supervised by trained and efficient foremen at an annual cost of \$50,000. The total cost to date, including initial contract work, is \$484,935.45. This does not include the amount of work done by private interests which we estimate at \$750,000. The initial drainage of our salt marsh area has been completed, and our oiling squad is being continued pending permanent improvements. One hundred barrels of fuel oil are distributed from March 1st to November 1st annually.

Relative to the recent development of mosquito work in Greater New York, we learned, after reviewing our activities during the past year, that the following problems must be solved in order to permanently eliminate the mosquito as far as it can be accomplished by human agency.

Despite the fact that we have kept our fresh water swamps under continuous supervision, distributed oil thereon and redug

water courses, we find that the results are not entirely satisfactory. At certain times of the year vegetation is so dense and the water courses are so sluggish that in some instances it is very difficult to treat known breeding places. We are also handicapped because of the lack of drainage facilities and insufficient labor to cope with this part of our activities. Due to the fact that boundaries are not clearly defined, and in most cases the owners are non-residents and not amenable to our authority and the cost of fill prohibitive, it remains for the city to eradicate these breeding places. Steps have been taken to relieve these conditions in the near future.

We discontinued the distribution of oil on the 1st of November, 1921. Later developments have proven to me that oil should have been continued to a later date, as we found numerous breeding places in our fresh water swamps as late as November 30th, specimens of which were obtained and placed on exhibit for demonstration purposes in the Grand Central Palace, during the week of November 14th, under the auspices of the Public Health Service. It is therefore obvious why we have determined to prosecute a more vigorous inland campaign.

For educational purposes the exhibit held at the Grand Central Palace was a wonderful success. Information was solicited and conveyed to visitors from all parts of the United States, Central America, South America and a considerable part of Europe, in relation to mosquito extermination work. Our literature was in such great demand that our supply was exhausted two days before the exhibit closed. As a result there is no doubt that humanity will be greatly benefited and an added impetus given to the movement throughout the entire civilized world. Subsequent to the exhibit there had been an increased demand to the department of health for literature on the mosquito, which we are now preparing. This desire for literature applies, in part, to our greater city, the citizens of which are showing an increased interest and desire to co-operate with the department of health in their efforts to stamp out this insect within the city limits and elsewhere. We have taken the public into our confidence thereby obtaining their good-will and their invaluable co-operation, which must of necessity go hand in hand. In addition, the transportation officials and private interests upon whose properties we found considerable breeding, have agreed to do all in their power to further the interests of the department of health in their campaign against the mosquito.

We have conducted an intensive campaign in the public parks and recreation playgrounds with very appreciable results. We

did not receive one complaint from the habitues of said places or from the residents residing in the immediate vicinity thereof during the past year. With the aid of the constituted authorities we were able to obtain immunity from the mosquito in the public places. Without their aid this would have been impossible with the small force at our command.

Two matters which necessitated prompt action were called to my attention, namely, breeding of mosquitoes in the street manholes controlled by the electric light and telephone companies, and pipe and culverts insufficiently graded to prevent mosquito breeding except under storm conditions. We have referred these matters to the party or parties responsible, and such steps as we deem necessary have been taken to prevent any further trouble from this source.

Since this paper was prepared we have received the assurance of the superintendents representing the companies just mentioned that no further mosquito breeding will occur in the manholes under their supervision, as arrangements have been made to distribute oil at stated intervals pending other methods to control the insect.

It might be apropos at this point to state the Mosquito Division of New York City comprises a force of approximately thirty-five persons, and their activities embrace the entire greater city.

During the past year complaints from citizens relating to local breeding were very few. We attribute this to the fact that the efforts of the department of health in this direction were so ably seconded by the inhabitants of our city, keeping their premises immune, and in many instances instructing their neighbors as to the methods necessary to obtain immunity from the insect.

We have found a marked decrease in abandoned excavations, due to increased activity in building operations and an appreciable increase in the number of fills on inland and salt marsh areas which greatly reduce the territory requiring our attention.

The methods of filling vary from the pump fill on the salt marshes to the ash or dirt fills inland.

Anticipating physical changes have been of great assistance to us in our work. We find an annual survey of the salt marshes necessary to determine how the tides have affected our drainage ditches. Our efforts in this direction have resulted in locating places where breeding is apt to occur because of obstructed drains caused by the elements or human agency. By this means we are able to disregard large areas requiring no immediate attention and devote our efforts exclusively to places where mosquitoes will no doubt breed.

We have also demonstrated to our satisfaction that ditches completely frozen, and remaining so during the winter months, are of great assistance in the spring cleanup, provided the outlets are kept open. When the spring thaw arrives nature assists materially, flushing the ditches, with few exceptions, with such force as to remove all foreign material.

We have proven the benefit derived from the removal of the excavated material taken from ditches on salt marsh areas, thereby preventing it from being carried to and fro by tides and deposited in such manner as to obstruct ditches and outlets in many instances. These conditions occur on every perigee tide, and should be considered in every initial contract. Fortunately we have no further trouble from this source, as the material excavated in our salt marshes has been practically disposed of in various ways, and by its removal maintenance has been considerably simplified.

By this statement I do not mean to infer that all excavated material is moved around at every perigee tide. To a great extent these conditions occur during initial drainage operations and before, if the work is done in the growing season, it has time to adhere to the surface of the meadow. I merely wish to emphasize the fact that considerable annoyance and further expense could be spared if due consideration were given to this matter and provided for in contracts.

In reference to initial drainage work, we find the necessity for a study of the area in question with a view to preventing the installation of ditches in areas which are tide-covered. We have found this condition not only in our own meadows, but in other places. It seems to me that this factor is vitally important, and should be considered in order to prevent useless expense.

The question as to the use of laticides in place of oil, for the immediate elimination of mosquito breeding, pending permanent improvements, became so urgent, due to scarcity and cost of fuel oil, as to demand consideration. Tests were made in co-operation with representatives of some of the principal companies who were anxious to promote the use of their products. Results were found to be unsatisfactory, both as to efficiency and cost, which was prohibitive.

It is with a sense of satisfaction that we note the increasing tendency on the part of builders and home-seekers to crawl in on the edges and areas of salt marshes on which drainage has been completed for a period of years, and in which in many instances farms are flourishing where formerly the property was valueless, thereby increasing revenue to the city in increased tax returns.

We note with regret the falling off among the pioneers and the lack of sufficient material to take their places, due, we infer, to the nature of the work and insufficient remuneration. It seems to me, at this stage of the game, that proper inducements should be made to recruit our ranks from the present generation. Due to the lack of interest in many localities by our constituted authorities, we are not able to state at the present time how this can be done. There is one thing certain—we commenced the work, have carried it on to the present time, and must see that it is carried to a successful conclusion.

In relation to Greater New York, we have no hesitation in stating that in the near future our city will be mosquitoless, as far as the active specimen is concerned. We expect to direct visitors to our city to the Museum of Natural History for information in relation to the extinct mosquito.

PRESIDENT MEYERS—We will now have the pleasure of listening to a paper read by a man well versed in mosquito control in Connecticut. Mr. Samuel Sealy, Assistant Entomologist of the Connecticut Agricultural Experiment Station, will address us on

Recent Development of Mosquito Work in Connecticut.

Interest in mosquito control in the State of Connecticut is very much affected by the seasons and sometimes runs very low at this season of the year. Some of our good citizens seem to forget that it is very necessary to make some plans ahead to combat the mosquito pest that surely will be present in some localities next summer. Others remember the stings of last season and are planning a campaign of relief.

There are along the shores of Connecticut, twenty-four towns which have within their boundaries greater or lesser salt marsh areas. Most of those areas are, or have been breeding places of mosquitoes, some of a more serious nature than others. The marshes in eleven of these towns have been drained for mosquito elimination, the funds necessary to do the drainage work in most cases being obtained by private subscription.

At the present time, approximately 6,000 acres of salt marsh have been drained and are under control. We still have some 14,000 acres that need attention, and have great hopes of getting the public agitated to the point where they will provide funds enough to go ahead with this work.

The drained areas, with two exceptions, are continuous from the New York State line eastward to the Hammonasset River, a distance of approximately seventy-five miles. Continuous in

this case does not mean an unbroken strip of marsh, such as are common in New Jersey and on Long Island, but that all areas between the two points are under control. Marsh areas in Connecticut are, in several cases, isolated tracts, land locked or rock bound on all sides. They vary in size from fifty to a thousand acres. It is sometimes a problem to drain them properly, as the only outlet is a very small shallow stream which is taxed to capacity in carrying off water between tides. Tide-gates are built in such places as funds become available and drainage troubles are reduced to a minimum.

The western section of the state which is protected by drained marshes has been almost entirely free from salt marsh mosquitoes during the last few seasons. However, as little has been done with the inland fresh water problem, the mosquitoes from these sources are making their presence noticeable.

In former years when the salt marsh hordes invaded the surrounding country, the fresh water mosquitoes were so few in comparison that they were not noticed. Considerable interest was shown last summer in planning to get rid of the few.

Our methods of maintenance and control of salt marshes are similar to those in other communities, but perhaps somewhat more costly.

The areas that are scattered along the coast for such a long distance are in most instances too small to keep a man busy in that locality for any great length of time, and necessitates having a crew located at a central point and transporting them by automobile from place to place as the work goes on. The time lost in transportation over such long distances brings our cost per acre considerably higher than the average in other states. Last season the cost per acre was eighty-three cents, exclusive of supervision.

The individual towns in which work was done pay three-quarters of the actual cost, the remaining one-quarter and all supervision costs and expenses being paid by the state.

The State Park Commission has purchased a large tract of land, approximately 900 acres at Hammonasset Beach, Madison, which is at the extreme eastern end of our drained territory. Nearly 450 acres are salt marsh, which before being drained were breeding mosquitoes in such numbers that it was almost impossible for one to breathe without strangulation. The high land is laid out as a public park with camp sites, parking spaces and bathing facilities to accommodate thousands. Last season the camp sites were occupied continuously from early summer until fall. Mosquitoes were only in evidence on two or three occasions.

After a careful inspection, it was determined that mosquitoes were blown from the undrained areas across the river east of the park. The most skeptical person, if he should visit this place on a Sunday and see the thousands of people enjoying themselves where in former years existence was unbearable, would become a convert to the anti-mosquito crusade.

The town of Fairfield is the only one so far to attempt any fresh water control work in recent years. During the last two seasons they have carried on an active campaign against fresh water mosquitoes. Several large breeding places, such as dumps and swamps, have been permanently eliminated. Brooks and streams of any importance have been regraded and cleaned. Low places and swamps that cannot be drained to advantage have been oiled systematically.

The outlook for mosquito work in the future is very promising. Two towns that have large salt marsh areas have applied for surveys and estimated cost of drainage.

It is hoped that next season will see this work well under way.

PRESIDENT MEYERS—We have heard from Greater New York, which is on this end of Long Island, from Suffolk County, which is on the other end, and now we have a paper by Mr. Wm. De Mott about mosquito control work in Nassau County, also on Long Island. Mr. De Mott is the Chief Engineer of the Nassau County Mosquito Extermination Commission and will speak about

Recent Developments in Mosquito Work in Nassau County.

MR. WILLIAM DE MOTT—Mr. Chairman, Ladies and Gentlemen: This afternoon you were discussing signs. It pays to advertise, there is no question about it. During the year 1910 Major Le Prince made me a call at Freeport, at the time the office was on Railroad Avenue, above a real estate office, and when Major Le Prince came to see me the first thing he asked was, "Where is the sign to direct me to your office?"

I said to the Major: "Downstairs, didn't you notice the small sign by the side of the door?"

The Major said: "Boy, if I had an office in Freeport, doing this kind of work, I would have letters six feet high on the top of the roof telling the whole county that we were the Mosquito Extermination Commission of Nassau County."

During the year we moved our office down to the southern part of the village and built an office there, and as soon as that office was completed I followed out Major Le Prince's suggestion, and

I had a sign built twenty-two feet long and four feet high, and had "Nassau County Mosquito Extermination Commission," with a black background, in yellow letters, and you can stand 2,000 feet away and read it. What is the result? That office has become a school of education. There is hardly a day during the summer time that there are not people walking in and wanting to know how we get rid of mosquitoes in Nassau County. I did more than that. This past year of 1921 we have had two motor boats built for salt marsh maintenance work. I named one "Sollicitans" and the other "Cantator." Now, that is cheap publicity, gentlemen. These boats are constantly upon the waters of Nassau County, carrying the men who do the maintenance work, and the people who travel up and down the bays see these boats with such peculiar names and they ask, "Who owns the boats?" And they soon find out from somebody that it is the Nassau County Mosquito Extermination Commission working on the job on the marsh land. That doesn't cost anything—just the boats advertising the names of the mosquitoes and the commission which is exterminating them.

I just thought of that while listening to Mr. Gies this afternoon and thought how cheap we could get publicity, and there is no doubt we can.

The Nassau County Mosquito Extermination Commission is composed of the following members: Hiram R. Smith, Freeport, President; Daniel Morrison, Freeport, Treasurer; Abraham Adelberg, Cedarhurst; Dr. Arthur D. Jaques, Lynbrook; Dr. Frederick L. Keays, Great Neck, and Irving Cox, Mill Neck.

The work of the commission is carried on under the general headings Salt Marsh, South Shore Upland, North Shore Upland and Winter Operations. The report will be made accordingly.

SALT MARSH.

The salt marsh maintenance and patrol work began on April 18th, with a crew of four foremen-inspectors and nineteen laborers, under the supervision of a district inspector. Due to the increase in the ditched areas, it was necessary to divide the district into five sections, instead of four, as in previous years. The entire district, from Inwood to Seaford, was covered six times at a cost of \$13,360.34. In connection with the maintenance and patrol, 11,778 feet of main and 27,179 feet of spur ditches were installed in areas where heavy breeding existed. As salt marsh mosquitoes are rarely ever found in the upland district adjoining

the ditched marshlands, the necessity of salt marsh drainage in mosquito control is proved.

In addition to the maintenance and patrol, we placed one man at High Hill Beach, a summer resort opposite Seaford. Beside inspecting around the cottages, where there were numerous rain barrels, tin cans, pails, and other receptacles containing water, he patrolled the beach, and oiled all stagnant pools where permanent elimination was impossible. A marked decrease of mosquitoes at the beach was noticeable, and residents expressed their gratitude and appreciation of the work.

SOUTH SHORE UPLAND.

The work in this district was carried on by a district inspector, four inspectors, a labor foreman and five laborers. Following is a summary of their work:

Total number of inspections,	6,079
Total number of gallons of oil used,	9,018
Total number of times breeding killed,	674
Total footage new ditches installed,	16,250
Total footage ditches cleaned,	91,800
Total number of ponds lowered,	1
Total number of wet areas drained,	6
*Total number of catch basins oiled during season,	5,400

*This includes the initial oiling and the reoiling found necessary.

In this district we started our first house-to-house work. An inspector was placed in Freeport, one of the largest villages in the county. The village was divided into four sections and the yards inspected systematically; 2,276 inspections and 3,300 reinspections were made, and 1,413 violations located from May 1st to September 30th.

NORTH SHORE UPLAND.

With the exception of a labor foreman and one laborer, the personnel of this district was the same as that of the South Shore Upland. Following is a summary of the work:

Total number of inspections,	9,385
Total number of gallons of oil used,	10,803
Total number of times breeding killed,	1,548
Total footage new ditches installed,	2,727
Total footage old ditches cleaned,	441,036
Total footage old ditches re-cleaned,	7,580
Total footage pond edges trimmed,	8,410
Total footage of swamps drained,	1

In addition to the foregoing, 152,698 feet of salt marsh ditches were cleaned, and 84,466 feet re-cleaned.

The Mill Pond and Leeds Lake, Manhasset; Mill Pond, Roslyn; Large Pond, North Shore Country Club Pond, and Mill Pond, Oyster Bay, were lowered every two weeks. More ditches were installed in the Public Swamp, Great Neck, thereby draining a larger area.

The following table shows the breeding percentage in the upland districts:

	<i>South Shore.</i>	<i>North Shore.</i>
Culex,	18%	43%
Aedes,	70%	10%
Anopheles,	12%	47%

Notwithstanding the high percentage of *Anopheles* breeding on the North Shore, no cases of malaria were reported from that section of the county. Three cases, without blood tests, were reported—one from Freeport, one from Rockville Centre and one from Garden City. As these cases were not positive, the record established since 1916 has not been broken.

WINTER OPERATIONS.

The system of installing ditches on the salt marsh, inaugurated last year, was continued. The work began on October 5th; 246,566 feet of main ditches and 79,216 feet of spur ditches were installed at a cost of \$5,723.48, plus \$1,657.66 for measuring, staking and supervision.

This year three inspectors, instead of two, were employed in each upland district during the winter months. On the South Shore the inspectors cleaned ditches and streams. Most of the cleaning consisted of removing leaves and cat tails, and cutting the thick growth of bushes on the sides of the streams. As a result many wet areas along the streams dried up. A chain survey of 26 miles of streams was made, and many new violations located and listed for inspection.

Similar work was done on the North Shore. A culvert was installed to drain a swamp at Port Washington which has always been a heavy breeder. In the future considerable oil will be saved on this violation.

By employing the inspectors throughout the year much time and labor are saved in the spring. During inclement winter weather the district inspectors worked on maps and charts, and prepared schedules for the ensuing year, while the inspectors enclosed the interior of the garage, and assisted the mechanic in overhauling and painting the cars and boats.

In August the work of the secretary and stenographer were combined, thus saving \$2,000.00 a year, and limiting the office force to the chief engineer and secretary.

From 1916 to 1921, inclusive, the commission has spent \$321,772.19 for mosquito control, and the county has increased in assessed valuation approximately \$85,000,000.00. While we do not claim that this increase is entirely due to mosquito control, the normal increase, with the mosquito still rampant, would not have been one-quarter of that amount.

The largest percentage of the increased valuation has been in the town of Hempstead, on the south side of the county, adjoining 19,000 acres of salt marsh lands. This acreage was breeding enough mosquitoes to invade the entire 300 square miles of the county in great hordes, before the marshlands were ditched and drained, and the mosquitoes exterminated by the commission.

The commission has ditched all the salt marsh areas on the north shore, approximately 800 acres, and of the 19,000 acres on the south shore 16,500 acres are now under control. Between five and six million feet of ditches have been installed, draining an area fifteen miles long.

During the year 1921 building increased very rapidly along the drained marshlands. A bungalow city was built on the west end of Long Beach. In the village of Lynbrook more than 400 houses were built, in Baldwin over 200, and in Freeport, the largest village in the county, with hundreds of acres of marshlands forming the southern section, 631 new buildings were erected.

Dr. F. L. Keays, of Great Neck, now a member of the commission, has stated that Great Neck could not progress, and that people moved from the village on account of the prevalence of malaria, but that there had been a turn in the tide in their favor since the commission started operations.

Land values have increased while taxes have decreased. Since the year 1919 the tax rate in the town of Hempstead have been lowered twelve points.

Mosquito extermination has been a success wherever it has been undertaken, but mosquitoes cannot be exterminated by "hot air," it takes grit and greenbacks.

SECRETARY HEADLEE—Mr. Chairman, may I say to the speakers who have been describing work outside of our own state that we have a nutty problem with us in counties where the work is on a county-wide basis, and it is this:

Heavy rainfall will multiply the possible breeding water surface by at least 100 per cent. In other words, the breeding

surface of water will be a hundredfold greater after a heavy rainfall than before the rainfall. I would like to inquire of any one of these gentlemen who cares to answer if he has found any way to expand his force quickly to take care of a situation of this kind and prevent the emergence of an enormous brood of mosquitoes.

MR. WINSHIP—In answer to that question, Dr. Headlee, I have not been able to expand my force. They are expanded to the bursting point. They have a certain amount of work to do and a certain territory that must be covered, and under those abnormal conditions we have to do the best we can and depend on the seepage to do the rest.

MR. LE PRINCE—If you were referring to the question of places needing oiling, I might just state that in the Isthmian work we had to give up oiling and get down to a concentrated larvicide usage, because a man could carry so much more. A man could carry at one time enough to last him half a day.

PRESIDENT MEYERS—This meeting stands adjourned until ten o'clock to-morrow morning.

FRIDAY MORNING SESSION.

(The meeting convened at 10:15 A. M., President Charles Lee Meyers presiding.)

PRESIDENT MEYERS—This morning we will listen to papers from the various commissions on

The New and Unusual Features of Mosquito Control in Counties.

The first paper will be read by Mr. Fred A. Reiley, Chief Inspector of the Atlantic County Mosquito Commission.

MR. FRED REILEY—The request for a report containing something "new and unusual" in anti-mosquito work in New Jersey is, to say the least, a large order. However, it is partly offset by the further request "positively not to exceed five minutes." I promise to follow to the letter the latter order.

A survey of the records of 1921 shows two instances that can certainly be classed as new and we trust will remain unusual. The first was the finding of the larvæ of *Aedes cantator* on the open meadow as early as February and again in March, at which time the larvæ were as numerous as mid-summer breeding of

Aedes sollicitans. The March brood reached the winged stage and covered the entire northeast part of the county and were a real nuisance. This mosquito nuisance so early in the season was a new experience, and we trust it will not be repeated this coming year. The following year it cannot recur because by that time our ditching machines will be moved to the area in question and a large part of the Mullica River meadows will be drained. I trust Mr. Engle, of Ocean County, will make note of this statement.

The second could be classed as unusual, at least in Atlantic County. In the course of regular machine ditching in the western part of the county we encountered an area of meadow—about 400 acres—with three-square, rosemary and sedge. Underlying these grasses were sand, coarse gravel and cedar stumps. To a county equipped with hand spades and men expert in handling them this condition would not present much of a problem. Atlantic County depends, as you know, almost entirely on mechanical means of ditching. So much that we do not have two men who can use a two-man spade to advantage. If small spades were used the draining of this area would take months where we were in the habit of cutting the same area in weeks.

We purchased a contractor's walking plow and attempted to cut with that. The grass roots were so tough that it was impossible to keep the plow in the meadows. The gauge wheel was removed and a frame, with side-cutting blades spaced twelve inches apart and seven inches deep, put on. This helped some, but it still required three men to keep the plow straight. A blade was then placed on the mold board which retarded the discharge of sod until the entire mass was clear of the ditch. This plow then proved very satisfactory and cut ditches 12" x 15" through the entire bad area, except where stumps were struck. Not having a circular saw mounted on the plow we could not ditch through the stumps, and in such cases the hand spade men had to ditch around them. About 100,000 feet of this ditching were dug.

The above-mentioned work set back the date of the completion of the drainage of meadows west of the Great Egg Harbor River, but we are exerting every effort to finish before the first of the 1922 brood of mosquitoes mature.

The season was notable for the one very heavy brood of salt marsh mosquitoes that covered the county on the 12th and 13th of August. During the time this brood was in the larval stage very careful inspections were made both of the drained and undrained salt marsh. The drained marshes produced *no* breeding

while the undrained was fairly alive with larvæ. Especially was this true of the Mullica River meadow from Leeds Point to Johnstontown. We, of course, had other broods during the season, but the only real nuisance was in the northeastern part of the county, and the Mullica River meadows were without doubt responsible.

The usual summer house and yard inspections were carried on in the more thickly populated parts of the county, and with one exception produced good results. Atlantic City experienced its first year of public ash and trash collection, and our reports show a very marked decrease in the number of probable breeding places for the house mosquito. The figures for 1920 were 18,000 and in 1921 3,600. Should this good work continue it would mean a reduction in the cost of fresh water work, and the money saved can be spent on the salt marsh drainage.

The Atlantic County Mosquito Extermination Commission held their regular monthly meeting last Tuesday afternoon. At this meeting orders were placed for a new Fordson tractor. This will be the second one purchased by this commission in two years. With two such ditching units working on the Mullica River meadows, the completion of the drainage in this county should not be so far in the future.

PRESIDENT MEYERS—Are there any questions or discussion of this paper? The next person we will hear from will be Dr. Lewis W. Brown, member of the Bergen County Mosquito Commission.

DR. LEWIS BROWN—It has been said and often repeated that "there is nothing new under the sun." If such indeed be the truth, the subject assigned for the symposium to-day is a most difficult one to handle, for certainly in Bergen County last year in our mosquito control operations we introduced no startling innovations or brought forth no revolutionary systems for the elimination of our avowed enemy. In fact, we followed pretty closely the accepted orthodox methods of mosquito extermination, choosing to emphasize certain phases that seemed to us of relatively greater importance and slighting or excluding other matters that in view of our restricted resources seemed of minor value. We drained, we oiled, we lectured, and as in previous years we collected wherever possible a share of the cost from the towns in which drainage work was actually done.

But although our work as a whole was not novel, there were one or two features that could perhaps be referred to as unusual in view of their magnitude if for no other reason. These I will mention briefly.

1. The new tidegates at Eckle's Creek.—These gates were originally planned in 1917, but were postponed because of the war, until the present season. Eckle's Creek, at the point where the new gates were constructed, is 55' wide and a bulkhead 110' in length was constructed to support the three sluice boxes. 3" plank 20' long were driven as a front line bulkhead and a 2" plank in the rear. The boxes were 3' x 6' and were built separately, floated into place, and bolted. The soil in the creek bed is a heavy clay and driving by hand was impractical if not impossible. A pile driver consisting of an unright frame, a 300 pound block, an "Ideal" hoist and a 3¼ horse-power engine furnished the necessary power to drive the piles firmly and securely into place. The heavy clay which made driving so hard made first class fill, and, when packed in, presented a strong bulwark against the heavy pressure of the tide. In general, the Eckle's Creek gate is very much like other closed-type tidegates in common use, but it has this to distinguish it from the others:

- a. It is the largest yet built in the state for mosquito control purposes.
- b. It is the first gate to be built for mosquito control in the construction of which a power-driven pile driver was used.
- c. It has a single beam front stringer 8' x 12", 60' long.
- d. It has a special system of cross-bracing giving it increased resistance and strength.

2. The other undertaking completed in Bergen County last year, which is perhaps worthy of mention, is the Carlstadt dike. This was also a salt marsh enterprise and was supplemental to the tidegates previously described. This dike, which extends from the brickyards in Little Ferry to Leive's Woods in Carlstadt, is 8,000' long. The dike was built with a 6' base, averaged about 32" in height, and was built 30" wide at the top. The dike was built without a core and leakage in spite of this has been slight. Near the gates the ditch is 6' wide and 5' deep and is graded for its entire length. The cost of the dike and ditch was less than 35 cents a running foot. The entire system, gates, dike and ditch keeps absolutely dry about 1,000 acres of marshland which formerly was among the most vicious and continuous mosquito breeding areas in Bergen County. It also helps to drain and affords outlet for an additional thousand acres of low-lying upland, which has constantly given us trouble and is the first step in a comprehensive plan for drainage of this section of the county.

This summarizes the most important endeavors in which we engaged last season. There are several others which might be

mentioned but lack of time forbids, and this paper is quite long enough. I hope some day my paper may be even shorter and may contain simply the following: "No mosquitoes at all in Bergen County last summer." Then I know you will all sit back and furnish the title by saying as one man, "New and Unusual."

PRESIDENT MEYERS—Are there any questions or discussion of this paper?

SECRETARY HEADLEE—Mr. Chairman, the type of tide-dike which Mr. Brown describes is new in mosquito work. Always heretofore we have attempted to make a bond between the dike and the marsh surface, holding that that was necessary to prevent leakage. The bond was usually affected by digging a ditch through the sod, packing in the clay and giving the dike an impervious core. In this case the dike was constructed on the meadow surface without any cutting of the sod beneath, and simply consisted of soil piled up in the form of that dike, with borders of sod.

When I saw the completed dike I thought it would surely leak, and I believe there was a place or two where it did leak, but that was rather promptly fixed up and it has done wonderfully well. The price of the dike, considering the cost of labor when it was built, is extraordinarily low, being 35 cents a foot, the size which Mr. Brown described. I personally inspected the tidegate which Mr. Brown described in Eckle's Creek, and that is a case of a tidegate set across the old channel of the creek which is always a difficult place to put a tidegate structure, because, usually, where the creek goes into the river or into the thoroughfare, the bottom is covered with soft mud and that mud is deep. It is filled with water and it is very difficult to make a bulkhead tight enough to keep little streams of water from getting through, and the small streams under those conditions soon become large streams and pretty soon the tidegate is undermined.

Yet that structure has been there for a considerable period of time. It has been subjected to all the ordinary tests of wind and tide and rain, and it stands as firm, apparently, as the day it was built.

There is a new feature which Mr. Brown brought out in the building of the front wall of the bulkhead. A large timber is laid at the back of the front series of sheet piling and bolted to it. That timber is large and stiff, and as a result, when I saw it some months after it had been built, the front wall of that bulkhead was just as straight as when it was put in—no weakening—no changing of direction. To anyone who is familiar with ordi-

nary construction, that represents a tremendous difficulty overcome. Ordinarily sheet piling will get curves in it; as time goes on it will shift, but apparently this timber has prevented that. We really have some new and rather unusual features in those two types of structure.

DR. BROWN—In addition, I would like to say there has been considerable sentiment against this system of drainage ditches for the past twenty-five years on the part of Jersey farmers; but since we have put in this tidegate they have not only come to us to thank us for the work but they want more. We have drained hundreds of acres for about two miles where the farmers are now actually raising produce for the market. In the northern part of the county, near our new isolation hospital, where we did only a little work last year, the farmers have proposed that the council pay a third, they pay a third and the commission a third to do additional work there.

MR. RIDER—Mr. President, I did an unusual thing this morning in asking for the privilege of the floor. But before saying what I had in mind, I wish to add in a general way some thoughts concerning this damming and drainage business.

Dams, bulkheads and tidegate problems have been worked out by cranberry growers, and it would seem to be good business to benefit by their experience.

Our problem in Atlantic County has not yet called for this kind of work. Our dams have a different spelling. The others are in the far offing, but I believe will come later.

At the last meeting of our commission our president suggested the propriety of cutting out the ditch cleaning for a period, that we might put on another tractor and machine on breeding areas that we had been unable to reach. This set in motion a new train of thought. Is there not a way that this increasing expense can be eliminated or reduced to a minimum cost? Nature keeps the crooked creeks clear with tides flowing in and out, why not our artificial ditches built on straight lines with more rapid flow?

I had seen these ditches dug beautifully and economically, but I had been derelict in not following them to their source to see that nature had been permitted to do her part. This was a principle in drainage which my experience had taught me was necessary and invaluable.

I confess I did not know that these beautiful, straight ditches, came to dead ends at the shore. Had I known this, I should have said at once, here is where we have fallen down and caused this extra expense.

Tides running in and out twice in twenty-four hours naturally carry soft mud and ooze to the end of these ditches. During the short period of tidal rest this mud and ooze settles and remains. So often repeated, the ditch soon becomes filled and useless, particularly at the shore ends. Freshets come, the water from the uplands flow down on the meadows, and unexpected breeding occurs. It should be "the expected happens," because we have failed to guard against it.

On the blackboard the crooked line represents the creek or thoroughfare which is the natural drainage, the straight parallel lines the artificial ditches. The shaded line made with the flat surface of the crayon represents the shore or upland. There is usually a continuous flow of water from springs and seepage which keeps the borders of the meadow constantly saturated and when the freshet comes the water flows uninterrupted over the surface of the meadow.

Is it not logical to conclude that a shore ditch should be dug to intercept these waters and direct them into these lateral ditches? This will bring relief from this burden and expense of ditch cleaning. Let nature do the work.

If the farmer objects it will be economy to provide bridges or pipes where crossings are needed.

I am not so sure but these shore ditches should have first attention and make many of these long ditches unnecessary.

Our problems are analogous, surface water flowing on the meadows produce mosquito breeding. Flowing over our cranberry beds produces fungous diseases which are disastrous. "Cut it out." I thank you.

PRESIDENT MEYERS—We will now listen to Mr. William Porter, Commissioner from Cape May County.

MR. WILLIAM PORTER—Cape May County, with its small population and its very large acreage of marsh lands, is still fighting the mosquito pest with the same vigor and persistency as it did six years ago when it first started this important work.

The methods and work of this commission are a continuation of those of past years and have been fully covered in previous conventions.

The importance of mosquito control work to Cape May County can hardly be overestimated from an economic standpoint. Its entire coast line is almost one continuous summer resort, entertaining thousands of visitors from all over the world.

Early in the season of 1921 we divided our crew into three sections and started to work putting our drainage systems in all

parts of the county in first class condition. About 150 miles of ditches were thoroughly cleaned, and after putting in three large sluices with tide gates on the Delaware Bay Meadows, we found we had very little funds left with which to install new ditches.

The sluices were placed on the Green Creek and Fishing Creek meadows and averaged 200 feet in length with 4 ft. x 6 ft. tide-gates. The total cost was \$4,383.07.

The result of the work in our county has been all that could be expected. Very little breeding, if any, was found in the drained sections, but the flights of mosquitoes from the districts which had not been drained were so large at times that it was almost impossible to convince the average person that the mosquitoes were not breeding on the drained marshes.

Our great problem for this year is the South Cape May District. This section has been drained for several years and kept free of breeding until about two years ago when the ocean forced its way through the sand dunes, leveling them until they reached that point where all extremely high tides flowed into these marshes. This made it impossible for our ditches to carry off the water fast enough, resulting in a large amount of breeding. The only way, within our limited means, that this condition may be overcome is to build up again the sand at this point. With this aim in view, we are now building a sand collector of two rows of alternating piling, set two feet apart and brushed at certain sections. It is hoped that the complete elimination of breeding in this large section will be the result.

Another problem with which Cape May County has to contend is the ever-shifting sand on the Delaware Bay shore. It is a physical impossibility to keep any natural outlets open for any length of time in this section. This necessitates placing large culverts at every outlet along the bay. These culverts are a large item in our annual budget and of course greatly reduce the amount of new ditching we are able to place. Still we feel that these culverts are one of the greatest factors in freeing our section of the mosquito pest.

Cape May County now has about 1,459,173 feet of standard ditches installed on its salt marsh meadows which is about two-thirds of the amount required to complete the salt marsh work.

During the last two weeks of July, 1921, we, as well as most other counties, had a large flight of mosquitoes. The weather conditions, being favorable, the undrained tracts of marsh were breeding mosquitoes in large numbers.

When we have heavy rains and high tides it is almost impossible for any system of drainage, however perfect, to carry off

all the water in the time it takes the mosquito to reach the flight state. Some of these breeding places were found by our inspectors on the drained marshes but not in numbers large enough to be of serious trouble. It is a debatable question whether it would not be to our advantage to dig double width ditches through a great deal of our meadows, especially on the Bay shore side where the condition of the marshes is such that the ditches soon become blocked and make breeding places of the ditches themselves.

One of the great troubles we have, and which we presume most everyone in mosquito control work has, comes from people who wilfully stop or block the ditches, making the work done of no effect, and at times a detriment not only to mosquito control work but to the marshes themselves. The only way to reach these people is through the local boards of health and this is a very unsatisfactory process with only one sure result—that of making enemies for the cause.

We are now starting the season of 1922 with a greater amount of the spirit of co-operation and enthusiasm than ever before and with the dollar worth more than in the past few years we hope to have better results, accomplish more, and make 1922 a banner year in mosquito control.

SECRETARY HEADLEE—I would like to say a word about the Cape May County work, particularly certain peculiar problems that appear in the Cape May County work.

Along the shore, where the sea has pushed up enormous sand dunes, the outlets to creeks which were at one time large enough to admit sloops and small schooners, are now closed more or less completely by every storm that drives in from the sea.

These dunes assume a position across the mouth of the outlet and behind that dune will be an enormous marsh covered with water.

The problem, of course, is to get the water out. To do that and allow the water to go out at every low tide that dune must be pierced and the water given a passageway. There is no way to keep that dune piercing open unless you dig it out, because the next storm across it will push the sand up and fill the opening. It is an endless job to keep digging it out after every storm.

The creek will usually run, meandering across the marsh. When the ordinary drainage ditches are put in, somewhat after this fashion, the water flows out, but there is no ditch flushing as Mr. Reiley mentioned. The only ditch flushing that occurs is from rainwater which apparently does not keep the ditches clean.

The result is that these ditches close up rather rapidly and have to be opened.

Relative to Mr. Reiley's statement about installing the band ditch, as we call it, along the junction of the marsh and the upland, and insuring in that way that the water flushes those ditches, the scheme is rather a practical one and has, so far as I can see, no very serious disadvantage, other than that a band ditch is not an agreeable construction to the landowner. He must cross the ditch to get on the meadow. Generally speaking, he won't bridge it. What he commonly does is to throw some sod in it and drive across. I do hold that the band ditch is a very important consideration and that it is now being used in a good many instances.

Where you have a strong tide-fall suck, and the water flows through that ditch, you have a wash-out of the soft underlying mud and a dropping of the surface of the marsh next to that ditch. It will not be long before the ditch deepens, so that, beginning fifteen or more feet back of the ditch, the land sinks, and, eventually, you will have a condition of the ditch that looks like that (indicating). It is impractical to drive a horse anywhere near that ditch, and it is pretty nearly impractical for a man to step on it and get out again.

This has actually occurred. I could show you ditches (there are some on the Atlantic Coast—there are more on the Bay Coast) where the tidal swell or suck is more pronounced. This, of course, may be met by stopping boards in the ditches, which would prevent the water falling below a certain point, very much as are used in cranberry practice.

The dike of sand is a good proposition in the cranberry work where I have seen those ditches successfully employed, but I notice the plan is always to dig down through any muck that may be present until the sand is struck. Then the dike is built of sand and a band effected with the old sandy surface.

In the Bergen County operation, to core that dam would have meant hauling sand in cars and then aboard boats to get it there. There is no sand anywhere around and they were compelled to employ the material that was there.

Of course, when we get down in this section of the state, we can get any amount of sand, and it may be that that would be one of the best ways to core the dikes. On the other hand, that involves considerable movement of sand. These dikes are built, say, 36 inches high, 3 feet wide at the top and 6 feet wide at the bottom, and cost 35 cents a foot, nearly \$5 a rod. Now my impression is that the dikes on the cranberry bogs aren't built for any such figure as this.

MR. RIDER—You mean running foot, Doctor?

SECRETARY HEADLEE—Yes.

MR. RIDER—We do not necessarily go through the mud to sand bottom. But we make sure there are no logs or sticks crossing the trench dug for the core. The sand goes to the bottom and forces the mud and ooze out of the way.

If sand is available it is preferable to clay, because if dug through by a rat it falls and stops the hole, while clay would stay in position and probably cause a washout.

PRESIDENT MEYERS—Essex County is represented by Mr. James E. Brooks.

MR. JAMES E. BROOKS—I understand that I have five minutes in which to tell of the new and unusual methods of mosquito control used in Essex County in the year 1921.

I can say it in a single sentence: the unusual thing was to have the ditch cleaning machine work all day without breaking down. A trick mule could not have thought out more ways of making trouble than this machine did. It was a well-developed case of the "Natural Perversity of Inanimate Objects," but, as usual, mind prevailed over matter. Each time the machine developed a weakness or met with unexpected obstacles, changes in design or method were adopted to meet the difficulty.

Early in March, 1921, the ditch cleaner was put in operation, with a temporary arrangement of an anchor and snatchblock, and a Fordson tractor to haul it. It was demonstrated clearly that the machine would clean ditches, and then the Essex County Commission authorized the placing of a winding drum and anchor on the Fordson tractor. It took some time to do this, and the machine did not get into operation again until the middle of August. From that time, until the latter part of November, the real work of developing the machine went on, and the experience gained was very valuable.

The machine did excellent work in cleaning the ditches. It cleaned them far better than they had ever been cleaned by hand. The machine makes the bottom of the ditch perfectly uniform, and it delivers the spoil further away from the ditch than is usual with hand labor. The longest run in an eight-hour day was three thousand eight hundred lineal feet, and no doubt this can be considerably increased during the coming season.

Many of the improvements which appeared necessary could not be made while the machine was on the meadows. After its withdrawal for the winter, these improvements were started, and when it goes back into service in April this year, it will be

prepared to meet many of the difficulties which led to delays in 1921.

That the machine will to the work for which it was designed and do it well has been clearly demonstrated. What remains to be done is to speed up the work to reduce its cost.

PRESIDENT MEYERS—Hudson County is represented by Mr. Lewis E. Jackson, the executive secretary.

MR. LEWIS E. JACKSON—Outstanding in the category of "New and Unusual Features in Mosquito Control" is the draining of cedar stump salt marsh by a system of ditches with an average interval of 1,000 feet.

The permanent drainage of a section of the Frank Creek territory was completed in 1921 by the Hudson County Commission by the installation of such a system, comprising 15,882 lineal feet of ditches thirty inches in width and of the present standard depth of thirty inches, serving an area of 357 acres of low-lying marsh. The area forms a part of a tract of 1,100 acres entirely enclosed, the surface of which is an average of one foot below mean low tide, and from which the water is lifted by the means of two electrically driven centrifugal pumps, having a maximum capacity of 4,000 gallons per minute. The number of feet of thirty-inch ditches per acre in this new system is forty-four or one hundred thirty-two feet per acre on the basis of the standard ten-inch ditch, which is remarkably low for any marsh.

In employing ditches thirty inches in width, the commission is following its general policy, established two years ago, of using ditches of increased capacity to provide for quicker take-off, especially advantageous in removing the winter accumulation of water, and for adequate storage. Such ditches also have the additional advantages of less friction and lower cost of up-keep.

This experiment of draining sections of marsh 1,000 feet in width by one ditch to each section proved successful in every way. The entire area was 100 per cent. drained, using the term "drained" with due regard for its meaning, resulting in absolute control throughout the season. Although the summer was a particularly dry one we are confident, from our observations of the effectiveness of these ditches, that they provide the desired element of safety under any condition likely to develop.

Although breeding on the salt marsh commenced at the early date of March 17th and continued heavy throughout the *Aedes cantator* breeding period, it is notable that the emergence of

this species was absolutely prevented, not a single adult specimen being taken in any part of the county during the 1921 season.

The control of sewer catch basin breeding, which is of prime importance in built-up communities, has assumed such huge proportions that a small auto truck was added to our transportation equipment and assigned to this work exclusively during the *pipiens* breeding season.

Our equipment was also supplemented by a gasoline driven portable pump with a capacity of 12,000 gallons per hour on a twenty-foot lift, for use in the permanent elimination of pools and other similar breeding places which cannot be drained or filled in. The pump is employed principally on the upland though opportunities also present themselves for its use on the marsh. The equipment weighs 900 pounds and is readily transported on one of the commission's auto trucks.

Excluding one municipality lying on the western limits of the county, mosquitoes on the wing were noticeably absent except during the short period from July 25th to August 10th, when comparatively few were present in widely separated districts. At no time were they especially troublesome, many regions being entirely free from them throughout the season. That annoyance from mosquitoes is being steadily reduced in Hudson County, through the work of the commission, is very generally and frequently remarked by the inhabitants. This fact is presented not as an unusual feature but as denoting progress in mosquito extermination.

PRESIDENT MEYERS—Mr. Frank Miller, Chief Inspector of the Middlesex County Commission, will read a paper for his county.

MR. FRANK MILLER—Mr. Lewis E. Potter has been unable to attend this convention. He has asked me to extend his regrets and deliver his paper if that is agreeable.

During the past year the Middlesex County Mosquito Extermination Commission encountered a rather unusual problem in the drainage of a large woodland swamp situated in the borough of Metuchen and in the township of Raritan. While the methods employed are not new to drainage work still it is believed that they have not been in common use for mosquito extermination, and since, by the use of these methods, we were able to accomplish the drainage more cheaply and efficiently than if done with hand labor, a brief description of the swamp and the methods used in drainage will be outlined in this paper.

The area in question, known as the Dismal Swamp, was a low-lying, woody morass of some six hundred acres. A drainage channel, commonly called Dismal Brook, courses along the south side of the swamp. Through lack of care this brook had become so badly choked that it was unable to drain the surrounding lowlands with sufficient speed to prevent the accumulation of standing water. As a result this six hundred acre area became a great mosquito incubator and the migrations of mosquitoes from this swamp to the borough of Metuchen completely overshadowed the results of the local campaigns waged by that community.

At the instigation of the Board of Health of Metuchen a drainage survey of the swamp was prepared together with cost estimates. A profile of the survey showed that from the headwaters of Dismal Brook to the lower end of the area in question there was a grade of seven feet in seven thousand feet of main channel. This indicated that with proper cleaning and grading the surface water in Metuchen and in the swamp itself could be readily drawn away. The benefits which would be derived from this drainage would be three-fold—(1) elimination of standing water in the swamp, (2) the elimination of large fresh water mosquito breeding areas, and (3) the lowering of the water table in the low-lying parts of the borough and township, thus enabling the cesspools in those sections to gain in capacity.

The drainage proposition was placed before the governing bodies of the two communities interested and it was adopted. An equitable financial agreement was reached whereby the borough of Metuchen appropriated one thousand dollars and the township of Raritan eight hundred dollars for this work. The Middlesex County Mosquito Extermination Commission accepted oversight of all operations.

In making the survey it had been discovered that a peculiar soil condition existed under the brook bed, which would make proper grade ditching difficult and expensive if done by hand. It was comparatively simple to remove the silt, mud and debris from the bottom of the brook with shovels, but this only accounted for approximately a fifteen-inch lowering of the channel. The survey called for a thirty-inch cut. Under this silt and mud was a layer of impervious clay which could only be removed at great expense and with great difficulty. However, beneath this layer of clay was found a strata of white sand.

Several years previous a similar condition had been met with by the Woodbrook Farms, a large dairy situated northwest of Metuchen, when they had regraded a section of Dismal Brook

running through their property. They had first attempted to grade the brook with hand spades. After working for two weeks they found that 1,000 feet had cost them thirty-four cents a foot. This cost made extensive operations prohibitive. Some new method had to be devised. The solution of the problem was reached and effectively carried out by the aid of a four-inch centrifugal pump. This pump, driven by a small Regal automobile motor, was rigged upon a scow. The scow was placed in the brook, the intake pipe of the pump was sunk through a hole in the clay, and the sand sucked out from under. It was then a simple matter to break down the layer of clay and obtain the desired grade. Through the kindness of the Woodbrook Farms owners this outfit was loaned, free of charge, to the Middlesex County Mosquito Extermination Commission for drainage work in the Dismal Swamp. Operations were necessarily slow owing to the limited capacity of the pump, but at the same time expenses were correspondingly low.

As the work progressed the brook level was lowered, the swamp gradually responded to the drainage action, until finally no standing water remained.

The results of this drainage have exceeded our fondest hopes. Six hundred acres of lowlands have been permanently drained. Farmers are now able to enter this area, once called Dismal Swamp, and obtain cordwood, which is quite a source of revenue in that section. A great mosquito incubator and a constant menace to local campaigns in Metuchen has been eliminated. Cesspools, both in the borough and township, have greatly increased in capacity. This last will aid considerably the pocket-books of the citizens residing in the low sections of the two municipalities. The results have really delighted the people affected by the drainage and many friends have been made of mosquito control. In fact when the Board of Freeholders of Middlesex County were making up the 1922 county budget, many prominent citizens of Metuchen, among them Mrs. C. A. Prickett, Vice-Chairman of the Third District of Women's Federated Clubs; Mr. Wilson, Mayor of the borough; Mr. Carmen, President of the Chamber of Commerce, and Mr. Van Kirk, Supervising Principal of Schools, appeared before the freeholders of their own accord and advocated an increased appropriation for county mosquito work. This increase was granted.

All these results were due to an insignificant appearing four-inch centrifugal pump and a paltry \$1,800.00 expenditure of local moneys. In all, 14,000 feet of brook has been graded, the average width of which is twelve feet at the bottom, the average

depth of solid matter removed eighteen inches. The cost with overhead, not including cost entailed by county supervision, was thirteen cents a foot, as against thirty-four cents a foot as experienced by the Woodbrook Farms in attempting hand ditching on the same brook system. The value of a small pump for similar work has been clearly demonstrated and by the use of such equipment cost figures can be greatly reduced.

PRESIDENT MEYERS—Is there any further discussion on this paper?

Monmouth County is represented by Dr. G. Van Voris Warner. We will hear his paper now.

MR. H. G. VAN NOTE—Mr. Chairman, Dr. Warner is not here, but I will read his paper.

The Monmouth County Mosquito Extermination Commission has its troubles the same as most all other active mosquito commissions, particularly when the mosquito breeding season is attended by unusual and heavy rainfalls during the months of July and August, and especially last year when these months were accompanied with unusual high temperatures.

The new and unusual features of the mosquito control work in Monmouth County in the past year 1921 presented themselves seemingly almost as soon as the mosquito extermination work started.

The first obstruction the commission had to contend with was the closing up of Pews Creek which empties into Raritan Bay. This closing up was caused by a northeast storm in April 28, 29, 30, of three days' duration, which filled up many ditches with sod and other refuse matter. The mouth of the creek was opened up to relieve the congestion and the clogged ditches in the meadows lying on both sides of this creek were re-cleaned.

Again on May 1, 2, 3, another northeast storm appeared having more force than the one in April, again closed up the mouth of this same creek and flooded a considerable area of farm land adjoining the meadows. A solid mass of large and small size drift wood blocked this creek for a distance of 750 feet.

The creek was again opened, the drift wood floated out to the bay and the ditches cleaned a third time. The breeding which developed from this cause was mostly destroyed and little annoyance was felt from the small brood that emerged.

It would seem that one of the solutions to the problem to prevent this creek from closing up would be to erect a wide flume extended well out into the bay and the cost would be approximately \$4,000, but inasmuch as the total annual appropria-

tion to the commission is \$7,500, apparently the money will have to come from other sources.

It will be well to note the recent sectional developments along this Raritan Bay Shore within the confines of Monmouth County, extending from Keyport on the west to Atlantic Highlands and Sandy Hook Bay on the east.

It can be said without fear of contradiction that this development is primarily due to anti-mosquito control work. It can be substantiated further by statements of the old time residents of this territory in comparing the present mosquito annoyance with that of past years.

A civil engineer who has resided and worked in this territory most of his life told the writer last season that he well remembers the time not over 15 years ago, when laying out and mapping many of these sections on or near these meadows, that hordes of mosquitoes which were ever present during the breeding season compelled him to place mosquito netting over his head and gloves on his hands in order to perform his work properly.

On July 15th, the white-banded salt marsh species (*solicitans*) appeared in large numbers at Manasquan and Sea Girt, and their annoyance was almost unbearable to the inhabitants of these places and to the soldiers situated at Camp Edwards, Sea Girt. On account of this annoyance His Excellency the Governor complained to the State Department of Health, and this department took the matter up with the N. J. State Experiment Station at New Brunswick. They in turn communicated with the superintendent of the Monmouth County Mosquito Extermination Commission.

The outcome of this complaint was an investigation made by a committee composed of Messrs. Wilbur Walden, Assistant Entomologist, Mr. Raymond Patterson, an official of the State Department of Health, and H. G. Van Note, Superintendent of the Monmouth County Mosquito Commission.

The investigation covered a territory from Sea Girt to and beyond Sea Side Park, and it was found that an undrained area containing about 10 acres located on the Point Pleasant side of the river in Ocean County had caused most of the annoyance complained of by the governor and other residents of the Sea Girt and Manasquan districts.

It was found that the Manasquan Inlet had been closed 10 or 15 days prior to the complaint and was the cause of the flooded meadows on both sides of the river. Larvæ were found on the undrained areas and sheet water was found in many places.

On the Manasquan side of the river in Monmouth County, investigation revealed that the sheet water had disappeared through the ditches after the Inlet had been opened up. No larvæ were discovered.

This is the largest brood this section has had since the commission organized in 1914. These mosquitoes gradually worked their way up the coast as far north as Seabright.

This annoyance lasted about three weeks.

The Ocean County Mosquito Commission was at once notified and they quickly installed many supplementary ditches to drain this section, and by so doing has prevented any such mosquito annoyance occurring again from this area.

This could have not occurred at a more critical time of the season, as the largest number of officers and soldiers was stationed at the camp at the time, and the largest number of citizens from all parts of the state, including many state officers and legislators, were visitors at the camp during this mosquito annoying period.

It was but natural that the anti-mosquito work of the county was criticized, due to this onslaught of mosquitoes, and for a long time it required considerable effort to explain the primary cause of this disturbance, which of course was due to the closing up of the Inlet.

On the other hand the closing up of the Inlet may react on the minds of those officials who have the power of making sufficient appropriations for mosquito control work in the state and county. Many of them suffered personally from the irritations and annoyances of these pests while on their annual visit to Camp Edwards.

Let us hope that more liberal appropriations will be received for anti-mosquito work than have been in the past.

PRESIDENT MEYERS—Ocean County's paper will be read by Dr. Frank P. Brouwer, member of the Ocean County Commission.

MR. ENGLE—Mr. Chairman, Dr. Brouwer was appointed to tell you about Ocean County, but one of his fellow-physicians advised him not to expose his voice in public for some reason or other, so I will tell what little there is. I feel that the story of Ocean County's work for the past year is like a drug-store mustard plaster—there is not much to it. We saw our job and "done" it so far as we knew how. The epitaph on the tombstone out west—"We have done our damndest, the angels couldn't have done any better"—is appropriate in our case. When we

started work in 1915 with 40,000 acres of salt marsh from which to eliminate breeding, and with the appropriations we have had, we think we have about as much footage cut as any of the other commissions and at as low a cost.

We have something like 700 miles of ditches, whatever that may mean to the average person. We started to clean them early in the spring and finished them at an expense of about \$1,200. We have in Ocean County a lot of pools that are usually permanent and which contain fish. During the dry spell last May and June these pools dried up and the fish died. Shortly afterward we had a tide just high enough to flow over the top of the meadows, percolate thru the grass and fill the pools. If there had been a real good storm tide, we would have been better off. The result was we had a fine crop of mosquitoes early in the season all along the shore. The flight didn't go very far, but they annoyed people between the salt marsh and the upland. Some people might say we had a rather bad year for mosquitoes, but from a hotel standpoint, from a cottage standpoint, from the standpoint of those located reasonably near the ocean, we were practically free from mosquitoes last year.

Some of you may not be just familiar with the geography of our county. (Points to map.) Here are our beaches. We have taken care of the territory in the upper part of Ocean County down to the territory around the Mullica River which has a vast acreage not yet taken care of.

When, if favorable conditions arise and an enormous brood emerges, it so happens that evening that we have a southwest instead of a southeast breeze, that brood flies over on these beaches and remains for about two weeks. These are the flights about which people complain. People are willing to stand a mosquito now and then, but it is these enormous broods which come over and stay so long that succeed in ruining our reputation. I don't know how many acres we have yet to be drained. We can count the feet that we have cut, but not the feet we are to cut, nor the amount of acres yet to do.

The problem that is perhaps somewhat peculiar to Ocean County is situated on the lower part of the beach above Barnegat Inlet. There we have somewhat the same condition Dr. Headlee described in Cape May, where ponds and old glades lie back of sand dunes. These dunes are constantly forming and changing and stopping the outlets to the ditches. Various schemes were tried but the one shown on the board has been the most successful.

These dunes form at the shore line and stop the natural drainage into Barnegat Bay. A ditch was therefore cut as far as the dune and a pipe flume installed underneath. The first one put in was made of wood but we are now using iron pipe. A wooden trap is built at the shore end of the pipe so that the debris which floats down the ditch may be easily cleaned out. The pipe is laid below the sand in the bay, below mean low water. The end of the pipe turns up with the outlet about six inches above the surface of the sand.

Now it is not surprising that this will fill with sand but when the head of water in the ditch becomes great enough the sand will be forced out.

You heard the gentleman from Monmouth County refer to the trouble at Manasquan Inlet. There was a territory that was supposed to be taken care of. The state, some years ago, had done all the ditching that was necessary. We inspected it from time to time and found no breeding but when the Manasquan Inlet closed last year the water flooded the meadows and filled pockets that nobody ever considered before. We had a pretty good crop of mosquitoes from them.

The best thing that happened was that the mosquitoes flew northward into Monmouth County and some of them bit the governor. If we could get more mosquitoes to bite our governors at a time when they don't want to be bitten, it would attract a good deal of attention to our mosquito proposition, as this did. After the opening of the inlet we cleaned those ditches and cut more. We will probably do more this year to protect that section and put it in better order. The situation is not bad, particularly at the Inlet. We will not have that thing occurring again.

A good deal has been said about ditching the upland. We have another problem in Ocean County from one end to the other. I don't know whether I am enough of an artist to give you an idea, but the most of you know that the meadows are higher at the bayside than at the upland. Then there is a low place in the meadows just before it commences to rise into the upland. I don't know what the geological history of that formation is but it is usually on the sandy bottom where four-fifths of our mosquitoes are bred.

We must drain that. Our contractors with their machines prefer to cut up to a point where the plough will not cut easily and then quit and let the commission handle the rest. We have willingly supplemented their work because we can really do it better and cheaper than they can. Ditching here is a mean

proposition. The farmers who first settled here understood the situation. It was good ground for grazing purposes, because it was partly salt and partly fresh, so they dug broad ditches parallel with the upland to drain it. In our county we call them band ditches or "farmers' ditches" and have cleaned out a great many of them.

We have met with the hay cutters' objection that they cannot get over their salt meadows. We have either got to kill some of these gentlemen or build them suspension bridges, but the draining must be done, no matter what it costs, and this year we will do as much as we possibly can.

I don't know that there is anything further to say. The superintendent's report of the weather last year reads like a sort of tirade against nature, because it really was a wet summer, after we got rid of that dry spell in May; there was just rainstorm after rainstorm that kept us busy watching for breeding places.

I read of a barber in Oklahoma the other day who married a widow, a very pretty widow. He said he was very happy. He said it was such a relief to go home at night and find a face that didn't have to have something done to it. I wish that was the way with our salt marsh.

SECRETARY HEADLEE—I would like to point out that the governor of our state, by reason of his long residence in Hudson County, as soon as the mosquitoes appeared at Sea Girt, decided that that was no way for the mosquitoes to do—there was something wrong—so he called for help.

PRESIDENT MEYERS—Passaic County's report will be read by Commissioner Walter R. Hudson.

MR. FRANK WILKINSON—I regret very much the physical condition of Mr. Hudson would not allow him to be present with us at this convention. I know the deep interest he takes in mosquito control work would surely have brought him here if it had been at all possible for him to do so.

In summing up the results of our season's work in mosquito control, it would be possible to make a most favorable report were it not for the condition which existed during last July in what is known as the Eastside section of Paterson. This district can be distinguished as territory surrounded by the river as it flows from Sixth Avenue to Market Street. The condition in the Passaic River is such that we were unable to control breeding and the annoyance was indeed great. It may be said at this time that the future prospect of being able to expect freedom from

mosquito annoyance in the Eastside section, Paterson, is not very encouraging. The reason for this is that the physical condition of the Passaic River during the summer is very bad owing to there having been in it for many years past a large amount of sewage. This once beautiful river almost completely surrounds the city of Paterson and at least two-thirds of the residential part of the city. It has been used as a means of disposing of sewage for at least fifty years, and the city of Paterson from the time it numbered but a few thousand souls to the present time, when the population is 135,000 or more, continues to use this river for the same purpose. There is a diminished flow of water due to manufacturing needs, and by reason of this the rivers is now in a very unsanitary condition.

The entire distance from West Street bridge, which is in the center of the city and just below the great falls to the city line at Crooks Avenue shows deplorable conditions, the river being filled with all kinds of substances and in many places being the receptacle for all kinds of rubbish. The appearance is bad, the odor is very trying at times and the conditions for the propagation of the mosquito are very favorable.

Strange as it may seem, no part of our government seems to be interested in the river. We are promised help by reason of the trunk sewer, but it is very questionable if the completion of this wonderful piece of work will afford any relief. There is hope, however, for quite speedy betterment should permission be granted to empty the sewage in Newark Bay. Those of us who come in contact with this stream in the principal work in which we are engaged are fearful that this once beautiful river will not soon again return to its original purity and become the limpid stream it once was. We know, of course, that there are millions of tons of accumulated sewage which must be disposed of, and we also know, to our great concern, that were it not for the Passaic River and the opportunities it affords to our common enemy, the mosquito and its progeny, we of Passaic County would have a rather pleasant time in directing the affairs of the commission.

Strange as it may seem to you, it is quite difficult for our commission to have our people understand that the mosquito visitations are due to causes such as the river. If once they did understand this condition they would rise in their might and insist that something drastic be done. We say this because during the last visitation, entirely due to the river, stories were being circulated of people staying awake all night rather than attempt to sleep with the buzzing, busy, biting mosquito in the air.

In the city of Passaic the freedom from the mosquito annoyance was such that not a single complaint was made.

Clifton, the other city in the county, was also clear with the exception of some spots where conditions are uncontrollable owing to breeding places, which we have attempted to do away with but which for various reasons are still maintained.

Altogether, we report conditions in Passaic County favorable. Our people are generally satisfied with our work and our board of freeholders makes our required contribution without objection.

PRESIDENT MEYERS—Union County is represented this morning by Mr. W. H. Randolph from whom we will now hear.

MR. RANDOLPH—There has been but little variation in our work during the past year. One interesting feature of the work in Union County was the securing of a contract from the Central Railroad of New Jersey to shorten Great Ditch, one of the largest original waterways on the salt marsh meadows between Elizabeth and Newark. A ditch 13 feet wide and $5\frac{1}{2}$ feet deep was dug at a cost of 50 cents per lineal foot, about 5,000 feet being dug altogether with our power dredge. This benefited the railroad company by securing a better supply of condenser water for its shops and also provided a better outlet for the southern portion of our meadows. The cost was entirely borne by the railroad company. The cutting of this shorter ditch will allow for the eventual reclamation by the filling of about 100 acres for a large railroad yard.

PRESIDENT MEYERS—Mr. Wilbur M. Walden, of the Experiment Station, will now summarize the county reports.

In summarizing the county work it might be well, first, to point out two interesting and unusual features of the county appropriations for the years of 1921 and 1922. The total appropriations for 1922 is 7 per cent. larger than the total for 1921. Five counties have increased their appropriations from \$500 to \$11,700. On the other hand, certain counties have decreased their appropriations from \$1,000 to \$5,000.

Weather conditions have played an important part in bringing before us some new problems in mosquito control work. On the Delaware coast of the state in Cape May County the outlets installed were completely clogged by the making up of the beach. This means that a modified type of outlet ought to be devised to take care of abnormal weather conditions. In Ocean County in Barnegat Bay the state has installed a cast-iron pipe outlet which has been described by Mr. Engle and which has worked successfully. The rise and fall of tide in the bay, however, is

only eighteen inches. An experimental outlet of this nature should be placed on the Delaware shore where there is a tidal difference in elevation of six feet. I think the money would be spent wisely in an experiment of this kind.

Mr. Reiley brought out an interesting fact in telling us that *Aedes cantator* were found on his undrained marshes in the month of February, 1921. The fact that they were found is not so unusual as the fact that they were in as great numbers as *Aedes sollicitans* can be found in midsummer.

Again, due to the unusual weather of last summer, the Manasquan Inlet in Monmouth County was closed absolutely for a period of three to four weeks. This condition made it impossible for any of the subsidiary drainage systems to the Manasquan River to function, with the result that a bad brood of mosquitoes got on the wing and nested not only the National Guard encamped at Sea Girt but the governor himself. The latter immediately got in touch with the State Department of Health making a formal complaint asking that something be done to rid Sea Girt of the infestation. Representatives of the department of health, Monmouth and Ocean County Mosquito Commissions and the State Experiment Station made an investigation and determined the cause of the trouble. Through the activity of the federal government in opening the Manasquan Inlet and the work of the two mosquito commissions in establishing better drainage systems in the areas adjacent to the river the mosquito breeding conditions were eliminated. This is the first time we have had an opportunity to bring home personally to the governor the value of anti-mosquito work. The mere fact that the governor called upon us to abate the nuisance shows that he must have had faith in our ability to do so.

An instance of the need for speeding up the initial work in those counties where the drainage is still incomplete appears in the fact that during the last part of July and the first part of August weather conditions were such as to cause several large broods of mosquitoes to emerge from the undrained marshes of Ocean, Atlantic and Cape May Counties. Knowing the mosquitoes were coming to Atlantic City, Mr. Reiley told the people through the newspapers when they could expect an infestation. They were not disappointed. Having had this advanced information it is interesting to note that in few cases did the people complain. In general they seemed to realize the causes of such a condition.

I would like to call attention to a few of the new features of mosquito control work brought out in the papers just read. Hud-

son County has demonstrated that thirty-inch ditches one thousand feet apart will drain a cedar swamp efficiently when the water table is sufficiently lowered by pumping. A few years previous Bergen County accomplished the same result in a cedar swamp having a good fall to its outlet, but Hudson County has made the conclusion final.

Essex County has demonstrated that a ditch cleaning machine is feasible although the present one is not yet a finished machine.

Bergen County has successfully planned and built a bulkhead one hundred and ten feet in length with three flumes. This county has also shown us that a dike can be successfully built without a core.

There is no need to touch on publicity methods for you have all heard of that feature of the work brought out admirably by Mrs. Boynton, Mrs. Olsen and Mr. Howell and Mr. Gies.

And lastly, I would like to mention the work of the Associated Executives. Without the outlay of a single penny from the organization they have given us two valuable contributions to mosquito control work, the moving picture and the Mosquito Manual. I do not have to describe them, you have seen both.

This year the executives will endeavor to study the salt marsh conditions with the following objects in view:

1. To evaluate in terms of porosity and physical characteristics of the soil the width, depth, length and frequency of ditching to free a given area of open salt marsh from mosquito breeding.
2. To evaluate the effect of mosquito drainage upon the important elements of the salt marsh vegetation.

In the above we assume that the condition and nature of vegetation is primarily the result of the average height of water table and possibly seed distribution. We also assume that the condition and nature of vegetation indicates a difference in porosity, physical character of soil and salinity of the soil solution.

In conclusion, I feel that we may look with pride on what we have accomplished in 1921 and can look for greater results in 1922.

PRESIDENT MEYERS—After this convention has adjourned you will have a new president and I want to say that my year of being president has been a very delightful one.

For seven years my connection with the work has been one of increasing interest and one I watched closely and proudly and I find that the interest increases continually, for much the same reason that Shakespeare describes the popularity of Cleopatra in the streets of Cairo. The infinite variety which neither custom

nor age could stay—its constantly increasing interest to me and I know it will continue that way.

The purpose of these few words is to thank everyone who has had to do with my office, for their unfailing and delightful courtesy. (Applause.)

MR. ENGLE—Mr. President, I have been thinking that we have such an indefatigable worker among us, who has accomplished so much on such a large scale, that I would be glad to hear from him some comments, criticisms, possibly commendations that have occurred to him since he has been with us. I refer to Mr. Le Prince.

MR. LE PRINCE—There is very little I can say. This is excellent work but there are times when we are surrounded by agencies that are so close to us that we can't see them and sometimes don't make use of them. I am very glad to know that the most important agency you get to help you has decided to assist. I might state that we should be doing very much less work than we are doing down in the south to-day, were it not for the assistance we have received from the various women's clubs. Don't attempt to get them to do all your work for you and do help them to help you. That is very essential. I have seen the entire load put on the willing person too often.

There is one other point I think is an extremely important one that has been referred to by several speakers here—that is, this question of co-operation. I would like to ask you all to consider seriously this fact. What percentage of the public in each of your counties has got your message? Do 5 per cent. of the people know what you are driving at? And if so, is it not possible to get more persons interested?

One of the best men we have had in the field was afraid to get up and speak before an audience. He has developed into a good persuader. That man tried to write for the papers and he was very successful in having all of his efforts returned to him. They were not published and somebody suggested he go direct to the editors and find out what was the matter. He learned what the editors wanted and what they were hunting for and his idea of appealing to the public can be found in the proceedings of the malarial field workers, U. S. P. H. S. Bulletin, under the heading of Effective Publicity.

Now the main point I wanted to get at was I am confident that we can get at a big percentage of the population that have not yet been touched. There are many ways of doing that. It is for you to find out how to get at those people in the proper

way. I believe it is possible to interest these people which we state are never going to help us. Our best assistance is coming from those who fought us hardest. Some of our best workers are men who are most quiet and whom you hardly expect results from. We need the co-operation of everybody and have left a large part of public out of consideration.

In some formerly very backward counties, where the work has been properly done, we are unable now to keep up with the work; it is advancing so rapidly, so don't give up hope. It is worthwhile fighting for and we must not expect the ladies to do all the work. They will do a lot more than they should have to do. They will help. They have pushed our work forward and they will push your work forward, but help them to assist you. (Applause.)

MR. HOWELL—I am very much interested in the schedule of figures. I am wondering how it appeals to the rest of the members of the association who look upon it. I wish to express my hope that those figures will appear in the record. To me, they are intensely interesting, particularly as I come in touch with the freeholders of all of these counties. I should be glad to have those within very close reach.

TABLE II.

SALT MARSH ACREAGE AND APPROPRIATIONS FOR 1921 AND 1922.

<i>County.</i>	<i>Acreage.</i>	<i>1921.</i>	<i>1922.</i>
Bergen,	8,378	\$31,850	\$30,620
Monmouth,	3,378	7,500	7,500
Atlantic,	53,325	28,500	30,000
Middlesex,	8,199	6,000	10,000
Hudson,	11,468	48,000	60,000
Passaic,	16,000	16,500
Essex,	4,631	73,800	68,250
Union,	4,413	35,000	40,000
Ocean,	40,400	12,000	12,000
Cape May,	53,638	15,000	15,000
Total,	\$273,650	\$289,870

MRS. OLSEN—I should like to ask if the boards of freeholders are responsible for the amount of money expended.

PRESIDENT MEYERS—Yes.

MRS. OLSEN—Then it is really up to the women of Middlesex County to get busy with their freeholders to get the money they need. We have less money than any other county—\$6,000 raised to \$10,000.

PRESIDENT MEYERS—Mrs. Olsen, the procedure is this: The mosquito extermination commissions make out budgets which are submitted to the Director of the State Experiment Station in New Brunswick for his approval. They are then submitted to the boards of freeholders who in turn are supposed to include in their budgets the amounts requested.

MR. HOWELL—The mandatory law places in the commission's hands the power to require of the board of freeholders a certain fixed portion of a mill of the ratables of your county, if they wish to, depending on whether the counties in question are of the first or second class. If our commission should ask for the maximum amount in Bergen County the freeholders would have to raise something in the neighborhood of \$60,000 instead of \$30,000—they would be helpless in the matter.

SECRETARY HEADLEE—Mr. Chairman, for the benefit of the ladies who perhaps are not entirely familiar with the way this law operates, perhaps I ought to explain my experience in the administration of this law. When I first came to the state the County Commission Law of 1912 had just been passed. I assumed, Mrs. Olsen, that the law meant exactly what it said. It provided that a mosquito commission should be appointed by the Justice of the Supreme Court presiding over the courts of the county. Those commissions were appointed in twenty-one counties of the state, and Essex and Union had commissions at work at that time. They were the only counties in the state that worked in the summer of 1912.

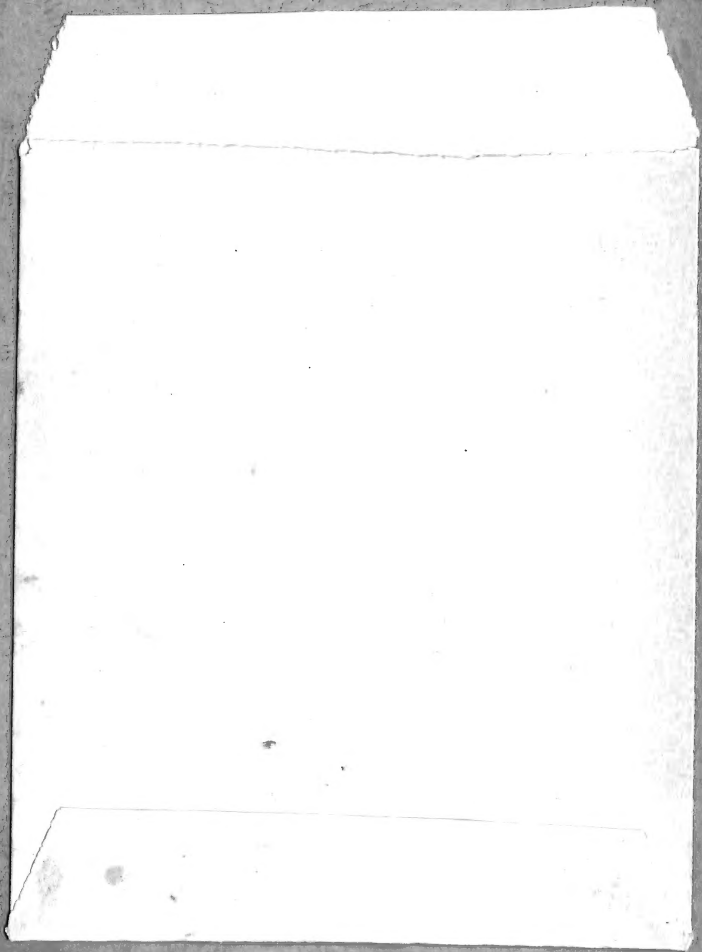
I got in touch with the commissions in the counties of Camden, Mercer, Gloucester, Hudson, Bergen, Middlesex, Monmouth, Ocean, Atlantic and Cape May. We began to lay out plans for mosquito extermination work in those counties. We prepared budgets of what we thought was necessary to make a decent start. Remember, that was in the fall of 1912. Everything seemed to be all right. I didn't consult the boards of freeholders; in fact, I didn't know the boards of freeholders cut the figure in the State of New Jersey that I know they now do. The legislative session came on after the first of the year of 1913 and the legislators literally fell over one another to put in repealers, and the shouts against the Mandatory Mosquito Law reverberated all over the state. The various newspaper writers, editorial and otherwise, poured forth their vials of wrath on this law which would compel the people of New Jersey to spend such and such sums. They figured it on the basis of the mill tax to arrive at the amount. It ran up into half a million dollars or thereabouts.

That first year's experience taught me something. I began to see that while mandatory laws were mandatory and could be used, if used unwisely they could be knocked higher than a kite. I saw that if we were to get this work on its feet we would have to develop it as public sentiment backed it.

PRESIDENT MEYERS—If there is nothing further, this convention stands adjourned.

(The meeting adjourned at 12.30 P. M.)

Adjournment.



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