

MOSQUITO ENGINEERING.

A New Science to Rid the Country of the Malaria-Conveying and Annoying Pests.
Practical Extinction of Their Breeding Places Secured on the North Shore of Long Island.

SOMEWHAT extraordinary as it may seem, there is reason to believe, from recent developments in practical science, that the mosquito has had his day. The mosquito's doom was sealed, theoretically, when the famous experiments upon the Roman Campagna proved conclusively that under certain circumstances this flying torment was death-dealing, and bore with him the responsibility of malaria. From that time forward the mosquito, save in remote countrysides, ceased to be regarded merely as an unpleasant visitation of Providence. However, only now has the vital problem been solved. A new branch of science has arisen that deals with the mosquito's destruction, with the permanent ridding of him from certain localities. This is the new science that for want of a better name at its birth may be called Mosquito Engineering. The man who has worked the problems out and can fairly call himself the science's founder speaks of himself as an Engineer in Economics.

It is one thing to prove scientifically that mosquitoes may be a source of danger; quite another to abolish them completely from a particular district of large extent. It is this latter, the thoroughly interesting and practical end, that has just been accomplished. A little volume published privately and hardly now off the press tells the story, one that it is by no means unlikely will rank as one of the important chapters of science for many a long year. The book is the combined reports of half a dozen scientists of standing, made for an association of wealthy property owners, detailing the work of practical research and of engineering. It deals with a fine strip of coast some thirty miles long by four or so in width, but a short distance from New York, taken up with scores of handsome country places and estates. Every inch of this territory has been explored and mapped out with reference to mosquito breeding places. Several of the worst points have been "engineered" with the result that mosquitoes have been exterminated from them. The association spoken of now stands ready to do more work on their extensive territory, the preliminary essays having proved such distinct successes from the practical standpoint.

The little book has the title "Mosquito Extermination, North Shore, L. I." It is the North Shore Improvement Association that has prepared this and has put into operation this great movement for mosquito destruction which has not its counterpart anywhere else in the world. While scientists have been discussing, this band of estate owners have been acting, and this report is the first complete account of what they have started to do and have already accomplished that has been issued. It is headed by a letter that in itself is a report, dated in February, from Dr. L. O. Howard, Permanent Secretary of the American Association for the Advancement of Science, the great mosquito expert of the country and chief of the Division of Entomology, United States Department of Agriculture. It was Dr. Howard who, called into conference at the very start, long before the association as an association had got to work, or even thought of beginning, encouraged one estate owner to attempt to improve his conditions. Dr. Howard read with care and critically the reports that follow his own, as he states, "in galley proof," and he indorses them all.

The field covered and the strip of country in question is the north shore of Long Island, from Port Washington along the Sound coast to Huntington Bay, as far inland as the Hempstead Plain, taking in Wheatly Hills and the famous country places there. It was not that this was a mosquito-ridden country. Close to New York there are many worse. This was precisely what recommended it to Dr. Howard as an ideal starting point for the work of preliminary experiment. If the conditions had been exceedingly bad the task of reforming them would have been too great a one for private purses. Dr. Howard thinks that some of the localities of the country will need the Government to come to their aid if the work of mosquito extermination in their field is to be done thoroughly and conclusively.

But the north shore of Long Island between these points certainly had mosquitoes, and there were even some bad "pockets" in marsh land close to the shore that made living on one or two of the country places very uncomfortable for several months of the year. Dr. Howard surveyed one large country place and pronounced his opinion. In the very nick of time, just when the work was waiting for his hand, sprung up this engineer in economics, who has brought, these past two years, mosquito engineering into being and has given it a standing and a form. He took in hand, first this one country place, then an entire neck of land that embraced one large country residence, several smaller ones, and a yacht clubhouse. From both of these districts mosquitoes have been definitely driven.

Henry Clay Weeks, a resident of Bayside, L. I., was this good genius who established and set on a footing mosquito engineering, and his reports fill much of the volume mentioned. Long thought out, (for he had this theory for the destruction of mosquitoes in mind many years, only waiting

for an opportunity to put it into practice.) Mr. Weeks's plan was simple in conception. It went direct to the root of the matter, in a fashion that has since been scientifically proved to be the only practical way. He solved the problem by engineering tactics pure and simple. Where others were temporizing with sprinkling petroleum this man ditched and dug. Constructing canals and dikes, he drained marshes. Stagnant pools and ponds he either filled in, drained off, or supplied with a permanent outlet. Gradually there passed out of existence mosquito breeding places that had existed during several generations of men. As mosquitoes are one of the shortest lived of insect races, as each breed lasts but a few days, and as they do not travel far, this abolishing of their breeding places meant the abolishing of the mosquitoes themselves.

The results proved this definitely. In the Summer of 1900 Mr. Weeks "engineered" the land, including a bad marsh or two at Lloyd's Neck, just beyond Oyster Bay, the property of W. J. Matheson. In the Summer of 1901 he took in hand a much larger problem, the clearing off of the meadows of Centre Island, Oyster Bay, where the Seawanhaka-Corinthian Yacht Club has its house and where Colgate Hoyt's country place is located. Here and there, as temporary measures, Mr. Weeks used petroleum and found that his "petrolizing" was successful, though not of the permanent value of his engineering.

Both of these pieces of engineering work were eminently to the point of abolishing mosquitoes from the immediate region. Today Centre Island and Lloyd's Neck, though originally as badly mosquito ridden places as the north shore of Long Island could produce, are practically free from these pests. The report includes a letter from Colgate Hoyt, written to Paul D. Cravath of the committee of the North Shore Improvement Association, that bears positive testimony. He writes:

I have read with great interest Mr. Henry C. Weeks's report to you on what was accomplished on Centre Island during the season of 1901, and I most heartily indorse all Mr. Weeks has said. I do not think, however, that either he or I have as yet solved the problem of the most economical, combined with the most successful, way of draining the outer great meadow on Centre Island. Owing to the unusual high tides and other conditions, the time and money expended there did not bring about the results we all so much wanted; and I personally question as to whether this can be successfully accomplished, except by the expenditure of very much more money than we had heretofore estimated.

Mr. Weeks's work in ditching and draining the inner meadow, in filling low places, and in thoroughly petrolizing ponds and stagnant pools, and eliminating, as far as possible, other sources of trouble, was in every way successful and gratifying; and, although, as he says, the season of 1901 was unusually favorable to the breeding of these pests, notwithstanding this, Centre Island was practically entirely relieved from mosquitoes, and for the first time, at almost all hours of the day and evening, we were able to enjoy the use of our piazzas and lawns without the annoyance of these pests.

I most heartily commend you and your associates in the work of fighting the mosquito along the north shore of Long Island, and from the results we attained last season on Centre Island I am confident that by intelligent and persistent work the mosquito can be entirely and permanently annihilated from our beautiful shores.

Mr. Matheson's work of mosquito reformation on his fine place at Lloyd's Neck in the Summer of 1900 was done at his own expense, and the work at Centre Island last year was paid for by the Centre Island property owners. While the engineering at Centre Island was yet in an incomplete state, however, the North Shore Improvement Association realized its value. They saw the ground was but being scratched for what could be made one of the most distinctive of countryside improvements and the association was not slow to act. They retained Mr. Weeks, still actively engaged in digging at Centre Island, and commissioned him to map out a plan for the mosquito reclamation of the entire shore and well back into the country from Roslyn to Cold Spring. The association secured Prof. Nathaniel S. Shaler of Harvard, a recognized authority on marine marshes, to make a special examination of the salt marshes in this locality, "with a view," as the report says, "to recommending the best means of eliminating them as the most prolific breeding grounds of mosquitoes."

Nor did this cover the whole programme of the association to cope with this great question. It also engaged, as entomologists, Prof. Charles B. Davenport, Professor of Entomology at the University of Chicago, and head of the Cold Spring Biological Laboratory, and F. E. Lutz, a young instructor in biology at the University of Chicago, who has made a special study of mosquitoes. Precisely what these men and Engineer in Economics Weeks did during the Summer a page from the report tells completely:

Prof. Davenport and Mr. Lutz and their assistants made a detailed examination of the entire territory and located, as nearly as possible, every breeding place of mosquitoes, including the smaller pools and streams and even the various artificial receptacles of water. [Note.—This means that they scientifically studied horse troughs, cisterns, rain buckets, gutters, pails, and upturned empty beer cans in front of rural public houses. They made thorough examinations of water at many different points in all of these, and were so consistent as to test the water in the small pools in marshy ground made by the hoofs of cattle. Much of this extreme attention to detail is not

brought out fully in the report. It should be especially noted, however, for its scientific value is very great. Many large colonies of mosquitoes were found, for example, in horse troughs and in cisterns, and the importance of these as mosquito breeders was discovered to be especially pronounced. I have especial authority for bringing this interesting set of points emphatically forward, for I was up with these men on the north shore several times last Summer and followed their work. The care they took in gathering facts cannot be too strongly stated.—C. C.]

Their detailed reports were delivered to Mr. Weeks, who, with his assistant, examined each body of water in which mosquito larvae had been found, with a view to devising the best means of preventing the further breeding of mosquitoes therein.

A map of the entire territory has been prepared, on which is located every natural breeding place of mosquitoes reported upon by the entomologists and the engineer, so that any resident of the territory can, by examining this map and the reports of Mr. Weeks, Prof. Davenport, and Mr. Lutz, ascertain the sources of mosquitoes upon his property or in his immediate neighborhood and the precise means recommended for affording relief to himself and his neighbors.

The map spoken of is not the least interesting portion of the report. It is made on a great scale, despite the fact that comparatively few miles are covered, is six feet long by some three broad, and is drawn in such exact detail that it includes every building in the district. By different shades and markings of pale blue it shows isolated ponds, tidal flats, salt marsh, fresh marsh, fresh water streams, fresh water courses, wooded areas; and by figures in red and in blue, 1, 2, 3, shows the mosquitoes found at each of these points, mosquitoes anopheles and mosquitoes culex, (the former the malaria bringers, the latter the mosquitoes that bite the most severely, and are the most annoying.) thus: Red figures—1, anopheles present; 2, anopheles common; 3, anopheles prevalent. Blue figures—1, culex present; 2, culex common; 3, culex prevalent.

As yet, outside of Lloyd's Neck and Centre Island, the mosquito work is largely preparatory. It is a huge undertaking that is being studied over carefully and will not be hastily started. Scientifically the field is clear and all the preliminary experiments and investigations have been made. Piece by piece marsh and meadow land will be taken up and made mosquitoless, drained, and dyked. It will be costly work, for each problem must be taken up independently, solved by itself. But the association does not fear the expense. Too many wealthy men and men of progressive ideas are within these bounds. All this spells improvement, the adding of large values to property very plainly.

Some active engineering work has, however, been taken up. In the Frost Creek marsh—in whose locality are the country places of William D. Guthrie and Paul D. Cravath—a dyke and sluice gate on Mr. Guthrie's property, as Mr. Weeks says in his portion of the report, "are drying out his marsh quite effectively, and doubtless when his drainage plans are completed there will be little if any trouble here."

In all, Mr. Weeks figures, something like \$14,000 will have to be spent on this region to destroy the historic and familiar breeding places, so that countless new generations of the pests may not breed there. In some cases he suggests petrolizing, in others, where there are ponds, stocking with fish is recommended, while regarding still others he insists that "engineering" is the one and only solution.

Prof. Shaler makes as an especial point that these marshes of the north shore once redeemed will not only do away with the plague of mosquitoes, but will gain greatly in money value themselves. They are practically useless now, but reclaimed there are vast possibilities for truck farming or for grazing meadows. "The fertility of fields," says Prof. Shaler, "which have been won from marshes is of the highest order, and their endurance to cropping without manuring much exceeds that of any other tilled land except it may be those in certain arid districts which have been irrigated. The range of crops for which they, if not at once, yet in time, become fitted is likewise great, including all our ordinary crops of farm and garden."

This has its emphatic importance, for it makes the new science of mosquito engineering worth while, in so much as it will create for these property owners, at relatively small expense, valuable lands out of their at present waste ones.

It is this point that seems to strike Prof. Shaler most forcibly, judging from his report. With words that from his scientific position carry much weight, he indorses the plans made and partially under way. One phrase of his is especially significant: "If carried to a finish (the plans) and adequately maintained, they bid fair not only to relieve this admirable district of its pests, but to make it the first instance and example of a kind of work which is to be of great benefit to mankind."

The conclusions of the association's Executive Committee, drawn from the reports of their experts, are, in part:

Mosquitoes breed chiefly in stagnant or slowly moving fresh or brackish water. That mosquitoes breed only in water is established beyond dispute. They never breed in the air or in bushes or in damp places, as is commonly supposed. There must be a distinct accumulation of water. While they do not breed in rapidly moving water, they breed to an appreciable extent in clear water.

Mosquitoes are not produced in marshes which are covered by salt water at every tide. While salt marshes are the most productive sources of mosquitoes, the breeding takes place principally in the pools of water left by the high monthly tides, which, not being reached by the intermediate tides, become brackish. If the accumulation of these brackish pools on a salt marsh can be prevented, it will cease to be a breeding place for mosquitoes.

Mosquitoes, as a rule, do not travel far from their breeding places. Nor are they,

except under exceptional circumstances, carried far by winds.

The Executive Committee of the association announces that with these definite conclusions in mind they will remove, throughout all this territory, many useless accumulations of water by draining or filling. They will either drain salt marshes, keep them covered with salt water, or treat them so as to prevent accumulations of brackish water between extreme tides. Some meadows can best be dyked and drained, others can best be kept flooded by tidal salt water ponds. In others it will be best to fill up the small holes in which the water accumulates between tides and regulate the banks of the tidal streams.

They will straighten out the banks of streams and regulate courses so that there will be no ponds of stagnant water in them, and hence no mosquitoes breeding there. They will use goldfish, sticklebacks, minnows, and sunfish in some ponds. These fish greedily devour the mosquito larvae. They will use petroleum periodically in other ponds. They will see that throughout the territory rain barrels, tanks, cisterns, cesspools, drains, and catch basins, all are kept carefully covered. "Rain barrels and tanks," the report reads, "should be kept covered and the water should be drawn from the bottom by spigots. Mosquitoes will not breed in cisterns if they are kept covered, especially if a few fish are introduced."

CROMWELL CHILDE.

A CHANGE OF HEART.

THE Woman was conscious of a positive thrill of affection for her worn, old carpet slippers when she realized the extent to which they had helped put her victim in her power.

She had sped up the stairs that led to the Principal's office so swiftly and silently that that august personage had never heard, even when she pushed open the door that led to the pleasant little room, with its homelike carpet and businesslike desk.

The visitor had never been so near so much concrete comfort before, so she decided to have a good look before beginning the attack. The "look," however, began and ended in a leisurely survey of the Principal, who sat all unconscious with her back to the door. It included the slim, white, well-kept hands. After a glance at them the Woman wrapped her own toll-stained ones in a corner of her shawl. It traveled to the strong, white neck, with the crisp little "scolding locks" lying against it, and the dainty white turn-over collar encircling it. It was all very well, the Woman told herself, it was mighty easy to have a white neck and white hands when you didn't have to hang out clothes in all sorts of weather—other people's clothes at that. At any rate neither her daintiness nor her whiteness was going to save her. The Woman had promised herself to administer what she called a "tongue lashing" to the trim young person before her for daring to "put back" her Carrie, and deliver it she would. So she drew a long breath before announcing herself by a beligerent "Ahem," when a diversion occurred, and she stepped aside into an alcove, that commanded a view of the interior of the office. The diversion was caused by the entrance through another door of a group of children. The Woman knew them all; there was Mrs. Stump's Otto, Mrs. Wokal's Nina, and what she termed the "Dago's little girl." They were all muddy, all damp, and all happy, and each tiny fist cherished some dilapidated specimens of the earliest Spring flowers.

The Principal swung around her chair and smiled earnestly at the carpet, and three guilty-looking little children scrambled for the mat and began a vigorous wiping off of muddy feet; then they returned and paid tribute, with the almost dead blossoms.

"You gotter put 'em in water," said Nina.

"They come outer Burden's woods," said "the Dago's little girl."

"I showed 'em how to get back; they was lost," boasted Otto.

The Principal received the gifts with appropriate exclamations of surprise and delight. She placed the dejected-looking "Jack in the Pulpit" beside the fainting violets and the dandelions, with microscopic stems, and eyed the disreputable looking result with satisfaction. Then the trio beamingly started to depart. At the door Otto stopped.

"The rain wuz first in the sea before it got in the wuz," he volunteered.

"You don't say so?" ejaculated the Principal.

"Yes; it wuz in the nature story to-day."

"The sun brung it up to the sky," cut in Nina, jealous of Otto's gibberish.

"When it falls down again," said the "Dago's little girl," "It's 'cos the clouds bunk their heads together and they have to cry. I know a song about it."

"Could you sing it?" asked the Principal.

"Yes'm," and in a treble as shrill and high as a grasshopper's, she began:

Two little clouds, one Summer day,
Wuz lying thro' the sky;
They went so fas' they bunked their heads
An' both began to cry!

"That's perfectly lovely!" said the Principal.

"The cunnin' little toads," said the Woman, and stole forth again, smiling.

Not until she had reached home did she remember that beautiful "tongue lashing" as yet undelivered.

"It must a bin Carrie wuz dum," she commented; "I don't believe that Principal would put no one down a class for spite."