

Florida's Mosquito Control System

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SUBTROPICAL FLORIDA, with its 1,221 miles of coastline, heavy rainfall, warm climate, and flat topography, gives rise to an abundant and unique fauna. Included in this unusual fauna are a number of arthropods which are greatly annoying and which carry diseases of humans.

The extensive beaches of the State are sometimes laden with seaweed, the larval habitat for dogflies, or stableflies (*Stomoxys calcitrans*). The adjoining flat land mass is pocked with tremendous salt marshes, swales, swamps, fresh water marshes, ponds, lakes, or streams which afford an environment conducive to the heavy production of 67 species and subspecies of mosquitoes, 22 species of sandflies (*Culicoides* spp.), several species of yellowflies (*Chrysops* spp.), as well as many other species of arthropods annoying or dangerous to man.

Early Observations on Mosquitoes

One of Florida's first counties, now Orange County, was once named Mosquito County.

Mr. Mulrennan, director of the bureau of entomology of the Florida State Board of Health, has served as entomologist and malariologist in Florida and Texas since 1932. Dr. Sowder, Florida's State health officer since 1945, has directed various State and local venereal disease control programs. He has also served as consultant for the Federal War Shipping Administration and for the former Public Health Service district 9, Dallas, Tex.

There was also a Mosquito Lagoon and a Mosquito Creek. The 1951 legislature abolished the name of Mosquito Lagoon, located in Volusia County.

The early settlements of Florida were almost entirely within the area later defined as the "malaria belt." Tallahassee, the State capital, was in the midst of this region. The Count of Castlenau, in his Views and Recollections of North America, describes the conditions which prevailed in the city in 1842: "But unfortunately in opposition to these numerous advantages there are the greatest plagues that can afflict a new settlement; an unhealthful climate; every year bilious fevers of a most dangerous nature spread consternation in the whole region. Then all the shops are closed, the fear of the epidemic and the stifling heat cause the planters of the neighborhood to leave the city, and all the inhabitants who can afford the expense of this kind go to the northern part of the United States to seek a more salubrious climate; the merchants take advantage of this season to go to New York or Philadelphia to place their orders, and the planter goes to Niagara or Saratoga Springs to display his luxury and spend in 3 months his year's revenue.

"However, although the climate is dangerous for strangers at all times, the most insalubrious months are August, September, October, and November; then no one can be sure of escaping the plague, neither the planter who has been settled in the country for years, nor the Negro born in the midst of the miasma of Carolina or under the burning sun of Georgia. The comparative extent of the huge cemeteries is a sad

warning for one who, charmed by the beauty of the sight, would want to establish himself in this region."

This "insalubrious situation" prevailed in Florida for more than three centuries, but in 1948 the last definite case of malaria transmission was reported, and the last case of yellow fever was reported in 1905. The reported cases and deaths from malaria for the period 1918-53 show that malaria had practically disappeared in 1942 (fig. 1). The peaks in 1944 and 1946 were attributable to returning war veterans.

Inception of Malaria and Mosquito Control

The direction of approach to the control of malaria was recognized in Florida as early as 1900 by Dr. J. Y. Porter, Florida's first State health officer, when he stated, "It was observed that the attacks [of malaria] were more than usually fatal along the river bottoms, marsh lands, and in the flat woods country. . . . It now is seen that it is not the germ itself which rises from the soil or water, but the *carrier of the germ*." Dr. Porter was also a courageous investigator of the means of contracting yellow fever. He once slept three nights in the bed of a man who had died of this disease in order to disprove the theory that fomites were responsible for its spread and to discourage the burning of bedding, the practice at the time.

Despite the early recognition of the cause of malaria, no organized effort was made to control it until the World War I period. At that time, drainage and larvicidal measures were introduced at Camp Johnston, near Jacksonville, jointly by the Army, the United States Public Health Service, and the Florida State Board of Health as a part of the general sanitation program around military establishments.

After this initial start, the Florida State Board of Health undertook its first malaria control project in 1919 in the city of Perry, a typical malarious community in Florida. At that time it was one of the largest projects of the kind in the country and involved the removal of 47,000 cubic yards of earth for drainage canals and ditches at an expenditure of \$28,000. The cost of the project was borne by Perry, Taylor County, and the Burton Swartz

Cypress Company. The State board of health supplied the technical supervision. A letter from the lumbering plant, after the work was completed, stated that the plant had been more than repaid for its share of the cost by the increased output resulting from the better health of plant employees.

First Organized Control Effort

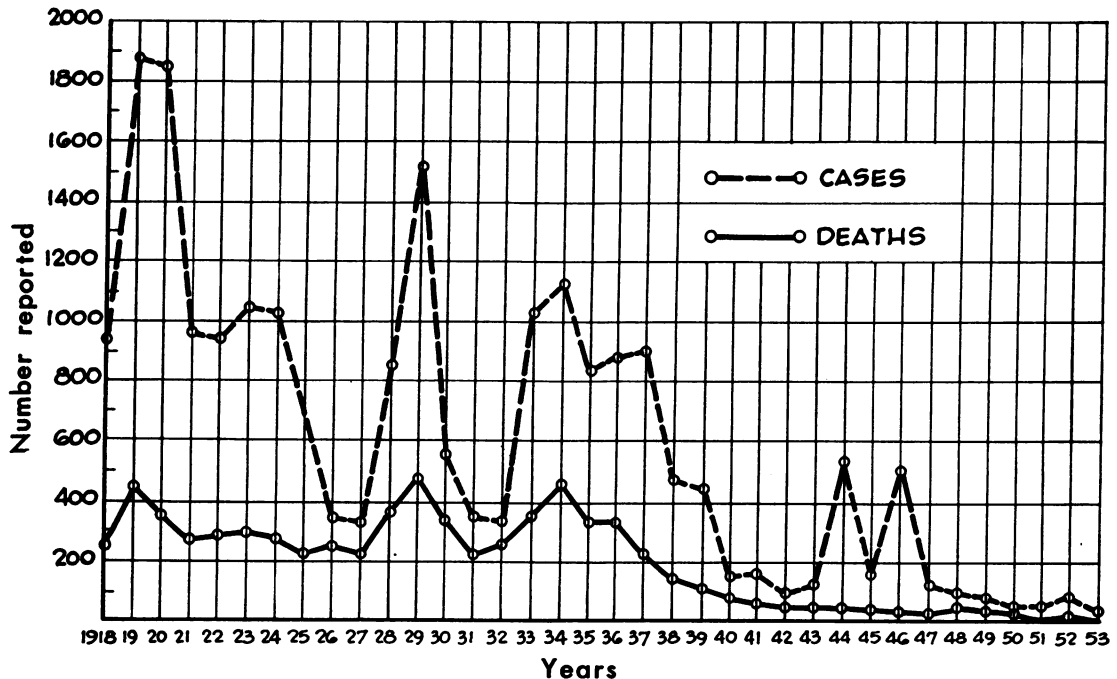
A great forward step in the control of mosquitoes in the State was the organization of the Florida Anti-Mosquito Association in 1922. The first meeting was called by Dr. J. Y. Porter, who, although no longer State health officer, retained a deep interest in the work. This organization has been primarily responsible for the promotion of legislation for the creation of mosquito control districts and of legislation making State aid possible to mosquito control districts and counties.

Another milestone was reached in 1931 when the Rockefeller Foundation established a malaria research station at Tallahassee to work with the State (mental) hospital at Chattahoochee and the State board of health. This station, under the direction of Dr. Mark F. Boyd from 1931 until its closing in 1947, performed work in the malaria field of inestimable value, not only to the State of Florida, but also to the world as a whole.

The State received further recognition in the mosquito research field when the United States Department of Agriculture, Bureau of Entomology and Plant Quarantine, established in 1932 a mosquito research station at Orlando. The station, in new quarters recently dedicated, is still functioning with funds made available by the Armed Forces. The research work of this station has been of great value to the mosquito workers of the State.

The year 1933 marked the beginning of widespread malaria and pest mosquito control operations throughout the State. The work was performed by the Federal relief organizations, the Civil Works Administration, the Emergency Relief Administration, and the Works Projects Administration, until 1941 when relief funds were withdrawn. A tremendous amount of drainage work was accomplished. The records show that more than 1,582 miles of ditches

Figure 1. Reported malaria cases and deaths in Florida, 1918-53.



were dug, with the removal of 225,287 cubic yards of earth. In 1935 the Public Health Service assigned engineers to the State to supervise the work.

In 1937 the Rockefeller Foundation, in cooperation with the Florida State Board of Health, the city of Pensacola, and Escambia County, organized a demonstration project for the filling of mosquito breeding areas and the lining of ditches with concrete "Panama inverts" and "Pensacola inverts."

In 1941 a bureau of malaria control was created within the Florida State Board of Health to study and make recommendations for controlling malaria in the State. The bureau was given the distinct recognition, during World War II, of being called upon by the Surgeon General's Offices of the Army and the Navy to set up a training station to teach the procedures of malaria control. Each class contained about 15 officers who were sent to foreign theaters of operation after 3 weeks' indoctrination in malaria control procedures. In all, about 200 officers were trained during an 18-month period. At the end of this period the Navy and the Army set up their own training schools at Bethesda, Md., and in the Panama Canal Zone.

In 1942 the Public Health Service set up the first Malaria Control In War Areas project at Tallahassee. Based on this first program, projects were set up at all military bases in the State, and similar projects were established in all the other southern States.

A program of DDT residual house spraying to eradicate malaria was inaugurated in 1945 in counties which had a high malaria rate in the past. All funds were supplied by the Public Health Service. Local funds were provided during the last part of the program, which was terminated in 1949. In addition to the house spraying program, a DDT dusting program was conducted in all counties having a high typhus rate.

In 1946 Florida's bureau of malaria control was abolished and a division of entomology was set up in the bureau of sanitary engineering. The division was responsible for promoting and carrying out all arthropod control work and for the administration of all arthropod control funds, as well as the enforcement of the Structural Pest Control Act. In 1953 the division of entomology was raised to independent bureau status.

Mosquito Control Legislation

The first State law on mosquito control was passed in 1925, making it possible for a county to vote for a mosquito control district and for the residents to tax themselves for the work. Another State law was enacted in 1929, and in 1941 the legislature provided for three alternate methods for establishing mosquito control districts in the State.

These methods are similar in many respects, but differ in the composition of the boards, taxation, bonds, and political subdivisions covered by the laws. By one method residents can establish by vote any part of a county or the whole county as a mosquito control district. Three board members are elected at the same time. The law provides for an assessment up to 10 mills on all taxable property and the board may also issue bonds. Another method provides for five board members, an assessment of 1½ mills, and permits inclusion of one or more counties in a district. Under the third method either the board of county commissioners may act as mosquito control commissioners, or a separate five-member board may be elected. This method provides for a countywide district and limits the amount of taxation to a minimum of \$10,000 and a maximum of \$25,000 in counties with a population of less than 65,000; and a minimum of \$20,000 and maximum of \$50,000 in counties having 65,000 population or more.

The first State law providing for State aid to counties and mosquito control districts was passed in 1949. This law provided that aid be given by the State board of health to mosquito control districts and county health depart-

ments in the form of insecticides, materials, equipment, personnel, and trucks in amounts not to exceed \$15,000 annually to any one county. This law for the first time recognized pest mosquitoes and other non-disease-bearing arthropods as being of public health and economic importance. A total of \$350,000 has since been made available each year under this law by the State legislature for the control of mosquitoes and human-biting flies.

In 1953 upon the recommendation of the Florida State Board of Health, the State legislature passed a second State aid law whereby any board of county commissioners or a mosquito control district that places funds in its budget for the control of "arthropods of public health importance," would receive funds directly from the State, upon proper certification by the State board of health, amounting to 75 percent of the total funds appropriated by the county or district. This law stipulates that State funds are to be used exclusively for permanent eliminative measures such as sanitary landfills, filling and draining of breeding areas, the purchase of all types of equipment, the hiring of personnel, and the operation of equipment to be used in carrying out permanent measures of arthropod control. The legislature appropriated \$1,250,000 annually for this program in addition to the annual appropriation of \$350,000 for both permanent and temporary control measures. In addition to the direct aid to counties and mosquito control districts, this law provided an additional appropriation of \$250,000 a year to be used by the State board of health for administration, consultation, and for

Total expenditures by source of funds, at 5-year intervals, 1930-54, mosquito and other arthropod control in Florida

Source of funds	Fiscal year					
	1930	1935	1940	1945	1950	1954 (estimated)
Total.....	¹ \$16, 726	\$9, 492	\$75, 892	\$512, 342	\$979, 071	\$3, 322, 105
Federal (grant-in-aid and direct).....			20, 492	404, 756	83, 942	8, 000
State.....			4, 730	5, 022	93, 321	1, 850, 000
Local (county, city, and mosquito district).....	(²)	(²)	29, 167	82, 984	789, 011	1, 464, 105
Private (Rockefeller Foundation).....	16, 726	9, 492	21, 503	19, 580	12, 797	-----

¹ Year 1931.

² Figures not available.

the construction and operation of a research laboratory. The State of Florida is therefore at present appropriating a total of \$1,850,000 annually for the control of mosquitoes and other arthropods of public health importance. Local appropriations for 1953-54 amounted to \$1,464,105, and direct Federal funds through the Public Health Service amounted to \$8,000, making a total of \$3,322,105 available for this purpose during the past fiscal year (see table).

The tourist industry is the largest industry in Florida and in 1953 brought in \$950,000,000. It is therefore important that the State do all in its power to protect the health as well as the comfort of its visitors. Furthermore, the permanent residents of the State are not unappreciative of the benefits to themselves of a vigorous program against mosquitoes and other pestiferous arthropods.

The Florida State Board of Health is now planning to construct a biological research center in Indian River County on the southeast coast of Florida. It is expected that around \$175,000 will be utilized in constructing and equipping the laboratory. In subsequent years it is planned to utilize about \$150,000 a year for research, and approximately \$100,000 is to be used in administering the mosquito control laws and in giving technical assistance to the counties.

The purpose of the research center will be twofold: (a) to produce the biological information the State board of health needs to promote and carry out the most effective and efficient control program possible, and (b) to expedite the incorporation of this information into control practices. The research center will be intimately connected with the control operations in all districts and counties, and thus practical needs will direct its research efforts.

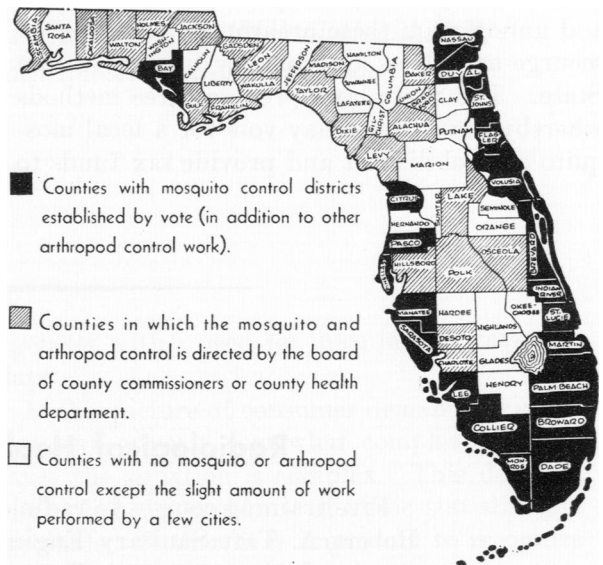
Mosquito Control Districts

The first mosquito control district was established by vote in Indian River County in 1925. At the end of 1953 there were 23 mosquito control districts in 21 of Florida's 67 counties (fig. 2). In addition to the 21 counties having organized mosquito control districts, arthropod control is carried on by 23 additional counties and the work is administered by the boards of

county commissioners and directed by the county health departments.

One small county, Brevard, with a population of 25,570 in 1950, appropriated \$208,649 for mosquito control for the fiscal year 1953-54. Indian River County, a small county, has a per capita tax for mosquito control of \$9.11 and Dade County (Miami), the wealthiest and most populous, has the lowest per capita tax of 17 cents.

Figure 2. Florida districts and counties performing arthropod control, January 1, 1954.



All mosquito and arthropod control is directed at the local level by an individual under the supervision of the mosquito control board or the board of county commissioners, elected by the people.

All boards are required by law to submit a plan of operation to the State board of health annually before expending their own funds or before receiving aid from the State. In order to assist the local boards with their administrative and technical problems, the State is divided into four operational districts. Stationed in each district are an engineer and an entomologist who are responsible for the arthropod control in an assigned number of counties.

Each board is also required by law to report each month on all county and State expendi-

tures for mosquito control as well as reporting at the end of each quarter on all of their operational activities.

Summary

Florida's geographic location and flat topography afford a favorable environment for the production of 67 species of mosquitoes, 22 species of sandflies (*Culicoides* spp.), many species of yellowflies (*Chrysops* spp.), and one species of dogfly or stablefly (*Stomoxys calcitrans*). Since some of these species transmit human diseases and many of the species bite and annoy man, these arthropods have been a scourge as well as an economic liability to the State. The State laws provide three methods whereby the citizens may vote for a local mosquito control district and provide tax funds to

carry out a control program. There are 23 mosquito control districts in the State and 23 counties that carry on mosquito control under the supervision of the county health departments. The districts and counties are now appropriating \$1,464,105 for mosquito control. There are two State aid laws administered by the Florida State Board of Health. One law carries an annual appropriation of \$350,000. The other law provides an appropriation of \$1,250,000 for aid to districts and counties, and an appropriation of \$250,000 to the State board of health for administration, technical assistance to local control bodies, and for research. At present, Florida is spending a total of \$3,322,105 annually, under the supervision of the State board of health, to control mosquitoes and other arthropods of public health importance.

Radiological Health Training Courses

Five training courses in radiological health will be presented at the Robert A. Taft Sanitary Engineering Center of the Public Health Service during 1954-55. The purpose of these courses is to indoctrinate public health workers with the significance of ionizing radiations, the environmental and occupational hazards attendant on their use, and recommended procedures for minimizing such hazards.

The courses are designed primarily for professional personnel of State and local health departments, but a limited number of qualified applicants from other government agencies and industry will be welcome.

Courses will be presented as follows:

November 1-5: Problems of radioactivity in water works.

January 10-21: Basic course in radiological health.

January 24-February 4: Occupational radiation protection.

March 7-10: Radiation hygiene, preventive medical aspects.

April 18-29: Basic course in radiological health.

May 2-13: Environmental radiation sanitation course.

May 16-20: Problems of radioactivity in water works.

For further information write to: Chief, Radiological Health Training Section, Robert A. Taft Sanitary Engineering Center, Public Health Service, 4676 Columbia Parkway, Cincinnati 26, Ohio.