AREA-WIDE MOSQUITO MANAGEMENT IN THE AMERICAS

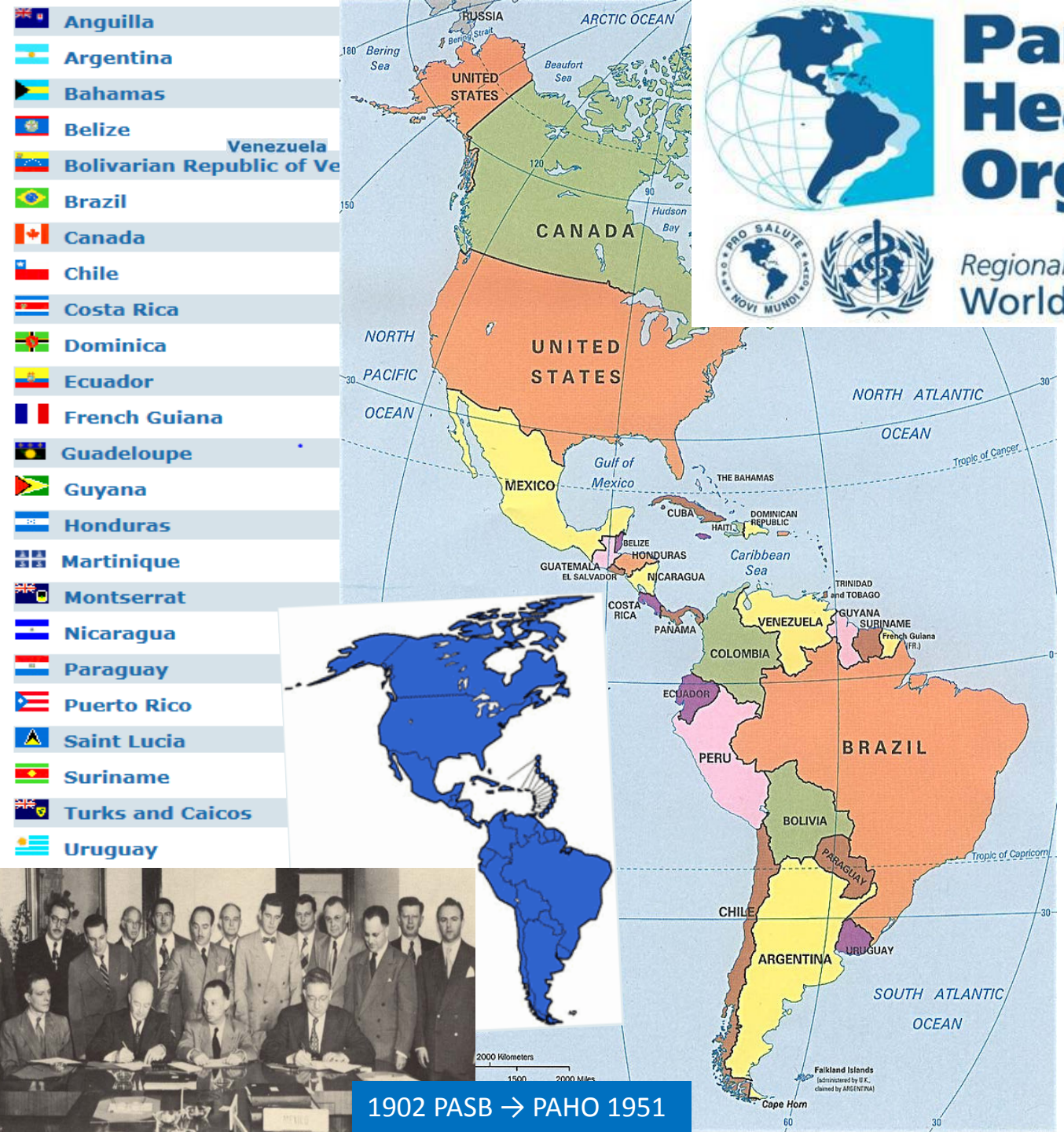
Graham White
University of Florida

Area-Wide
and/or
Wide Area ?

Pan American Health Organization

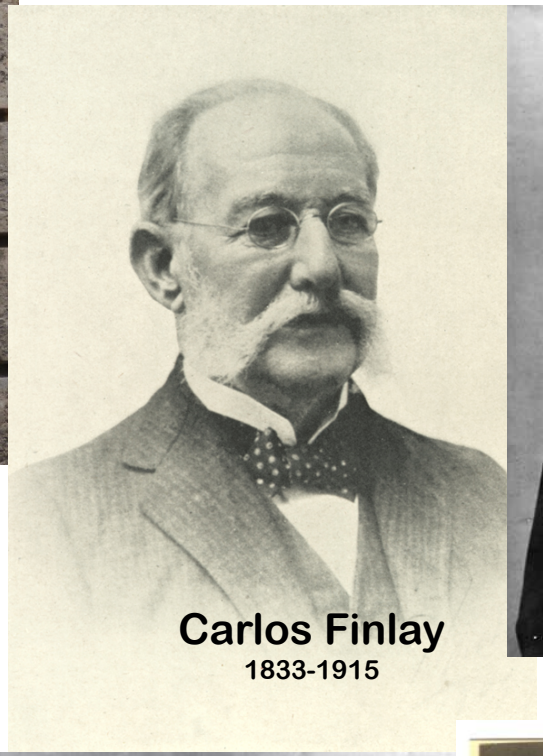
Regional Office of the World Health Organization

- Anguilla
- Argentina
- Bahamas
- Belize
- Venezuela Bolivarian Republic of Ve
- Brazil
- Canada
- Chile
- Costa Rica
- Dominica
- Ecuador
- French Guiana
- Guadeloupe
- Guyana
- Honduras
- Martinique
- Montserrat
- Nicaragua
- Paraguay
- Puerto Rico
- Saint Lucia
- Suriname
- Turks and Caicos
- Uruguay

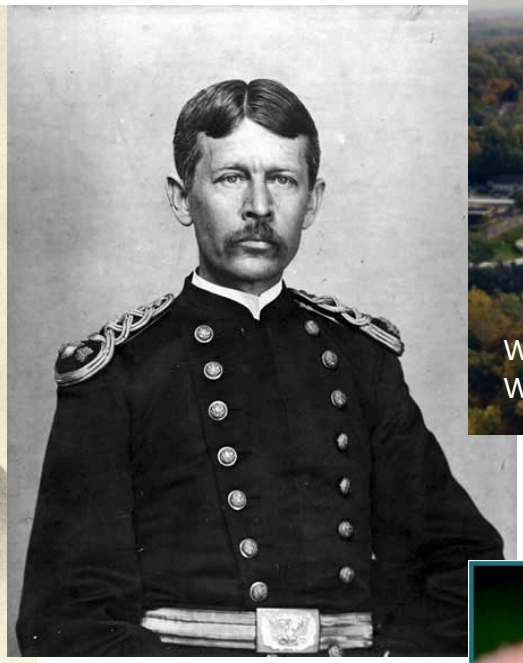


1902 PASB → PAHO 1951

- Antigua and Barbuda
- Aruba
- Barbados
- Bermuda
- Bolivia
- British Virgin Islands (UK)
- Cayman Islands
- Colombia
- Cuba
- Dominican Republic
- El Salvador
- Grenada
- Guatemala
- Haiti
- Jamaica
- Mexico
- Netherland Antilles
- Panama
- Peru
- Saint Kitts and Nevis
- Saint Vincent and the Grenadines
- Trinidad and Tobago
- United States of America

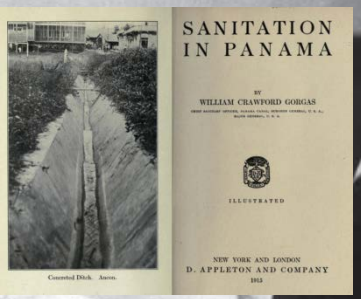


Carlos Finlay
1833-1915

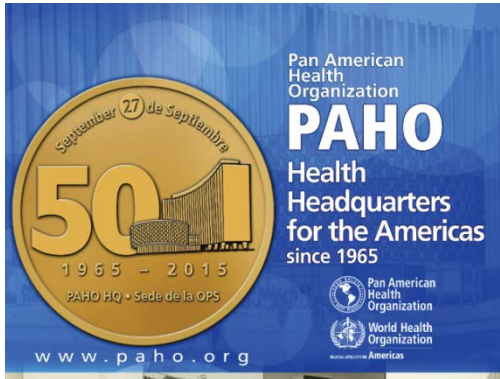


Walter Reed
1851-1902

William Gorgas
1854-1920



Fred Soper
1893-1977



Following in Soper's footsteps: northeast Brazil 63 years after eradication of *Anopheles gambiae*

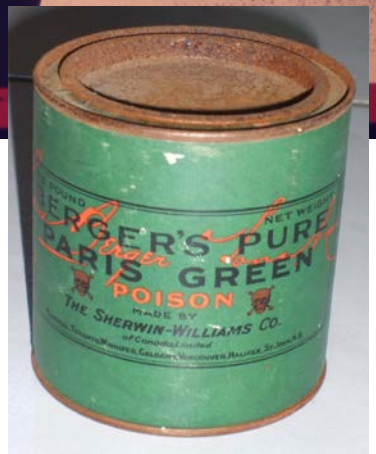
Gerry F Killeen

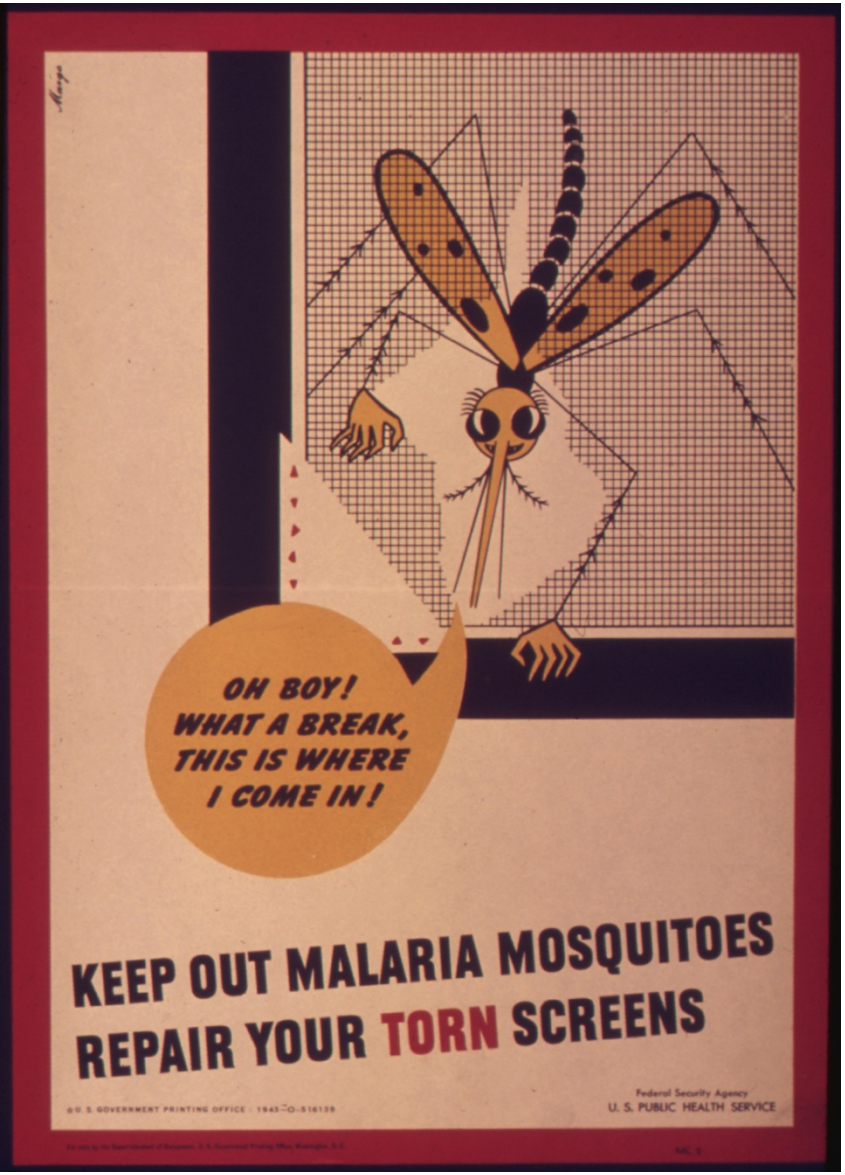
Sub-Saharan Africa has long suffered under the yoke of the *Anopheles gambiae* mosquito, but for northeast Brazil (figure 1) its arrival over 60 years ago was a new and horrifying experience. This African mosquito is an exceptionally effective malaria vector because it is well adapted to feeding upon people and to exploiting aquatic habitats associated with our daily activities. *Anopheles gambiae* sensu lato probably accounts for most of the world's malaria deaths and socioeconomic burden. Fortunately, the Brazilian experience had a happy ending. The prospect of *A gambiae* spreading across much of the Americas motivated a ruthlessly effective response that deserves a special and heroic place in the annals of public health. Building on the successes and infrastructure of the Yellow Fever Service for *Aedes aegypti* elimination, the Rockefeller Foundation and Brazilian government collaborated to form a new Malaria Service of the Northeast. This new entity rolled the invader back into oblivion with an aggressive eradication campaign, focusing primarily upon larviciding of all potential habitats. The driving force of this endeavour was an enigmatic man called Fred Soper whose sheer will and determination was a key element in this success, and a source of inspiration today (see Killeen GF, et al. Eradication of *Anopheles gambiae* from Brazil: lessons for malaria control in Africa? *Lancet Infect Dis* 2002; **2**: 618–27). I recently took an opportunity to fulfil a long-held dream and follow in some of Soper's footsteps. Tired of gazing at yellowing maps like figure 1, I went to see the northeast of Brazil for myself.

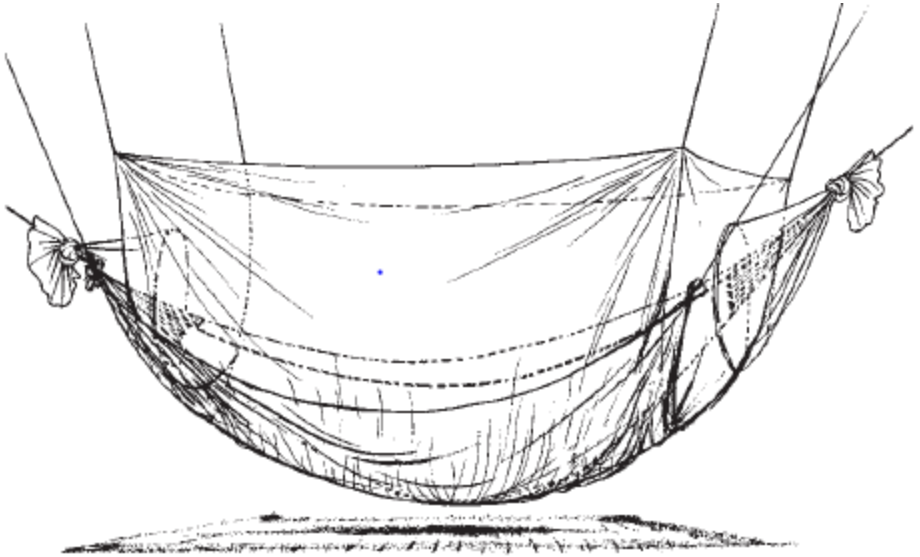
As soon as the plane emerged from the clouds and began final descent, the lush green countryside and abundant surface water of the Fortaleza area told me that I was in the right place at the right time. Mother Nature had cooperated and the rains had arrived as expected in March 2003. The view through my cabin window confirmed that the meshwork of blue lines and oblong shapes crammed onto the pages of my road atlas represented real bayous, rivers, lakes, and ponds. Even the taxi ride to downtown Fortaleza passed through surprisingly large tracts of wetland, flagged with Carnauba palms. Fortaleza was Soper's administrative fortress, from which the cleansing of infested lands to the east was masterminded. He and his colleagues were gravely concerned that if *A gambiae* reached these wet and populous areas, it would be impossible to stop. The following day I set off for the Serra do Baturité to get an overview of these bountiful valleys before heading east to the drier areas where the war against *A gambiae* was fought. I found the mountains and surrounding lowlands lush and green, with ample natural and artificial water

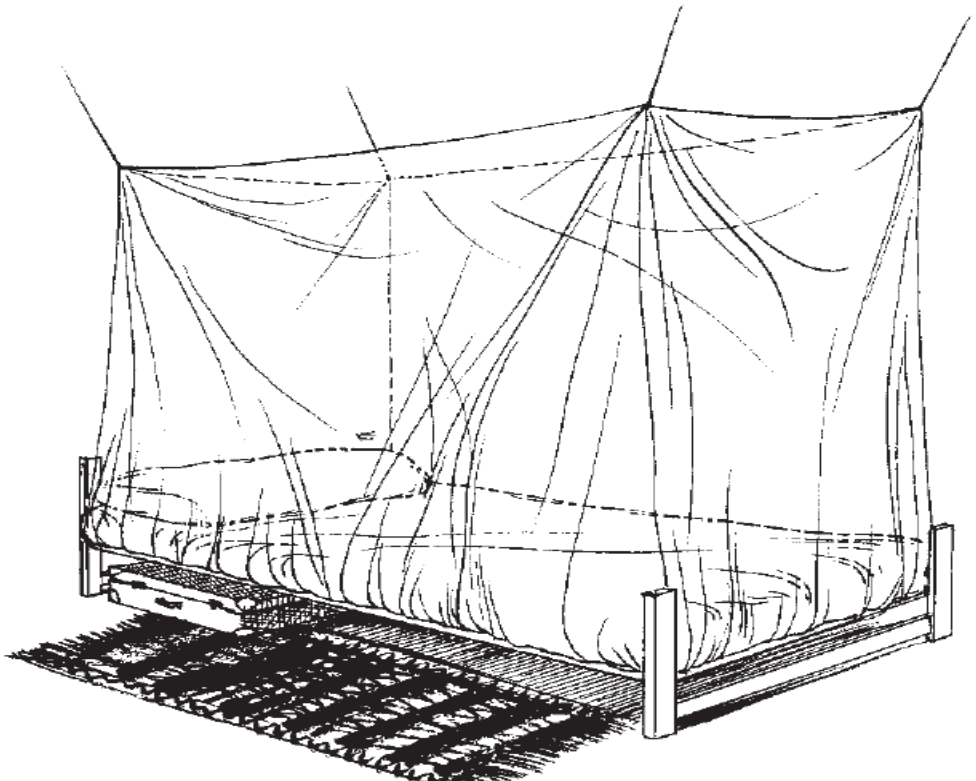
Figure 1. A topographical map of northeast Brazil (reproduced from Soper FL, Wilson DB. Anopheles gambiae *in Brazil—1930 to 1940. New York: Rockefeller Foundation, 1943).*

GFK is a research scientist at the Swiss Tropical Institute,




OH BOY!
WHAT A BREAK,
THIS IS WHERE
I COME IN!
KEEP OUT MALARIA MOSQUITOES
REPAIR YOUR TORN SCREENS
U. S. GOVERNMENT PRINTING OFFICE : 1943 O-516139
Federal Security Agency
U. S. PUBLIC HEALTH SERVICE





Initial Plan for the Eradication of *Aedes aegypti* from the United States

By D. J. SCHLIESSMANN
Chief, *Aedes aegypti* Eradication Branch
and
NORA J. MAGENNIS
Staff Assistant
Communicable Disease Center, Public Health Service, U. S. Department of Health, Education and Welfare, Atlanta, Georgia.

THE COMMUNICABLE Disease Center of the U. S. Public Health Service has initiated a program to eradicate *Aedes aegypti* from the United States and from Puerto Rico and the Virgin Islands. This program, conducted in conjunction with state and local departments of health, will provide two-way benefits. It will afford our country protection against a return of yellow fever, which is entrenched in portions of the hemisphere and is therefore a continuing threat so long as *Ae. aegypti* populations remain; and against dengue, which has continued to occur in epidemics with considerable frequency—most recently, as a widespread epidemic during late 1963 and early 1964 in the nearby Caribbean Islands. In addition, the program will contribute significantly to an on-going international effort to eradicate urban epidemics of yellow fever from the Western Hemisphere.

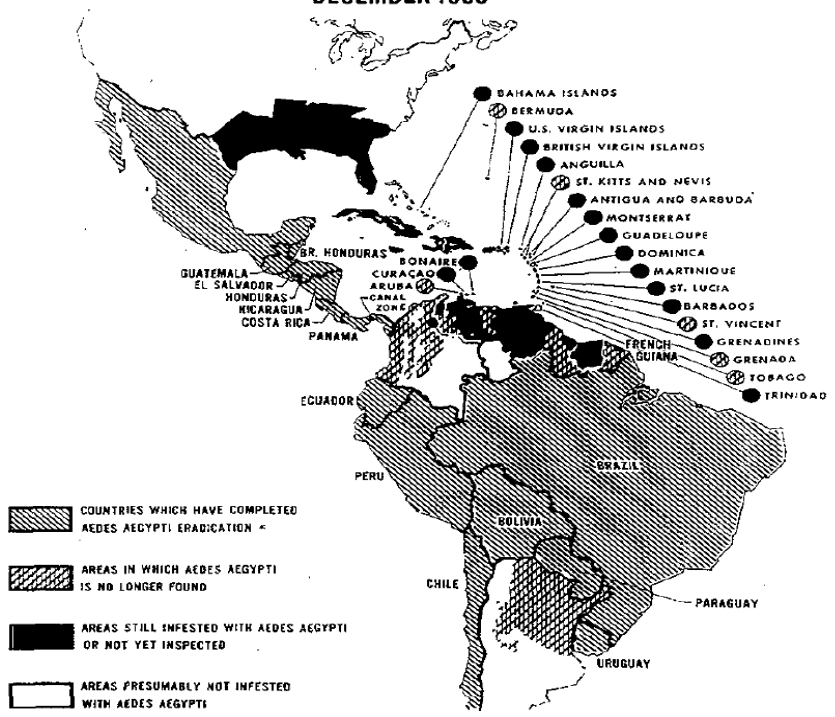
Ae. aegypti Proved Carrier

Yellow fever, the more formidable of the diseases spread by *Ae. aegypti*, was a primary public health problem during the early history of the New World. Major epidemics occurred in settlements throughout all the vast region extending from Buenos Aires, Argentina, on the south to Boston, Massachusetts, on the north. However, about the turn of the century, this terrifying disease began a rapid regression, and before the first quarter of the century had passed, it had disappeared from the United States and a number of Latin American countries.

This rapid disappearance of urban outbreaks of yellow fever from areas where it had so recently been a dreaded scourge followed close on the heels of the memorable work of Carlos J. Finlay, who first advanced the theory that urban yellow fever is spread only by *Ae. aegypti*; Walter Reed and the Yellow Fever Commission, who proved Finlay's theory to be true; and William C. Gorgas, who, despite the doubts of many of his contemporaries, first applied this knowledge to rid an endemic area of yellow fever.

The idea that any country could eradicate the disease by controlling *Ae. aegypti* populations quickly took hold throughout the yellow fever endemic areas of the hemisphere. However, in 1928 the trend toward eradication of this disease was suddenly and shockingly reversed. After an absence of 20 years, yellow fever suddenly re-

STATUS OF THE AEDES AEGYPTI ERADICATION CAMPAIGN
DECEMBER 1963



* ERADICATION CARRIED OUT ACCORDING TO THE STANDARDS ESTABLISHED BY THE PAN AMERICAN HEALTH ORGANIZATION

WORLD ASPECTS OF MOSQUITO ACTIVITIES IN 1970

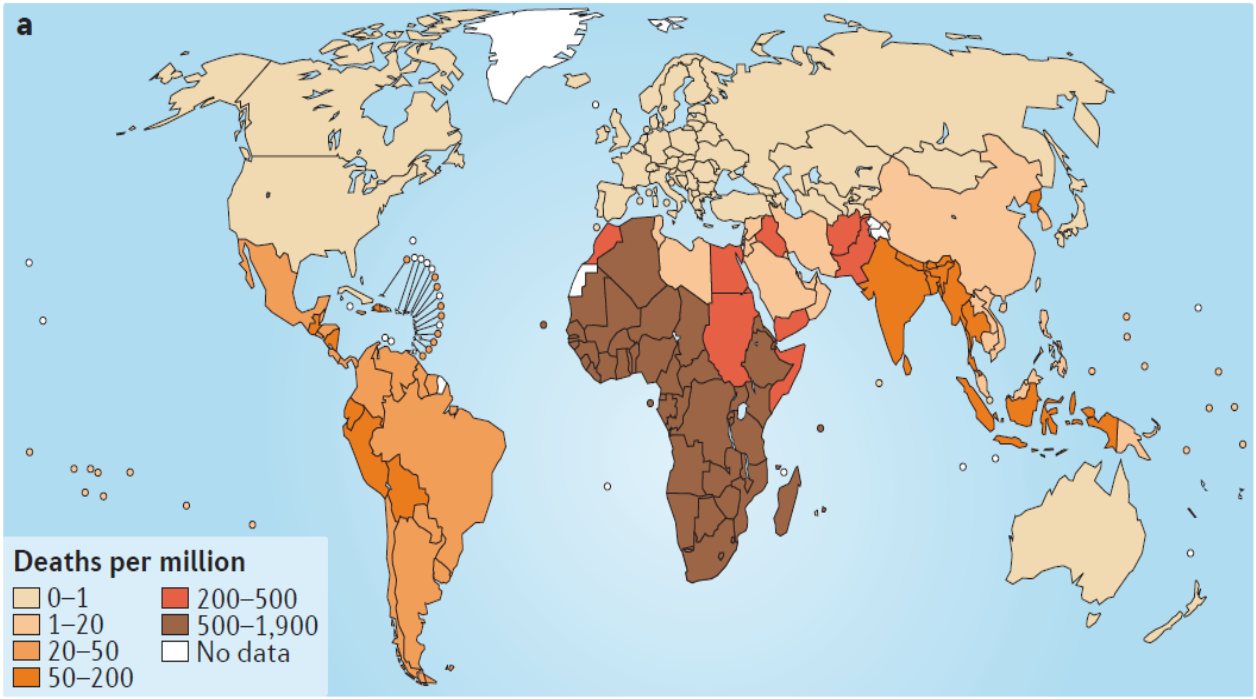
Highlights

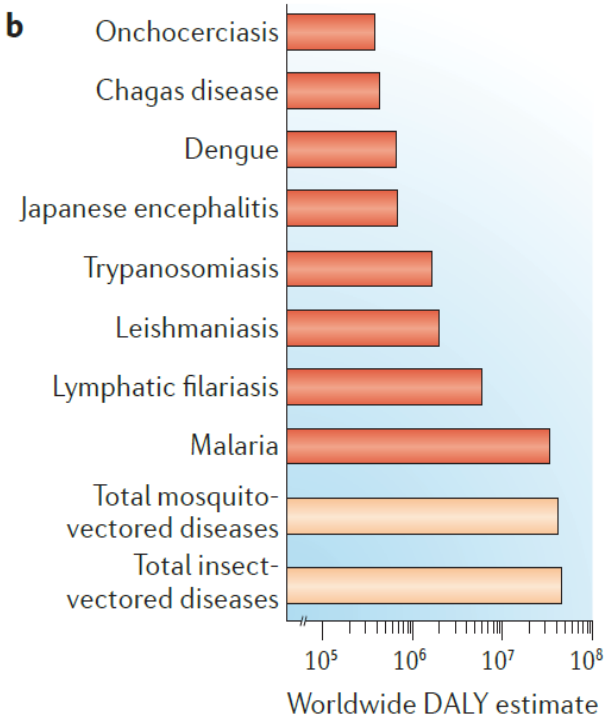
HELEN SOLLERS-RIEDEL[1]

Plant Protection Division, Agricultural Research Service

United States Department of Agriculture

In 1970 additional reinfestations of *Aedes aegypti* were found in Mexico. All were found near the border with the U. S. and were in the States of Tamaulipas and Coahuila. A new reinfestation occurred in Matamoros and was considered to be distinct from the one in October, 1969. The latter was eliminated in 1970 after the area was treated with DDT.


a
Deaths per million
0–1
1–20
20–50
50–200
200–500
500–1,900
No data


b
Onchocerciasis
Chagas disease
Dengue
Japanese encephalitis
Trypanosomiasis
Leishmaniasis
Lymphatic filariasis
Malaria
Total mosquito-vectored diseases
Total insect-vectored diseases
10^5
10^6
10^7
10^8
Worldwide DALY estimate

CC/NUMBER 50
DECEMBER 12, 1983

This Week's Citation Classic

Knipling E F. Possibilities of insect control or eradication through the use of sexually sterile males. *J. Econ. Entomol.* **48**:459-62, 1955.
[Entomology Research Branch, Agricultural Research Service, USDA]

The paper describes the effect on the dynamics of insect populations subjected to competitive mating by the release of insects sexually sterilized. Simple simulation models depict the increasing adverse impact on reproductive success as the natural population declines, a type of suppressive action not produced by conventional control methods. [The *SCI*® indicates that this paper has been cited in over 150 publications since 1961.]

E.F. Knipling
National Program Staff
USDA/Agricultural Research Service
Beltsville, MD 20705

ects prior to and during World War II. However, the 'autocidal' approach was discussed with other scientists. The general reaction ranged from skepticism to ridicule. Nevertheless, after having been assigned responsibility for directing USDA's research on livestock pests in 1946, I made efforts, to no avail, to obtain funds for research on the concept. Then, another colleague, A.W. Lindquist, called my attention to Muller's paper[4] describing the sterilizing effects of X rays on drosophila. I wrote to Muller describing my theory of screwworm control by releasing sterile flies in natural habitats. He had reservations about certain ecological aspects, but expressed confidence that screwworm flies could be sterilized by X-ray

Sterile
Insect
Technique

theoretical population trends per generation:
9 sterile males released for each fertile wild male
with a 5-fold rate of increase (Knipling, 1955)

generation	STERILE MALE RELEASES				insecticidal 90% control	uncontrolled population
	fertile males	sterile males /generation	sterile:fertile male ratio	next generation		
1	1,000,000	9,000,000	9:1	500,000	1,000,000	1,000,000
2	500,000	9,000,000	18:1	131,580	500,000	5,000,000
3	131,580	9,000,000	68:1	9,535	250,000	25,000,000
4	9,535	9,000,000	944:1	50	125,000	125,000,000
5	50	9,000,000	180,000:1	0	62,500	625,000,000

VectorBase
Bioinformatics Resource for Invertebrate Vectors of Human Pathogens

Anopheles albimanus

Anopheles albimanus it is one of the main vectors of malaria in Central America, northern South America and the Caribbean. On the Atlantic coast it is found from Texas to Venezuela, on most of the Caribbean islands and on the Pacific coast, from Mexico to northern Peru.

Habitat

The larval sites used by *An. albimanus* are characterised across its range as open, sunlit and containing clear water. The species can be found in natural and man-made habitats where these characteristics exist. For example, it occurs in recently planted rice fields, or in older fields with sunlit areas in between the rice plants. The larvae tolerate a wide variation in water chemistry and are able to exploit diverse food sources enabling them to survive in both fresh water (e.g. irrigation channels, small ponds, marshes, slow flowing streams and river margins) and brackish water (e.g. mangrove swamps).

Behaviour

An. albimanus is predominantly exophagic with exophilic resting behaviour, however there is some indication that in the northern reaches of its distribution (Mexico, Central America), this species exhibits a preference for resting indoors after feeding. *An. albimanus* bites in the evening and during the night. It appears to show a tendency for zoophily, but some reports have indicated anthropophillic activity.

Vectorial capacity

An. albimanus is considered to be a dominant malaria vector

Strains, genome assemblies and ge

Strain: STECLA
Assembly: AalbS2
Gene set: AalbS2.3 25 Apr 2017

In the table above, only current assemblies and gene
shown. Full listings are available on the strain page(s)

Tools and data resources

- BioMart
- BLAST
- Hittinger et al (2009) Anopheles RNA-Seq transc
- Anopheles albimanus @ Malaria Atlas Project (E
- Martinez-Barnetche et al (2012) *Anopheles albim* female transcriptome

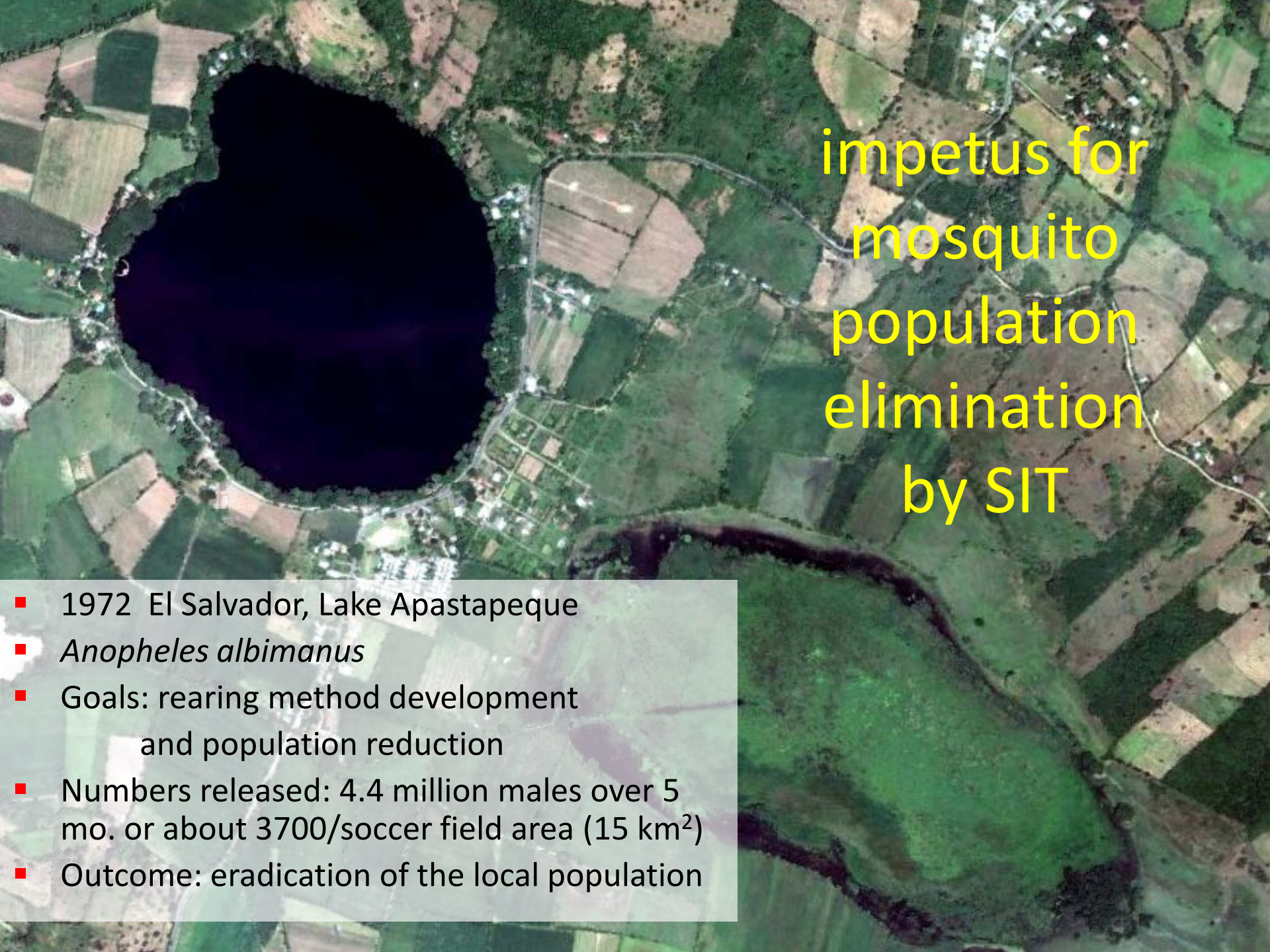
Current data files

Data Type	Version
Scaffolds	AalbS2
Peptides	AalbS2.3
Transcripts	AalbS2.3
Base Features	AalbS2.3

Full Downloads

Recent news

Posted



impetus for mosquito population elimination by SIT

- 1972 El Salvador, Lake Apastapeque
- *Anopheles albimanus*
- Goals: rearing method development and population reduction
- Numbers released: 4.4 million males over 5 mo. or about 3700/soccer field area (15 km^2)
- Outcome: eradication of the local population

Historical applications of induced sterilisation in field populations of mosquitoes

David A Dame*[1], Christopher F Curtis[2], Mark Q Benedict[3], Alan S Robinson[3] and Bart GJ Knols[4]

Address: [1]Entomological Services, 4729 NW 18th Pl, Gainesville, FL 32605-3425, USA, [2]London School of Hygiene and Tropical Medicine, UK, [3]Entomology Unit, FAO/IAEA Agriculture and Biotechnology Laboratory, IAEA Laboratories, A-2444 Seibersdorf, Austria and [4]Div. Infectious Diseases, Tropical Medicine & AIDS, Academic Medical Center, F4-217, Meibergdreef 9, 1105 AZ Amsterdam, The Netherlands and K&S Consulting, Kalkestraat 20, 6669 CP Dodewaard, The Netherlands

Email: David A Dame* - dadame@ufl.edu; Christopher F Curtis - not@valid.com; Mark Q Benedict - m.benedict@iaea.org; Alan S Robinson - a.s.robinson@iaea.org; Bart GJ Knols - bart@malaria-world.com

* Corresponding author

Published: 16 November 2009

Malaria Journal 2009, 8(Suppl 2):S2 doi:10.1186/1475-2875-8-S2-S2

This article is available from: http://www.malariajournal.com/content/8/S2/S2

Abstract

Research on sterile mosquito technology from 1955 to the 1980s provided a substantial body of knowledge on propagation and release of sterile mosquitoes. Radiation sterilisation and chemosterilisation have been used effectively to induce dominant lethality and thereby sterilise important mosquito vectors in the laboratory. Experimental releases of chemosterilised males provided complete control of *Anopheles albimanus* in a small breeding population (14-15 sq km) in El Salvador. Releases of radiation sterilised males failed to control either *Aedes aegypti* or *Anopheles quadrimaculatus* in the USA. Releases of radiation-sterilised and chemosterilised male *Culex quinquefasciatus* in the USA and India were successful in some instances. Development of genetic sexing systems for *Anopheles* and improved physical separation methods for *Culex* have made it possible to rear and release males almost exclusively (> 99%) minimizing the release of potential vectors, the females. Factors that affected efficacy in some field programmes included reduction of competitiveness by radiation, immigration of fertilized females from outside the release zones, and

Breeland SG, Jeffery GM, Lofgren CS, Weidhaas DE: **Release of chemosterilized males for the control of *Anopheles albimanus* in El Salvador I. Characteristics of the test site and the natural population.** *Am J Trop Med Hyg* 1974, **23**:274-281.

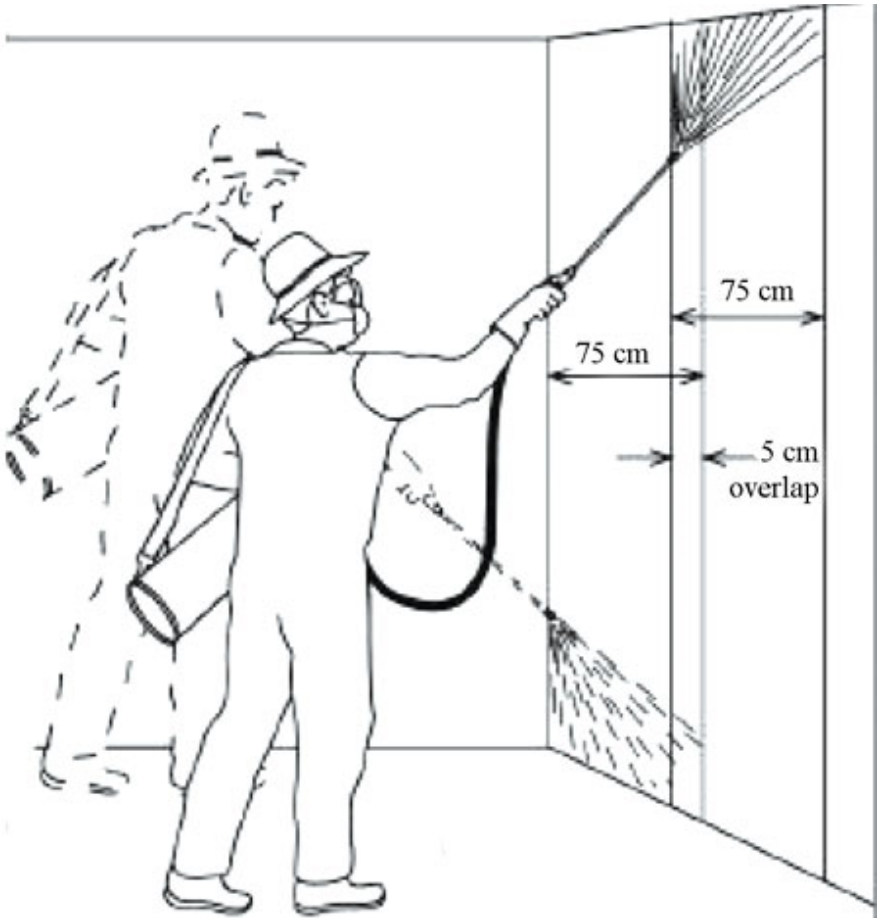
Lofgren CS, Dame DA, Breeland SG, Weidhaas DE, Jeffery GM, Kaiser R, Ford HR, Boston MD, Baldwin KF: **Release of chemosterilized males for the control of *Anopheles albimanus* in El Salvador III. Field methods and population control.** *Am J Trop Med Hyg* 1974, **23**:288-297.

Dame DA, Lofgren CS, Ford HR, Boston MD, Baldwin KF, Jeffery GM: **Release of chemosterilized males for the control of *Anopheles albimanus* in El Salvador II. Methods of rearing, sterilization, and distribution.** *Am J Trop Med Hyg* 1974, **23**:282-287.

Dame DA, Lowe RE, Williamson DL: **Assessment of released sterile *Anopheles albimanus* and *Glossina morsitans morsitans*.** In *Cytogenetics and genetics of vectors* Edited by: *Kitzmiller JB, Kanda T. Amsterdam, the Netherlands: Elsevier Biomedical*; 1981:231-248.

Seawright JA, Kaiser PE, Dame DA, Lofgren CS: **Genetic method for the preferential elimination of females of *Anopheles albimanus*.** *Science* 1978, **200**:1303-1304.

Weidhaas DE, Breeland SG, Lofgren CS, Dame DA, Kaiser R: **Release of chemosterilized males for the control of *Anopheles albimanus* in El Salvador IV. Dynamics of test populations.** *Am J Trop Med Hyg* 1974, **23**:298-308.


75 cm
75 cm
5 cm
overlap

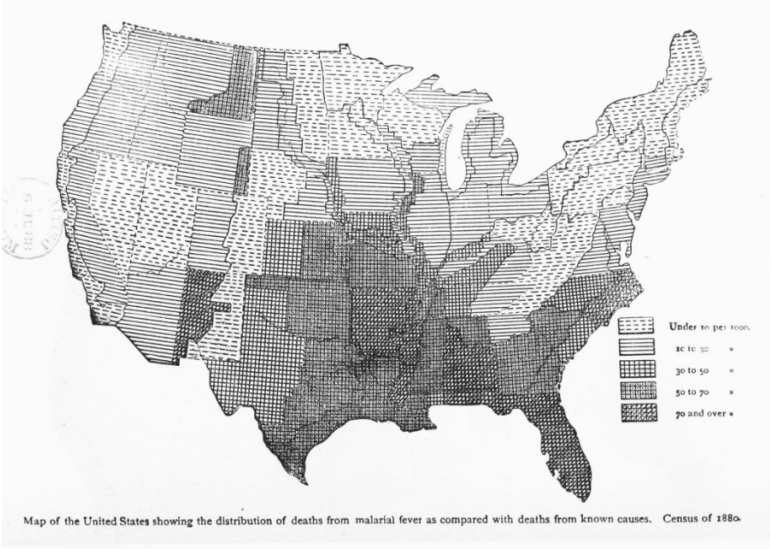
WHO recommended insecticides for indoor residual spraying against malaria vectors

Insecticide compounds and formulations[1]	Class group[2]	Dosage (g a.i./m^2)	Mode of action	Duration of effective action (months)
DDT WP	OC	1-2	contact	>6
Malathion WP	OP	2	contact	2–3
Fenitrothion WP	OP	2	contact & airborne	3–6
Pirimiphos-methyl WP & EC	OP	1-2	contact & airborne	2–3
Pirimiphos-methyl CS	OP	1	contact & airborne	4–6
Bendiocarb WP	C	0.1–0.4	contact & airborne	2–6
Propoxur WP	C	1–2	contact & airborne	3–6
Alpha-cypermethrin WP & SC	PY	0.02–0.03	contact	4–6
Bifenthrin WP	PY	0.025–0.05	contact	3–6
Cyfluthrin WP	PY	0.02–0.05	contact	3–6
Deltamethrin SC-PE	PY	0.02–0.025	contact	6
Deltamethrin WP, WG	PY	0.02–0.025	contact	3–6
Etofenprox WP	PY	0.1–0.3	contact	3–6
Lambda-cyhalothrin WP, CS	PY	0.02–0.03	contact	3–6

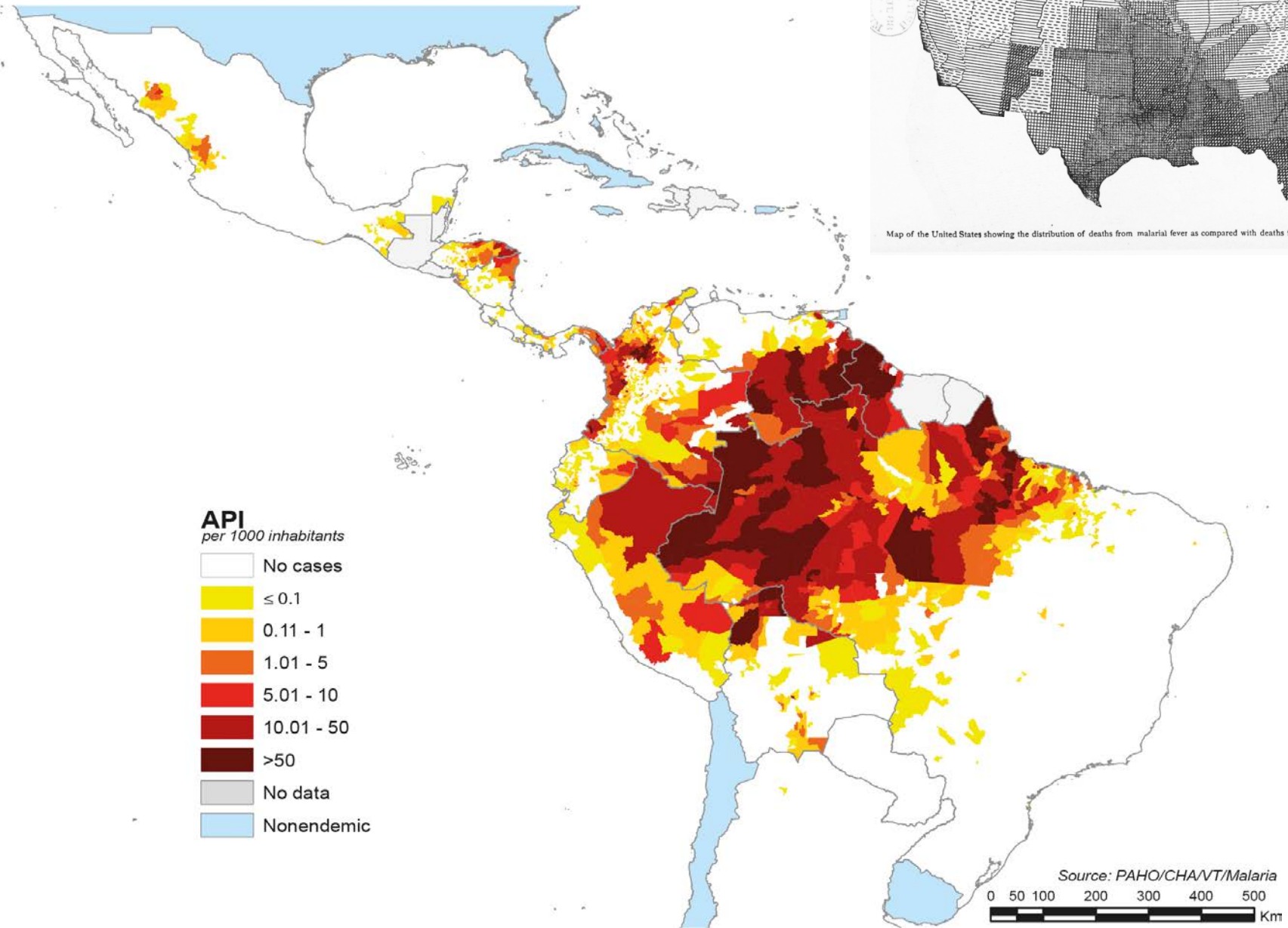
X-PERT® Hand Compressed Sprayer

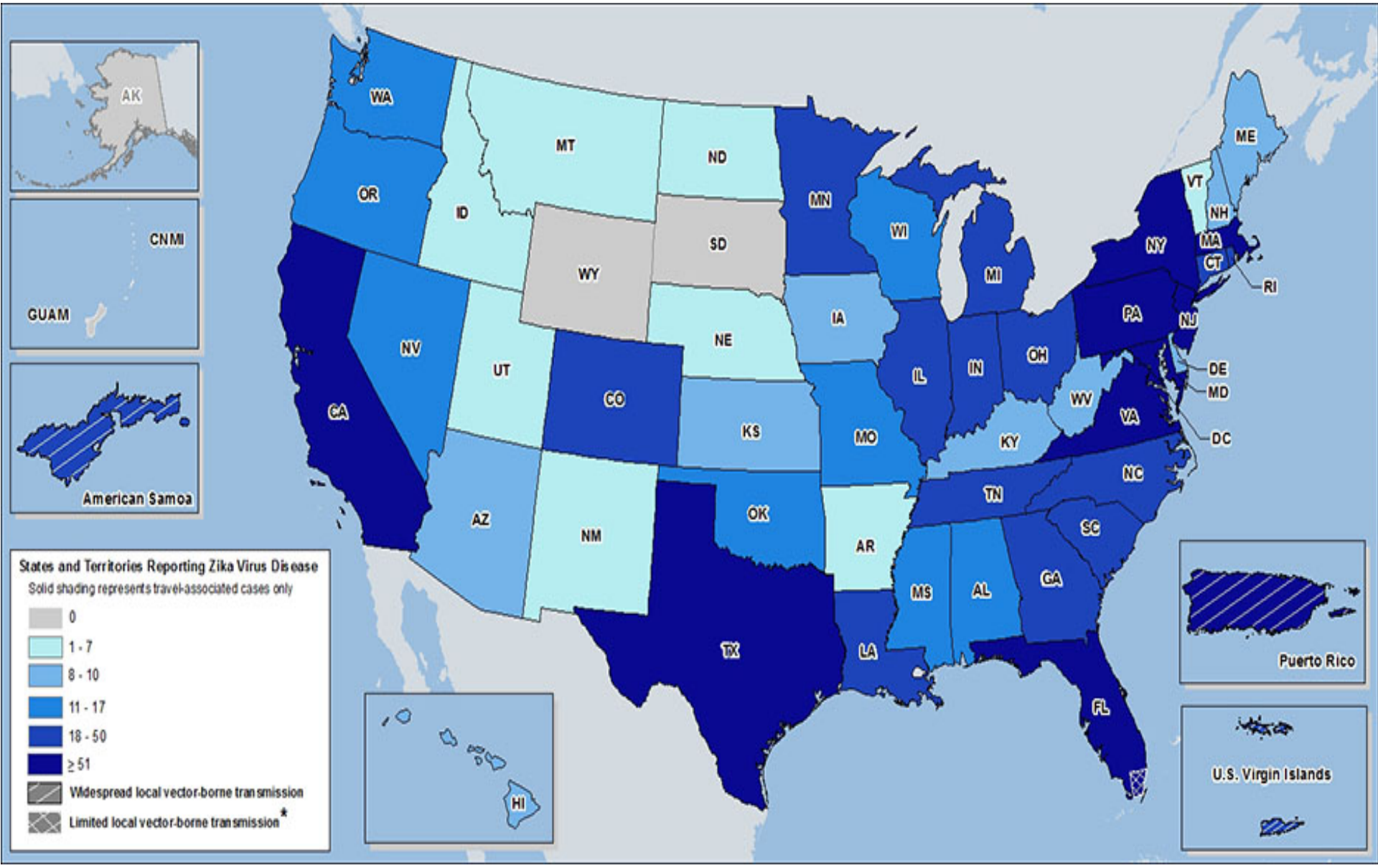
STIHL® Model SR450

Herrera et al. (2015) Prospects for Malaria Elimination in Mesoamerica and Hispaniola. PLoS Negl Trop Dis 9(5): e0003700. https://doi.org/10.1371/journal.pntd.0003700



Map of the United States showing the distribution of deaths from malarial fever as compared with deaths from known causes. Census of 1880.




AK
CNMI
GUAM
American Samoa
WA
OR
CA
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MS
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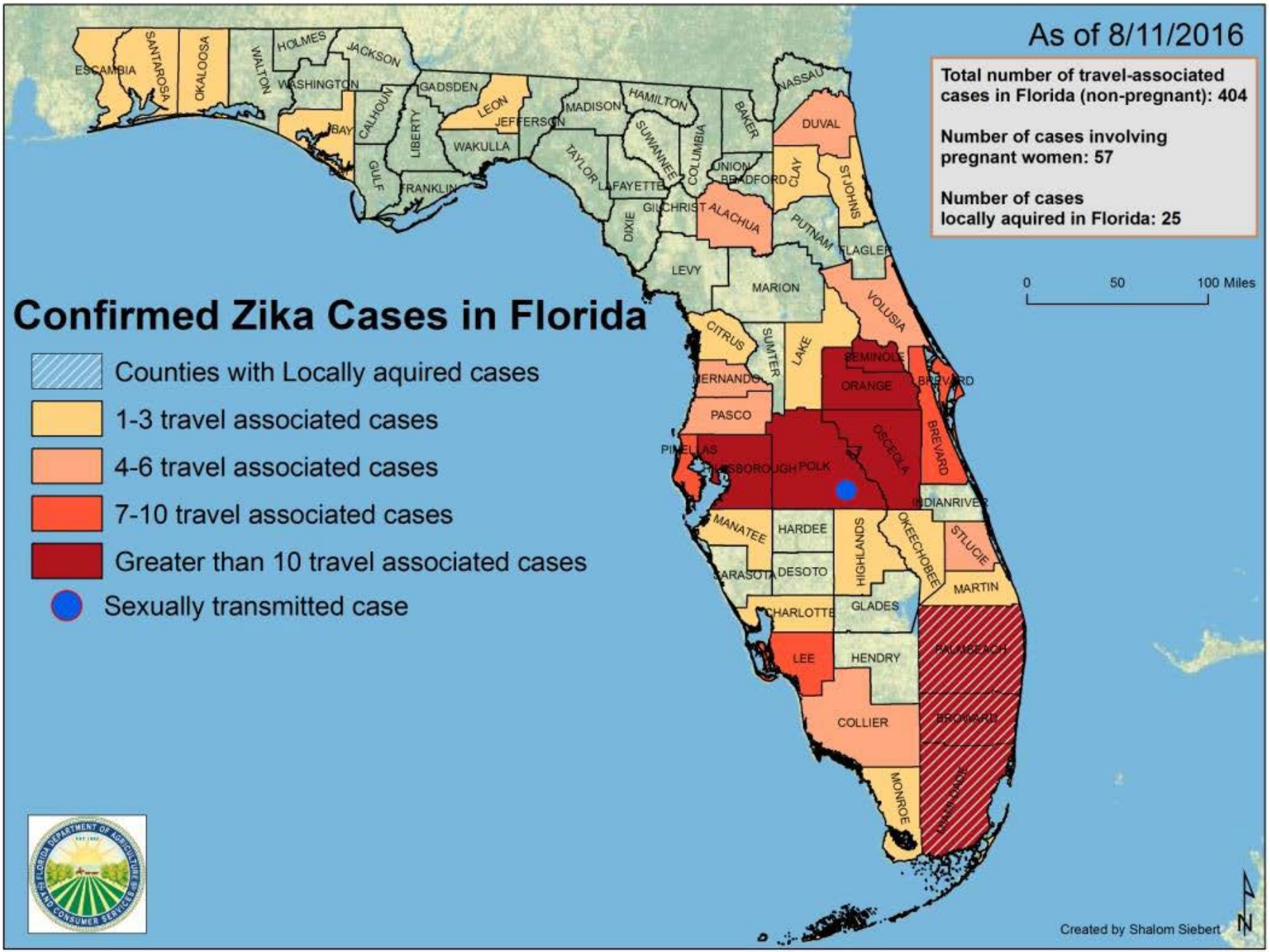
IN
KY
TN
AL
OH
WV
GA
FL
SC
NC
VA
PA
NY
ME
VT
NH
MA
CT
RI
NJ
DE
MD
DC
HI
Puerto Rico
U.S. Virgin Islands
States and Territories Reporting Zika Virus Disease
Solid shading represents travel-associated cases only
0
1 - 7
8 - 10
11 - 17
18 - 50
≥ 51
Widespread local vector-borne transmission
Limited local vector-borne transmission*


As of 8/11/2016
Total number of travel-associated cases in Florida (non-pregnant): 404
Number of cases involving pregnant women: 57
Number of cases locally aquired in Florida: 25
Confirmed Zika Cases in Florida
Counties with Locally aquired cases
1-3 travel associated cases
4-6 travel associated cases
7-10 travel associated cases
Greater than 10 travel associated cases
Sexually transmitted case
0
50
100 Miles
ESCAMBIA
SANTAROSA
OKALOOSA
WALTON
HOLMES
WASHINGTON
JACKSON
BAY
CALHOUN
GULF
FRANKLIN
GADSDEN
LEON
WAKULLA
JEFFERSON
LIBERTY
MADISON
TAYLOR
HAMILTON
SUWANNEE
LAFAYETTE
COLUMBIA
BAKER
NASSAU
DUVAL
CLAY
UNION
BRADFORD
ST JOHNS
PUTNAM
ALACHUA
GILCHRIST
DIXIE
LEVY
MARION
FLAGLER
VOLUSIA
CITRUS
SUMTER
LAKE
SEMINOLE
ORANGE
BREVARD
HERNANDO
PASCO
PINELLAS
HILLSBOROUGH
POLK
OSCEOLA
INDIANRIVER
MANATEE
HARDEE
HIGHLANDS
OKEECHOBEE
STLUCIE
SARASOTA
DESOTO
MARTIN
CHARLOTTE
GLADES
LEE
HENDRY
PALMBEACH
COLLIER
BROWARD
MONROE
MIAMI-DADE
Created by Shalom Siebert
N

BY LAINE DOSS

FRIDAY, AUGUST 12, 2016 AT 1:21 P.M.

Photo by Masson Liang

UPDATE: (August 12, 2016) According to a news release issued by the Wynwood Yard, a third employee was found to be Zika-positive. The Yard learned this after receiving some aggregate numbers from the Department of Health after it tested a group of more than 65 employees last Thursday, August 4. All three employees are part of the same group that was tested last week. The Wynwood Yard reports that all employees are doing well and that management is awaiting more test results.

Miami New Times

Sterile Insect Technique

An effective alternative to chemical insecticide applications, Sterile Insect Technique (SIT) is a special activity pursued by Dynamic Aviation. With SIT operational experience exceeding 250,000 flight hours, Dynamic Aviation is recognized as the international leader in the release of sterile insects.

Dynamic Aviation

The New York Times

A plane sprays pesticide over the Wynwood neighborhood of Miami in August, the second round of aerial spraying in the area. Joe Raedle/Getty Images

Fumigating in Miami, Florida after 14 Zika cases were found last year;
from "Brazil marks end of Zika virus outbreak health emergency" 12May2017 www.dw.com


AFRC
09107
U.S. AIR FO

ultra-low volume (ULV) spray

Aerosol Space Spray "fogging"

droplet size and cloud *droplet density* measurements by laser diffraction

DRIFT IS ESSENTIAL FOR MOSQUITO CONTROL (contrary to Ag sprays)

thermal fog

Aerial Application Technology

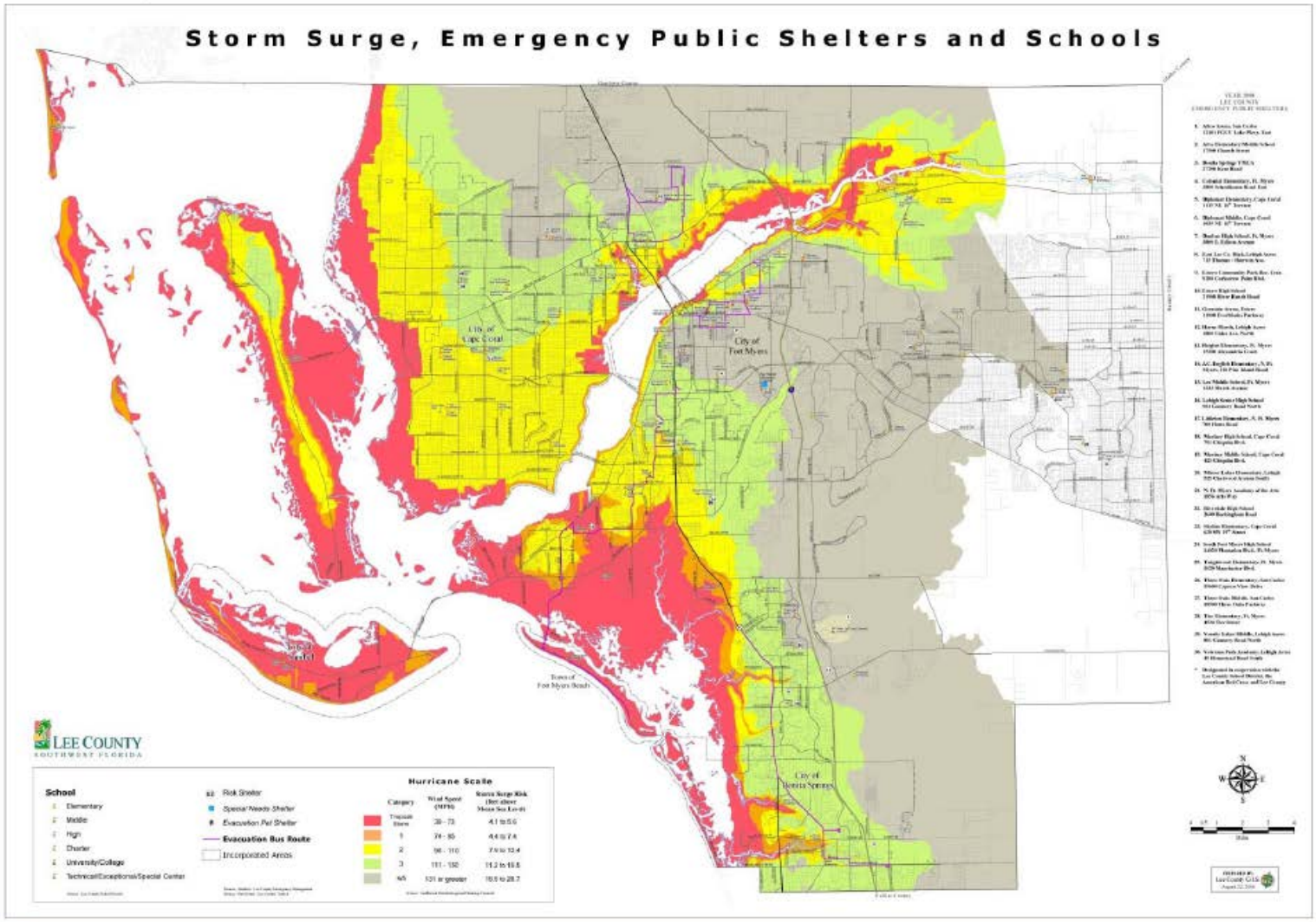
USDA Agricultural Research Service

NAVY ENTOMOLOGY CENTER OF EXCELLENCE — Medical Entomology — JACKSONVILLE FLORIDA

Ground Adulticiding

- Accomplished using a ULV (Ultra Low Volume) fogger mounted onto a pickup.
- These trucks usually begin just after sunset and apply materials at 10 mph.

Lee County is flat and holds a lot of temporary standing water with almost 60,000 acres of saltmarsh and several hundred thousand acres of other wetlands and fresh water habitats for mosquito breeding.



LCMCD

Former Buckingham Army Airbase

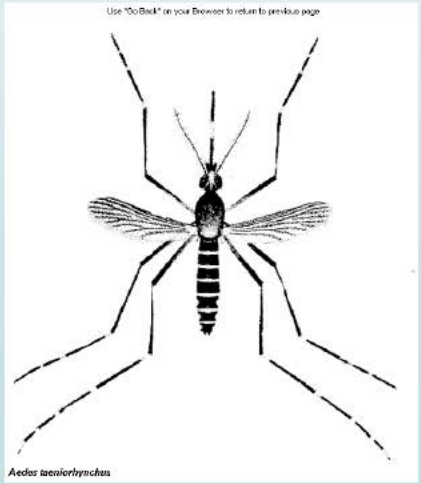
Seven Heliports

Aedes taeniorhyncus

black saltmarsh mosquito

Can fly 25 to 30 miles

Aggressive Biter



Mosquito larvae are located by using a white dipper to sample water habitats. The stage of development and temperature will indicate how much time is left before they become adults.

Adult mosquito surveillance can be accomplished with several different types of traps as well as landing rate observances.

CDC Light Trap

New Jersey Light Trap

Landing Rate Counts

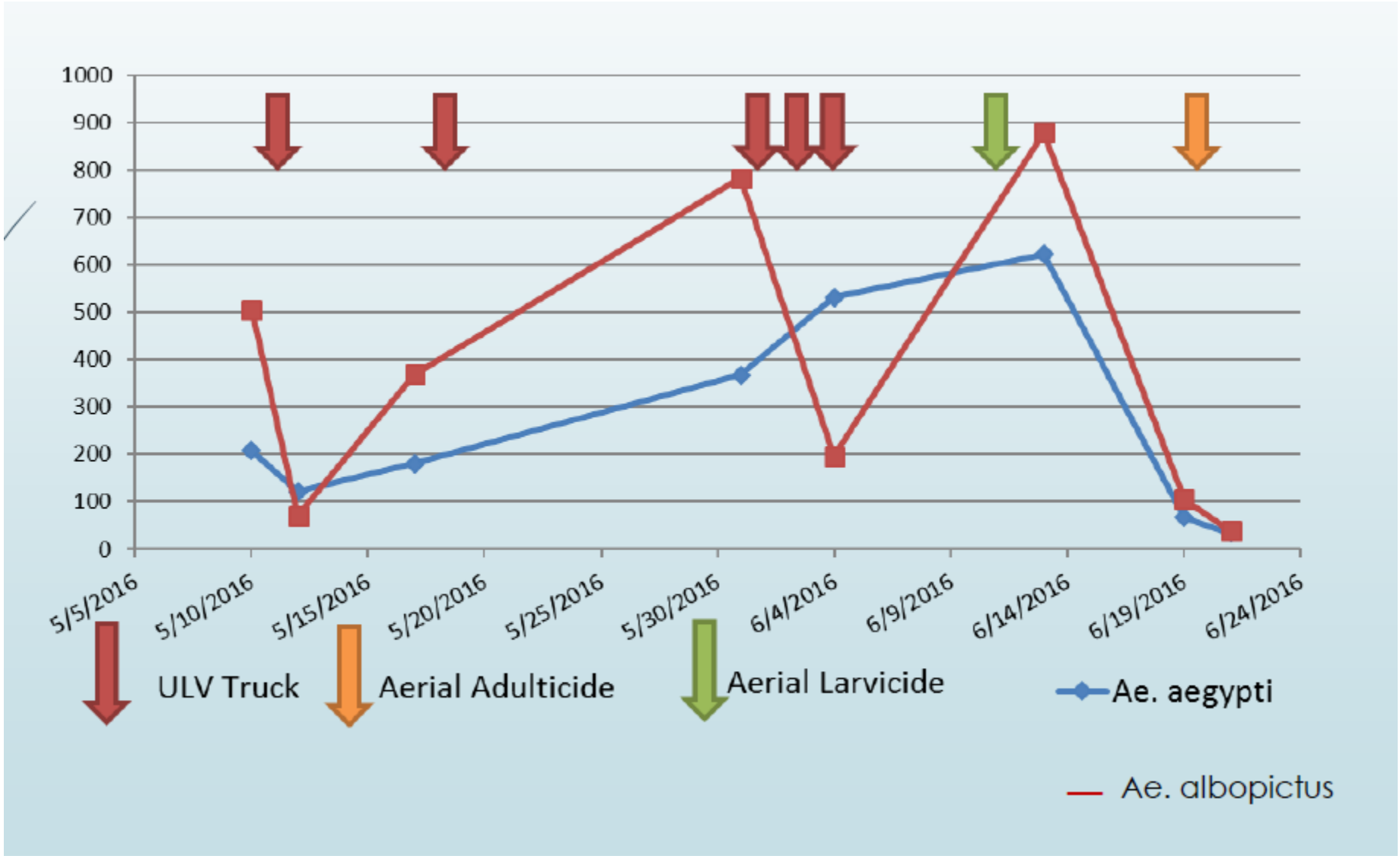
Truck Traps

Gravid Trap

Huey ULV Larviciding System

Application Parameters

Aircraft	Bell 206	
Air Speed knts	60	
Altitude	100 ft	
Nozzle System	AU5000	6000 rpm
Material	Vectobac WDG	
Application Rate	200 gm/ac	100 gm/ac
Flow Rate per acre	1 gal	
Tank Mix	200 gm/gal	100 gm/gal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6/19/2016
6/24/2016
ULV Truck
Aerial Adulticide
Aerial Larvicide
Ae. aegypti
Ae. albopictus

interspecific differentials for IVM & SIT consideration

aegypti aegypti	***factor***	***albopictus***
ex Africa – circumglobal between 10° isotherms	*geographical range*	ex SE Asia, expanding to temperate latitudes
domestic/urban	*ecology*	wider peridomestic
mostly humans	*bloodmeal hosts*	wider range of animals/birds
very limited (usually <<100m)	*adult flight range*	less than most other mosquitoes
perennial, no diapause	*seasonality*	Winter diapause of eggs & larvae
can be > 1 year	*egg aestivation/desiccation*	weeks/months
mostly artificial containers, thrives in dark drains	*"breeding sites"*	wider range of natural (e.g. axils) and artificial containers
not naturally	*Wolbachia symbionts*	Yes: *w*AlbA, *w*AlbB prevalent
CHIKV, DENVs, YFV, ZikaV etc.	*vector competence*	CHIKV (alanine<valine advantage), DENVs, (YFV), ZikaV etc.
prevalent vs DDT, SPs, some OPs	*Insecticide resistance*	incipient (no problems yet)
loser vs *albopictus* in subtropical Americas (satyrization)	*competitive displacement*	loser vs *aegypti* in Asia

pros: easily mass produced & released for SIT/IIT - males polygamous, females usually monogamous

cons: very high R0 and limited dispersal of adults; mosquitoes more fragile than tephritids & tsetse

The Asian tiger mosquito

IN THE NEWS

These webpages contain the results of operational research. You will have access to scientific publications, unpublished data, contact information and multiple tools developed during the project

Areawide management of the Asian tiger mosquito (AW-ATM)

funded by **USDA-ARS**(2008-2013)
Click this box to enter. Below are links to general information on this mosquito's life-history and **critical management topics: Surveillance, Education, Control**, and the **Economics** of it all. Click for details.

Aedes albopictus **(Skuse)**
scientific name and (author)

CLICK FOR SITE MAP

insect photos by Ary Farajollahi

What is it?
An Asian mosquito with temperate and tropical forms. Worldwide invasive.

Where is it?
Backyards. The immatures grow in small containers, the adults hang on vegetation.

Is it dangerous?
The adult females are aggressive human biters and can transmit viral diseases.

Surveillance
This day-biting mosquito is not attracted to light. Find out ways to trap them.

Education
Homeowners need to be involved in mosquito control. Teach by example.

Control
Target hot-spots. Start early with larvicides. Adulticides work in a pinch.

THE BOTTOM LINE: COST (ECONOMICS)

Center for Vector Biology
New Jersey Agriculture Experiment Station
Rutgers University, 2014
*Questions about this website? contact **Dina Fonseca**, the webmaster*

http://asiantigermosquito.rutgers.edu/

Overview of *Aedes* Control

Existing Methods

Immature control

Major categories

- Container cleaning (bleach/wash/dump)
- Container manipulation (polystyrene beads)
- Container treatment
- Social campaigns (education, source reduction)
- Environmental Management
- Legislation

Conatiner treatment

Insecticides

- Temephos
- Novaluron
- Spinonsad
- Diflubenzuron
- Bti

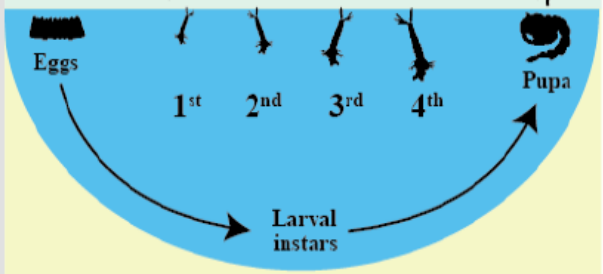
Bleach

Methoprene
Pyriproxyfen

Biologicals

- Copepods

- Larvivorous fish



Adult control

Major categories

- Space spraying
- Indoor residual spraying
- Personal protection

PLOS | NEGLECTED TROPICAL DISEASES
PLOS Neglected Tropical Diseases | DOI:10.1371/journal.pntd.0003655 May 7, 2015

REVIEW

A Critical Assessment of Vector Control for Dengue Prevention

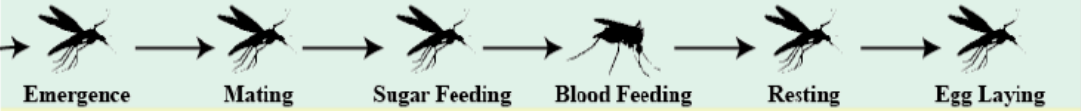
Nicole L. Achee[1]*, Fred Gould[2], T. Alex Perkins[1,2], Robert C. Reiner Jr.[3,4], Amy C. Morrison[5,6], Scott A. Ritchie[7], Duane J. Gubler[8,9], Remy Teyssou[9], Thomas W. Scott[5,6,9]

Space spraying: Truck ULV, Low-flying aircraft, hand-held portables, perifocal treatment

Personal protection

- DEET
- Picaridin
- Bed nets
- Consumer products

Indoor residual spraying



RIDL and fsRIDL

Toxic sugar baits

Behavior modification

Lethal Ovitraps
Auto-dissemination

Wolbachia
Other within-tissue symbionts
Para-transgenesis
Antipathogen genes without drive

Curtains / IRS

New entomopathogenic fungi

Molecular insecticides, medea/HEGs, new insecticides

Methods under Development

Keep mosquitoes out of your septic tank

Mosquitoes can get inside broken or unsealed septic tanks and lay eggs. Each day thousands of mosquitoes fly out of cracked or broken septic tanks. Mosquitoes can spread viruses like Zika, dengue, West Nile, and chikungunya.

Mosquitoes may be laying eggs inside your septic tank if it is:

- Open or unsealed
- Broken with cracks or spaces between the blocks
- Missing a ventilation pipe screen cover

Mosquitoes in a septic tank

Repair broken septic tank covers

Cover ventilation pipes

Inspect and repair your septic tank to keep mosquitoes out

Here's how:

- Seal the septic tank.
- Repair cracks or gaps in the exterior walls of the septic tank using cement.
- Cover ventilation pipes with a screen mesh, repair broken pipes, and seal at the joints.
- Fill abandoned or unused septic tanks with dirt or gravel.

Septic tank ventilation pipe with screen mesh

Septic tank with concrete cover

Septic tank sealed with PVC cap

Welcome to the American Mosquito Control Association

AMCA® is a nonprofit organization that is dedicated to providing **leadership**, **information** and **education** leading to the enhancement of public health and quality of life through the suppression of mosquitoes.

» Leadership

AMCA is a professional association with members in over 50 countries, representing researchers, educators, vector control professionals, industry representatives, and students.

Learn more »

» Information

There are over 3,000 different species of mosquitoes throughout the world; about 200 species occur in the United States.

Learn more »

» Education

AMCA is proud to offer educational events that highlight the latest science, technology, and products used to conduct research and control vectors.

Learn more »

Click here to view our Zika Virus Fact Sheet.

NEW!! Click here to view AMCA's Best Practices for Integrated Mosquito Management Manual, 2017.

***** Recently updated from 2009 version by the AMCA expert advisory panel as part of the CDC sole-source contract for Establishment of Training and Certification Programs for Mosquito Surveillance and Control.***

NEW!! Click here for AMCA's New Video that debuted at the 83rd Annual Meeting!

Ask the Expert

Do you have a question about mosquitoes or mosquito control? Ask our expert. Ask the Expert »

AMCA NPDES Burden Statement

AMCA NPDES HR 897 Zika Letter

Study Finds Zika-Control Products Not Found in Lobster Population in Long Island Sound
Click here to read the press release.

Zika Information Center

Aedes albopictus, the Asian tiger mosquito, a potential secondary vector of Zika virus. Photo by Ary Faraji.

UPDATE

Update from AMCA's Zika Task Force (ZTF) - Report from the Zika Summit in Brazil

Click Here To View

For information on Zika (where it is in the world, how to protect yourself) please visit the CDC or WHO

American Mosquito Control Association (AMCA)

@AmericanMosquitoControl

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Posts

American Mosquito Control Association (AMCA)
1 hr ·

AMCA President, Wayne Gale, along with AMCA members met with Congressman Francis Rooney's office as part of the 2017 AMCA Washington Conference.

FMCA
Florida Mosquito Control Association

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Annual Conference

This year's Annual Conference is at Hawk's Cay in Marathon and it will be here before you know it...Watch for details here soon! Don't miss out!

Register now »

Become a Member

Members enjoy many benefits including networking opportunities, and up-to-date information on industry news. Join us today!

Join now »

MOSQUITO AND VECTOR CONTROL ASSOCIATION OF CALIFORNIA

Home | About | Advocacy & Legislation | Training & Certification | Membership | News & Events | Resources | Login

WE HAVE A MISSION

To provide quality public information, comprehensive mosquito and vector-borne disease surveillance, training to high professional standards, and effective legislative advocacy on behalf of California mosquito and vector control districts. Learn more...

Search | Search

LATEST MVCAC NEWS

California's wet winter could lead to an early mosquito season and increased virus transmission (April 14, 2017)

CARPHA
Caribbean Public Health Agency

MOSQUITO RESEARCH and CONTROL UNIT

- Control Activities
- Home
- The Friendly Aedes Aegypti Project
- About Us
- Brief Guide to Common Mosquitoes of the Cayman Islands
- Disease Information
- Cayman Brac
- News, Links & FAQs
- Contact Us
- Freedom of Information

The Friendly Aedes aegypti Project

An Oxitec & MRCU Collaboration

Secure Log-in

CONTACT US

Telephone +1 345 949 2557

Fax + 1 345 949 8912

E-mail: info@mrcu.ky

OPERATING HOURS

8.30am – 5pm

Monday to Friday

WELCOME

The Mosquito Research and Control Unit (MRCU) was established in 1965 to suppress mosquito populations so as to minimise discomfort from mosquito biting. To protect residents and visitors from mosquito-borne disease, and thereby enhance the quality of life and promote the economy of the Cayman Islands.

Control Op's

GM Mosquitoes

Why are they Friendly

The "Friendly *Aedes aegypti* Project" utilizes a pioneering technique using genetically modified male mosquitoes to control the *Aedes aegypti* species. Here's why they are "friendly":

Modified genes cannot be transferred to other species, even if the GM mosquitoes are eaten.

• GM males cannot pass their genetic modification to the females only to the offspring.

BBC NEWS

Cayman Islands Government Ministry of Health & Culture

Cayman Islands Government Website

Innovative Control Approaches

Can we use *Aedes* mosquitoes against themselves?

- Mosquitoes are much better at finding each other (for mating) and their preferred cryptic larval sources than we are

Two concepts were evaluated in California in 2015

- A *Wolbachia*-based autocidal approach (Los Angeles County)
- Auto-dissemination of insect growth regulators (Fresno County)

UNIVERSITY OF KENTUCKY

MOSQUITO mate™

CONSOLIDATED MOSQUITO ABATEMENT DISTRICT

San Gabriel Valley Mosquito & Vector Control District

GREATER LOS ANGELES COUNTY VECTOR CONTROL DISTRICT

Oxitec development history

Pink bollworm

OX513A

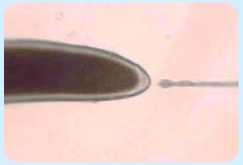
Brazil factory

2002/4

Company formed as spin out from Oxford University

Technology platform developed and exemplified in both agricultural and mosquito species

OX513A developed



Injection of DNA

2005/7

Global first release of a GE insect Pink Bollworm (marker only) in USA

Mosquito development spurred by Gates funding

2008/9

First outdoor release of OX513A mosquito in the Caymans

Environmental Impact Statement in the USA – environmentally preferred solution

WORLD ECONOMIC FORUM

Technology Pioneer 2008

World Economic Forum

2010/12

First outdoor release of OX513A in Brazil

First agricultural collaborations

Oxitec Brazil established

2013

Outdoor trials of OX513A in Panama and Brazil

First larger scale urban project starts in Jacobina, Brazil

First agricultural insect strains into development

Oxitec medfly

2014

Oxitec Brazil National Biosafety approval in Brazil Panama outdoor trial

USDA FONSI for agriculture trial in USA

Brazil approval for agricultural trial

2015/16

First direct projects OX513A Brazil scale up underway WHO VCAG recommendation for stage 3: larger scale / epi

Oxitec acquired by Intrexon to accelerate development

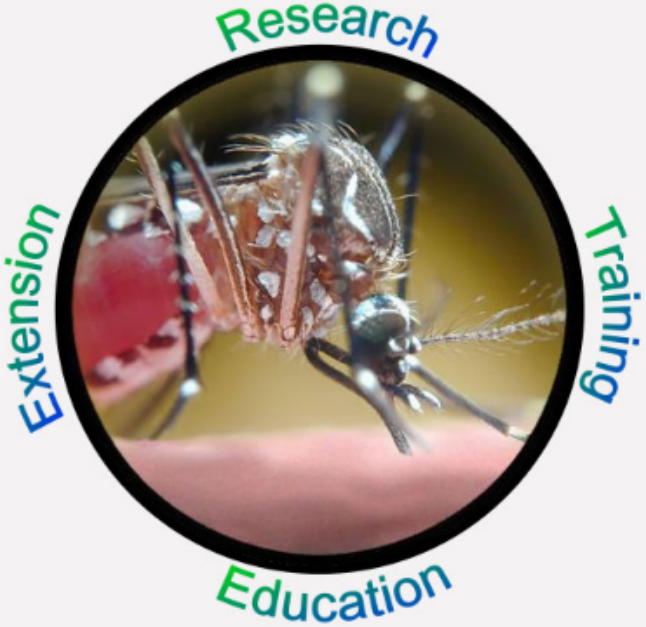
Zika crisis emerges

New UK factory

The Mosquito Information Website is all about mosquitoes and their impact on Florida. From mosquito biology to the current status of West Nile Virus in Florida, this is the one-stop source for mosquito information including research, training, extension and education.

LATEST INFORMATION ON ZIKA VIRUS

Registration for the 2017 Advanced Mosquito Identification Course is now CLOSED. MORE INFORMATION...



SOLUTIONS for your LIFE

EPI Emerging Pathogens Initiative

Search the Mosquito Website

Search

Search

Website Information

Mailing Address

Florida Medical Entomology Laboratory
200 9th Street SE
Vero Beach, FL 32962
Phone: 772-778-7200
Fax: 772-778-7205

Mosquito Training

Advanced Mosquito Identification Course
Dodd Short Courses
CEU Opportunities
Other Mosquito Events

Mosquito Events

Dodd Short Courses
FMCA Annual Meeting
Other Mosquito Events

Arboviral Surveillance

Sentinel Maps
Sentinel Movies
MWTD Risk Analysis
Arboviral Diseases

Mosquito News

BuzzWords
Florida Arbovirus Update
U.S. Arbovirus Update
Hurricanes and Mosquitoes
Other Mosquito News

Mosquito Factsheets

Mosquito Repellents
Eastern Equine Encephalitis
West Nile Virus
Other Factsheets