

Mosquito-borne Diseases of concern for Florida Citizens

Summer 2010

By

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Prepared for faculty and staff of the Florida Cooperative Extension System



This document is provided as a reminder of the mosquito-borne diseases of concern in Florida, recommendations for Florida citizens to protect themselves from infections from mosquitoes, and resources to obtain additional information.

While mosquito-borne diseases are always a concern in Florida, there was a very low level of mosquito-borne disease transmission to humans from 2005 – 2009. The summer of 2010 was an active mosquito-borne disease season in Florida. The two issues that made this season different were: 1) While there are imported cases of Dengue reported from Florida travelers each year, for the first time since 1934, there were locally acquired cases of Dengue in the Florida Keys; and 2) Four cases of eastern equine encephalitis have been diagnosed in Florida citizens. All four of these cases resulted in fatalities. The number of eastern equine encephalitis cases in humans over a year period in Florida typically does not exceed five.

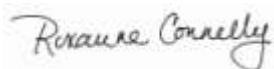
Late in 2009, cases of dengue were reported from the Old Town area of Key West, FL. Infections due to dengue virus (DENV) were acquired by bites from local mosquitoes, not from outside of the state. Cases of dengue are still being reported from Old Town. The four human cases of eastern equine encephalitis resulting in fatalities occurred in Hillsborough County (2), Leon County (1), and Wakulla County (1).

Two other mosquito-borne viruses, St. Louis encephalitis virus (SLEV) and West Nile virus (WNV) occur in Florida, although no human cases were reported in 2010 as of August 9. The University of Florida's Florida Medical Entomology Laboratory located in Vero Beach, FL, maintains an active surveillance program for EEEV, SLEV, and WNV and releases updated risk assessments when the data warrants. The latest update can be viewed at

http://mosquito.ifas.ufl.edu/Documents/MWTD/FMEL_AERA_2010_06.pdf

It is my intent that this document will provide you with information you can use when talking to news reporters, writing your newsletters, and providing programs for the public. If you need additional assistance, please contact me.

Sincerely,



Roxanne Connelly, PhD

Associate Professor, State Extension Medical Entomology Specialist

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Information contained in this document is from the University of Florida's Florida Medical Entomology Laboratory and the U.S. Centers for Disease Control and Prevention.

Synopsis

Each of the mosquito-borne diseases described here are caused by viruses that are passed either from mosquito to human to mosquito (DENV), or from bird to mosquito to human (EEEV, SLEV, and WNV). There are no vaccines available to the public or cures for humans for any of these 4 mosquito-borne diseases.

Reducing mosquito larval habitats is always important. However, this technique by itself will not provide protection from mosquito bites. The best method of protection from mosquito bites is the correct use of effective repellents.

The general description for symptoms that may be present due to infection with these mosquito-borne viruses is often simply “flu-like symptoms.” However, this description does not convey the severity of symptoms that may accompany infection; that information is provided in a detailed list of symptoms for each disease provided in this document. Infected individuals respond differently to the presence of pathogens in the human body, therefore, infection with the DENV, EEEV, SLEV, or WNV may or may not cause disease in humans.

The mosquito-borne diseases described here cannot be self-diagnosed, and physicians who suspect a patient has one of these diseases must send blood or spinal fluid samples to the state lab for testing for confirmed diagnosis.

	Reservoir Host (is not harmed by the virus)	Florida Vector Species	Susceptible Hosts (may become ill from infection with the virus)	Peak transmission
DENV	Mosquitoes	<i>Aedes aegypti</i> <i>Aedes albopictus</i>	Humans	N/A
EEEV	Birds	<i>Coquillettidia perturbans</i> <i>Aedes infirmatus</i> <i>Culex nigripalpus</i>	Humans, horses, exotic birds	July - August
SLEV	Birds	<i>Culex nigripalpus</i>	Humans	August - October
WNV	Birds	<i>Culex nigripalpus</i>	Humans, horses, corvid birds	August - October

Dengue

Dengue, also known as breakbone fever, is caused by a virus that cycles from mosquito to human to mosquito. Prior to the 1940s, there were regular occurrences of dengue outbreaks in Florida. Since the 1940s, cases that are reported in Florida have been in people who were bitten by infected mosquitoes while visiting dengue-endemic areas. In 2009 and 2010, locally acquired cases of dengue were reported from the Florida Keys. The mosquito species responsible for dengue virus transmission in Florida are “container mosquitoes” because they lay their eggs in water-holding containers such as those that can be found around the yard and home. The adult mosquitoes do not fly far from the larval habitat and prefer to obtain blood for egg development on humans. The most important means of reducing risk for contact with dengue vectors is by wearing effective mosquito repellents and ridding the yard and home of water-holding containers that can support the growth of mosquito larvae.

Symptoms



- High fever and at least two of the following to indicate the disease without laboratory diagnoses:
 - Severe headache
 - Severe eye pain (behind eyes)
 - Joint pain
 - Muscle and/or bone pain
 - Rash
 - Mild bleeding manifestation (e.g., nose or gum bleed, petechiae, or easy bruising)
 - Low white cell count

- Watch for warning signs as temperature declines 3 to 7 days after symptoms began. Go **IMMEDIATELY** to an emergency room or the closest health care provider if any of the following warning signs appear:
 - Severe abdominal pain or persistent vomiting
 - Red spots or patches on the skin
 - Bleeding from nose or gums
 - Vomiting blood
 - Black, tarry stools (feces, excrement)
 - Drowsiness or irritability
 - Pale, cold, or clammy skin
 - Difficulty breathing

Distribution & Seasonality

As of 31 July 2010, local dengue transmission was restricted to the Old Town area of Key West, in Monroe County. Cases were reported in the Fall of 2009 and the Spring and Summer of 2010. As of August 2010 there was not enough data to determine a seasonal pattern of transmission for dengue in Florida.

Florida Vectors of DENV

Species	Larval Habitat	Distribution in Florida	Adults
Scientific name: <i>Aedes aegypti</i> Common name: Yellow Fever Mosquito	Water-holding objects found around the home and yard such as flower vases, tires, toys, bottles, conch shells, cans, refrigerator drain pans, barrels, bromeliad plants, and more.	Found in all Florida counties, but is only abundant in the Florida Keys	 <p>The adults do not fly far from their larval habitat, generally not more than 500 meters.</p>
Scientific name: <i>Aedes albopictus</i> Common name: Asian tiger mosquito	Water-holding objects found around the home and yard such as flower vases, tires, toys, bottles, cans, barrels, tree-holes, bromeliad plants, and more.	Found in all Florida counties, but does not occur in the Florida Keys. Abundant throughout the state.	 <p>The adults do not fly far from their larval habitat, generally not more than 500 meters.</p>

At-risk

People who reside in areas where DENV is circulating in the mosquito population risk exposure to infected mosquitoes by spending time outdoors without wearing insect repellents. Unlike many other mosquito species that are active mostly at dawn and dusk, the mosquitoes that transmit DENV, *Aedes aegypti* and *Ae. albopictus*, are active human biters throughout the day. Those at a higher risk of exposure live in homes where the windows and doors stay open, and where screens are in disrepair. Residents or visitors who spend time in open-air establishments also are at risk for encountering infected mosquitoes. As of early August 2010, the only area of Florida where there was evidence of DENV circulation was in the Old Town area of Key West.

Historical for Florida

The last epidemic of locally-transmitted DENV in Florida was in 1934-35 when an estimated 15,000 people were reported to be infected.

Florida 2010 Situation (as of 31 July 2010)

In 2010, 24 cases of dengue were acquired in Key West, involving 18 residents, 5 residents of other counties, and one out-of-state visitor.

Notes:

There is no specific medication for treatment of a DENV infection. Recommendations from the U.S. Centers for Disease Control and Prevention for persons who think they have been infected are to use analgesics (pain relievers) with acetaminophen and avoid medications containing ibuprofen, Naproxen, aspirin or aspirin containing drugs. They should also rest, drink plenty of fluids to prevent dehydration, avoid mosquito bites while febrile and consult a physician.

Eastern Equine Encephalitis

Eastern equine encephalitis has likely been present in the U.S. for a long time, but it wasn't until 1933 during an outbreak in horses in the Mid-Atlantic States that it was named. This disease is rare in humans and is caused by infection with the eastern equine encephalitis virus (EEEV) that is transmitted to humans through the bite of infected mosquitoes. Horses infected with EEEV have a very small chance of surviving and most often are euthanized. However, there is an effective vaccine for horses. The fatality rate in humans infected with the EEEV is high with nearly a 35% fatality rate, and survivors will need medical care for the remainder of their life.

Symptoms (progressing from onset through all potential symptoms).




- Sudden onset of headache
- High Fever
- Chills
- Vomiting
- Disorientation
- Seizures, coma
- Death

Infected humans will respond differently and may not exhibit all of these manifestations. About 5% of humans infected with EEEV will develop encephalitis.

Distribution & Seasonality

Cases have been reported mainly from Gulf Coast and Atlantic States and the Great Lakes region. In Florida, cases are sporadic and tend not to occur in clusters. For example, 5 cases in 2005 occurred in 5 different counties.

Florida Vectors of EEEV

Species	Larval Habitat	Distribution in Florida	Adult Image
<p>Scientific name: <i>Coquillettidia perturbans</i></p>	<p>Shallow lakes and ponds with emergent vegetation and marshy borders; larvae and pupae attach to emergent aquatic plants, primarily cattails</p>	<p>Found in all Florida counties</p>	
<p>Scientific name: <i>Aedes infirmatus</i></p>	<p>Temporary woodland pools</p>	<p>Found in all Florida counties</p>	
<p>Scientific name: <i>Culex salinarius</i></p>	<p>Fresh or foul water of ponds, ditches, grassy pools, brackish water swamps</p>	<p>Found in all Florida counties</p>	

At-risk

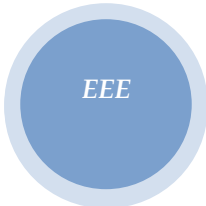
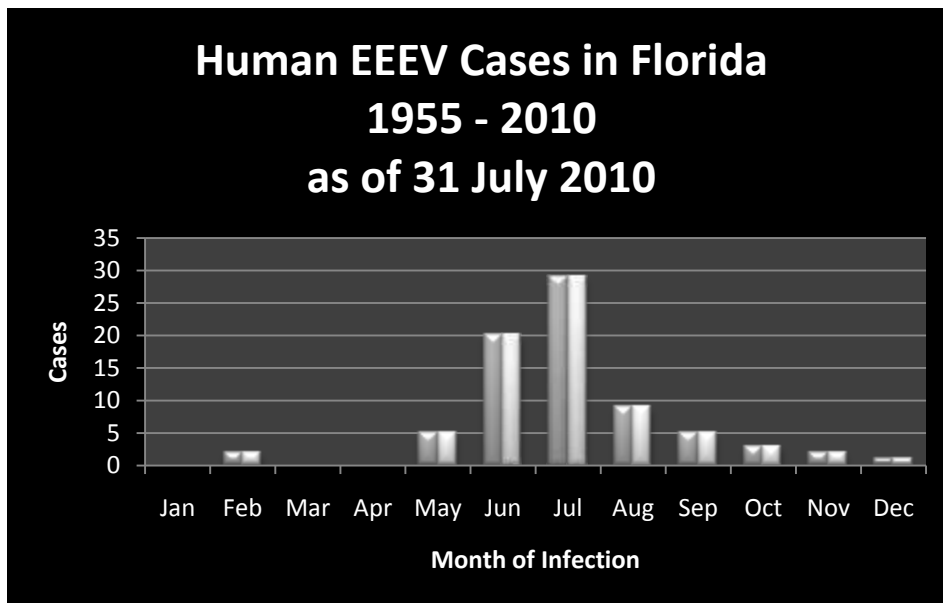
Anyone exposed to mosquitoes when they are biting, and when virus is circulating in a given area, are at risk of encountering a mosquito infected with EEEV. Humans involved in the following activities are at a higher risk simply due to their activity coinciding with mosquito habitats at times when mosquitoes are seeking blood for reproduction:

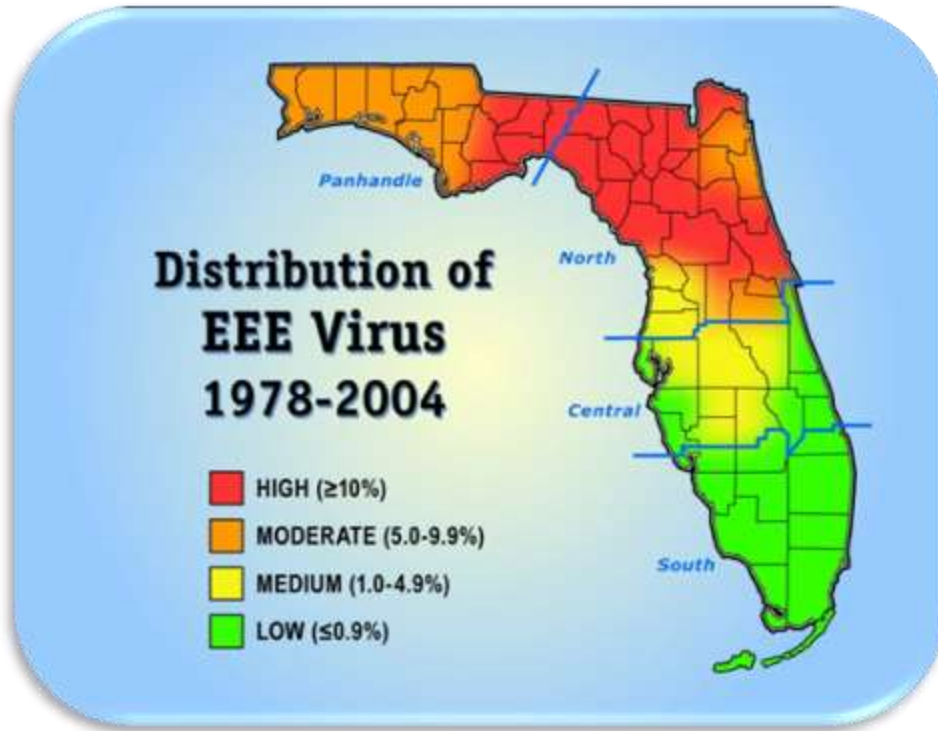
- Work outside.
- Live, work, or visit areas near woodland habitats, especially those with freshwater swamps.
- Participate in outdoor recreation.

While the chances of being infected are high for the at-risk activities mentioned above, people over 50 and under 15 years of age are at greatest risk for experiencing severe symptoms and disease. It is thought that infection with EEEV provides life-long immunity from subsequent infection with this virus.

Historical for Florida:

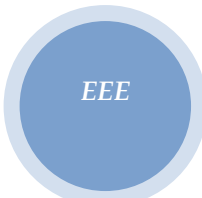
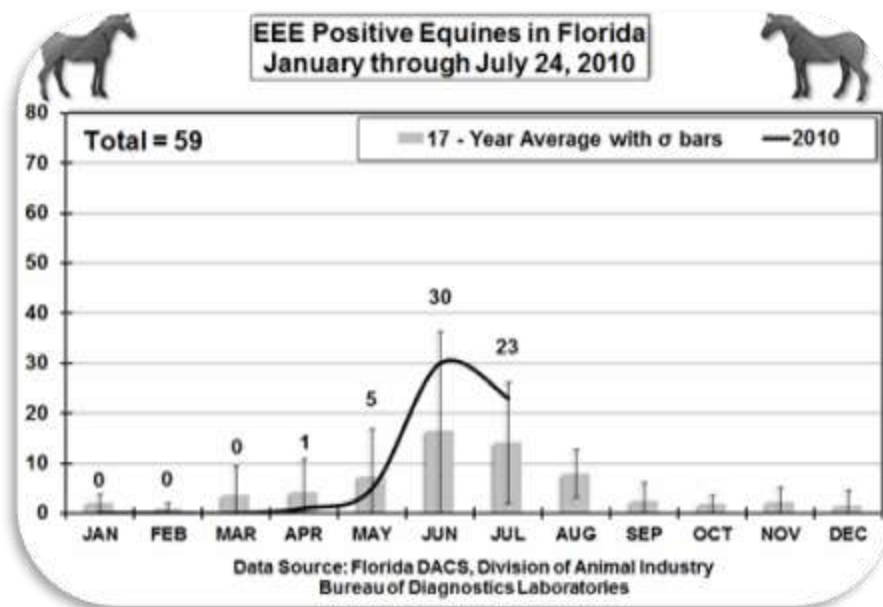
- The majority of cases are reported during the summer months peaking in July
- Highest number of cases in a one year period is 5 (2005)

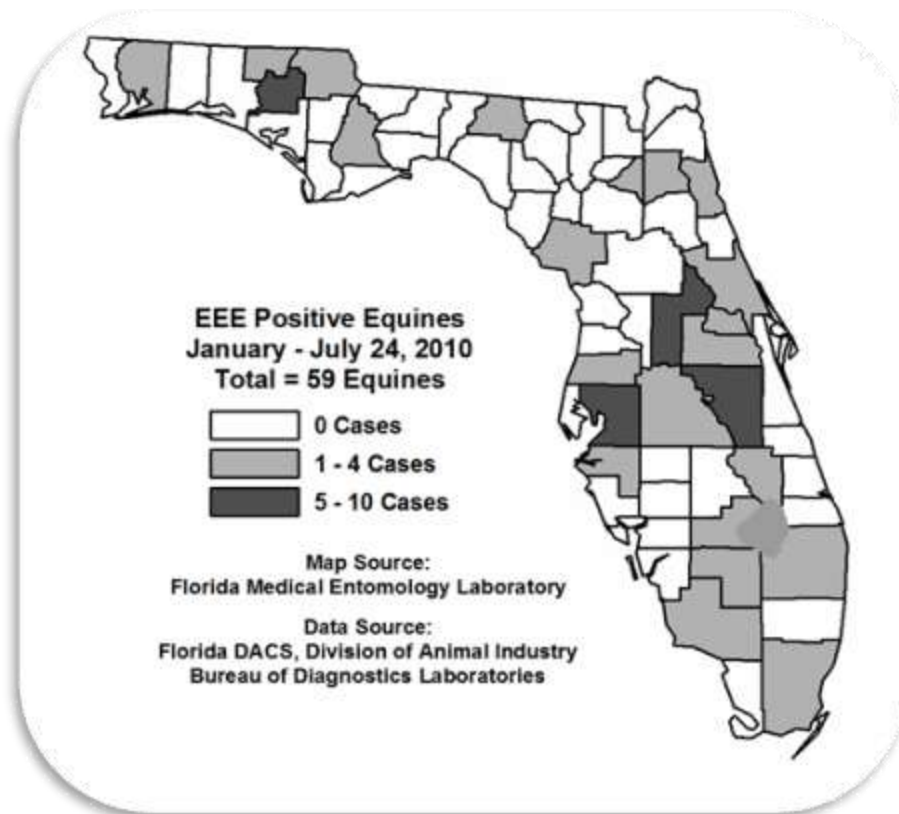




Florida 2010 Situation (31 July 2010)

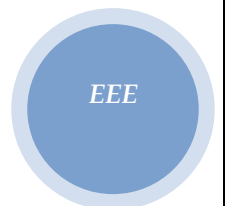
- 4 human deaths – Hillsborough County (2), Leon County (1), and Wakulla County (1)





Notes:

Humans and horses are considered “dead-end hosts” because they develop a low amount of virus in their blood that makes it difficult for them to infect biting mosquitoes. Some birds are “reservoirs” of the virus and are not harmed by the presence of the virus in their blood. However, exotic birds such as emus and ostriches are highly susceptible and the virus can wipe out entire flocks of these exotic animals.



St. Louis Encephalitis

St. Louis encephalitis is caused by infection with St. Louis encephalitis virus (SLEV) transmitted to humans through the bite on an infected mosquito. Major epidemics of SLEV occurred in Florida in 1959, 1961, 1962, 1977, and 1990. Epidemics in Florida are cyclic, occurring approximately every 10 – 20 years, but the virus is considered to be endemic in this area. Horses are not affected by SLEV.

Symptoms

- Fever
- Headache
- Dizziness
- Nausea
- Malaise

Less than 1% of SLEV infections will develop into clinical illness.

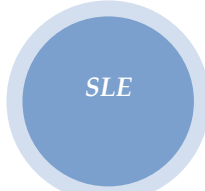
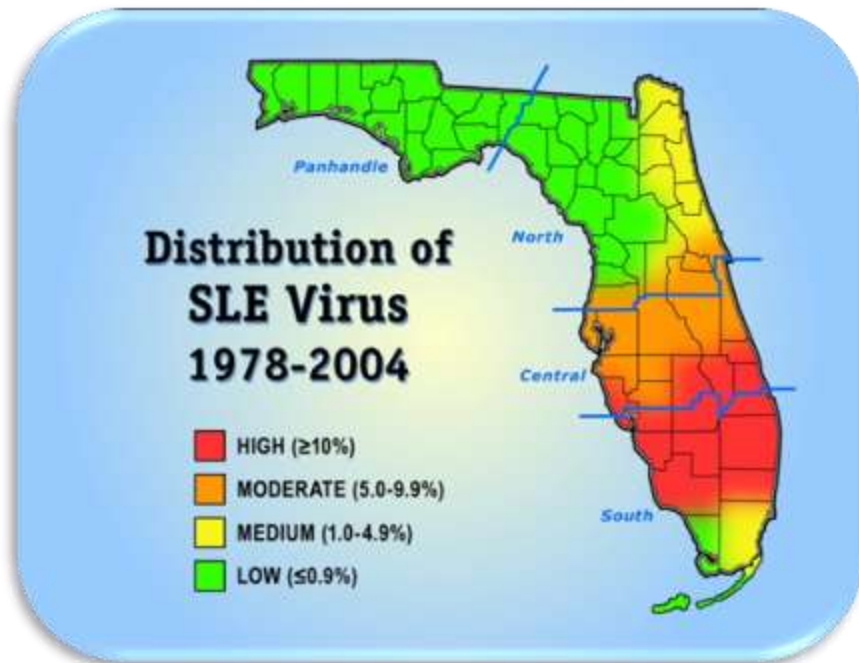
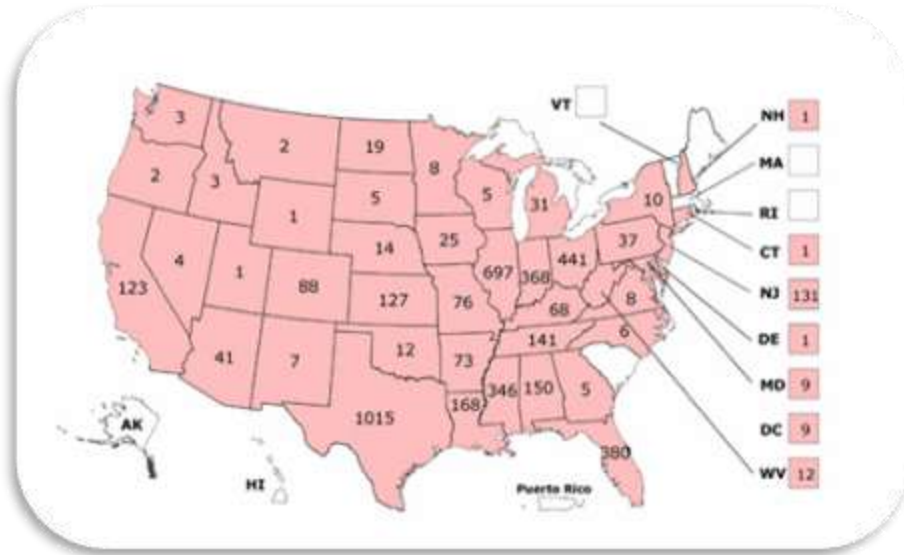
Severe infections progress to:

- Stiff neck
- Confusion
- Disorientation
- Dizziness
- Tremors
- Unsteadiness
- Coma



About 40% of children and young adults infected with SLEV develop only fever and headache or aseptic meningitis; almost 90% of elderly persons with SLEV develop encephalitis. The overall case-fatality ratio is 5 to 15%. The risk of fatal disease also increases with age.

Distribution

St. Louis Encephalitis Cases Reported by State, 1964-2008



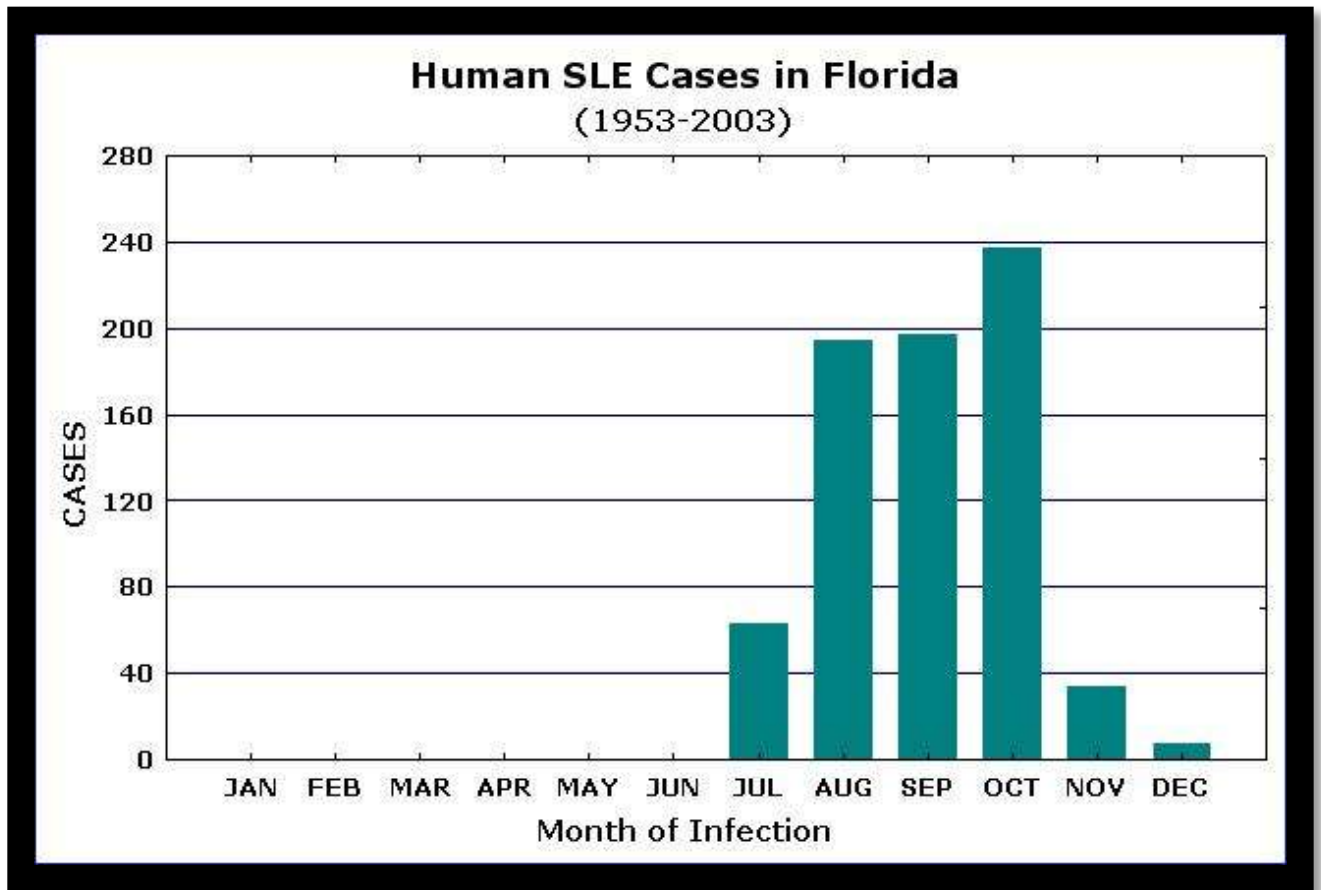
Florida Vectors of SLEV

Species	Larval Habitat	Distribution in Florida	Adults
Scientific name: <i>Culex quinquefasciatus</i> Common name: Southern House Mosquito	Highly organic, polluted, foul water in containers, catch basins, ground pools, effluent from sewage treatment areas, abandoned swimming pools, dairy lagoons, ditches, animal watering tanks.	Found in all Florida counties	
Scientific name: <i>Culex nigripalpus</i>	Ditches, containers, grassy pools, dairy lagoons, furrows of citrus groves	Found in all Florida counties, abundant throughout the state.	

At-risk

The Florida vectors of SLEV are most active in seeking blood meals from dawn to dusk. Anyone bitten by a mosquito in an area where the virus is circulating can get infected with SLEV. The risk is highest for persons who engage in outdoor work and recreational activities and those living in low-income areas. Elderly persons are at increased risk of severe disease if they are infected.

Historical for Florida

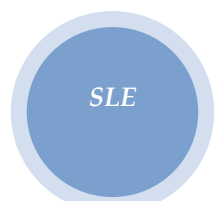


Florida 2010 Situation (31 July 2010)

There was no evidence of SLEV activity in Florida.

Notes:

The larval habitats of mosquito species involved in transmission of SLEV in Florida are not usually associated with containers around the home. The larval habitats occur on a much larger scale, such as pastures, orchards, waste water sites, etc., and are best managed by organized mosquito control districts. The best method against infection with SLEV is through the use of effective insect repellents.



West Nile Fever/West Nile Encephalitis

West Nile virus (WNV) was detected in the United States in 1999 in New York and by 2001 was reported in Florida. Human infections occur through the bite of an infected mosquito. Human and animal (horse) cases of West Nile increased from 2001 – 2003, but then tapered off to about 3 human and 3 horse cases per year. The majority of human and horse cases in Florida occur in late summer through early fall. There is a vaccine to prevent WNV in horses, but there is no vaccine for humans.

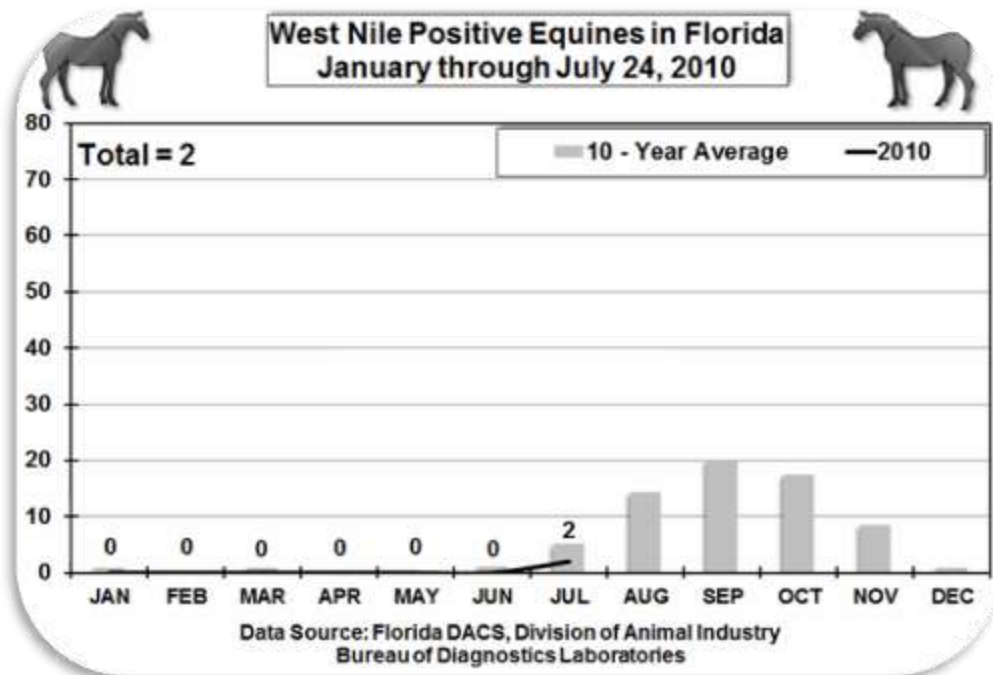
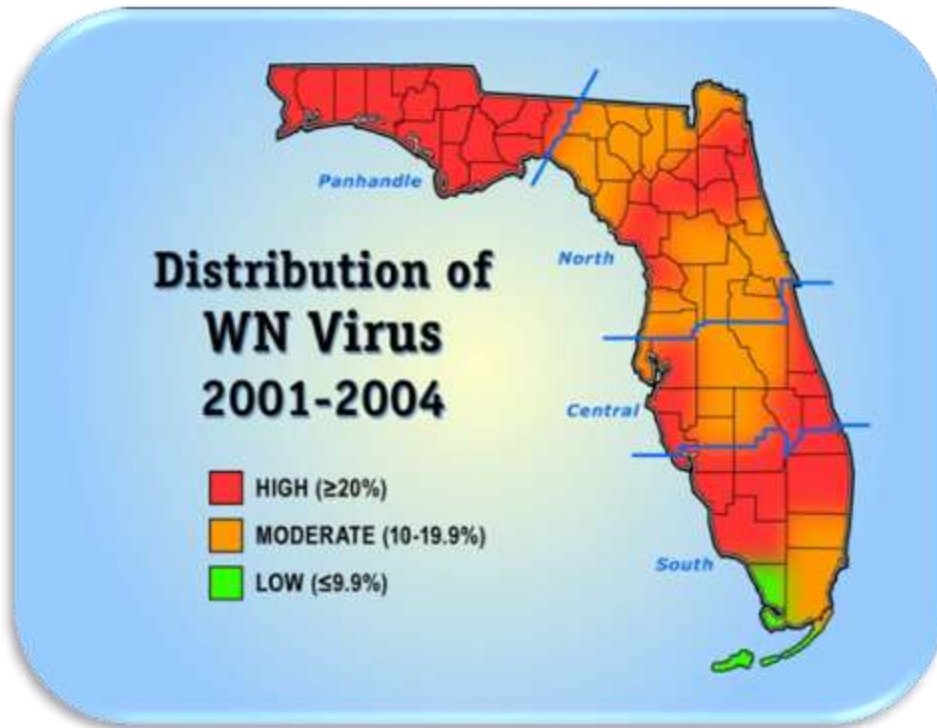
Symptoms

- West Nile Fever
 - Fever
 - Headache
 - Body aches
 - Nausea
 - Vomiting
 - Swollen lymph glands
 - Skin rash on chest, stomach and back


- West Nile Encephalitis
 - High fever
 - Headache
 - Neck stiffness
 - Stupor
 - Disorientation
 - Coma
 - Tremors
 - Convulsions
 - Muscle weakness
 - Vision loss
 - Numbness
 - Paralysis

About one in 150 people infected with WNV will develop severe illness. The symptoms may last several weeks, and neurological effects may be permanent. Up to 20 percent of the people who become infected have mild symptoms that can last for as short as a few days, though even healthy people have become sick for several weeks. Approximately 80 percent of people (about 4 out of 5) who are infected with WNV will not show any symptoms at all.

Distribution & Seasonality



Florida Vectors of WNV

Species	Larval Habitat	Distribution in Florida	Adults
Scientific name: <i>Culex nigripalpus</i>	Ditches, containers, grassy pools, dairy lagoons, furrows of citrus groves	Found in all Florida counties, abundant throughout the state.	

At-risk

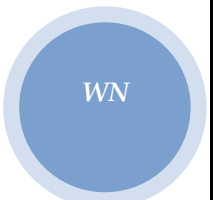
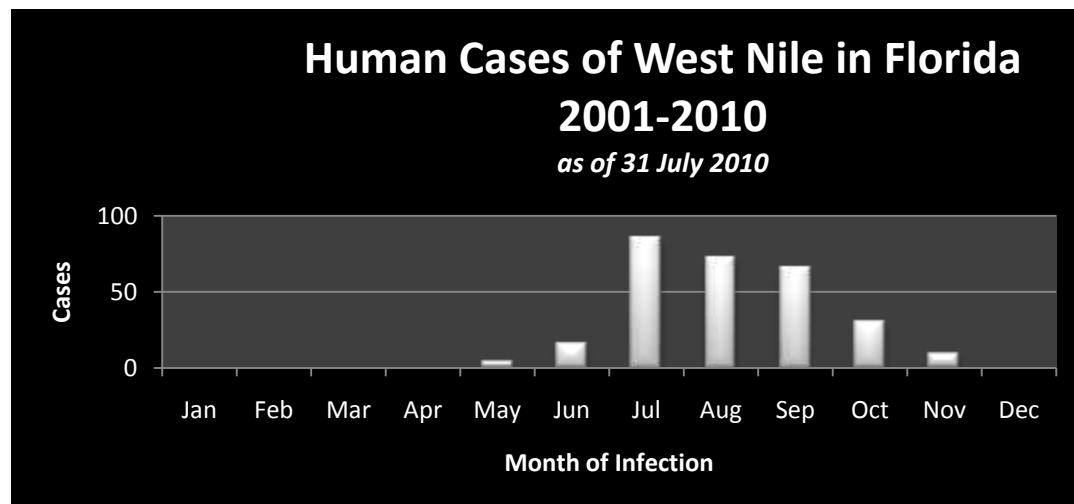
Spending time spent outdoors increases the risk for a person to be bitten by an infected mosquito. Pay attention to avoiding mosquito bites if you spend a lot of time outside, either working or playing.

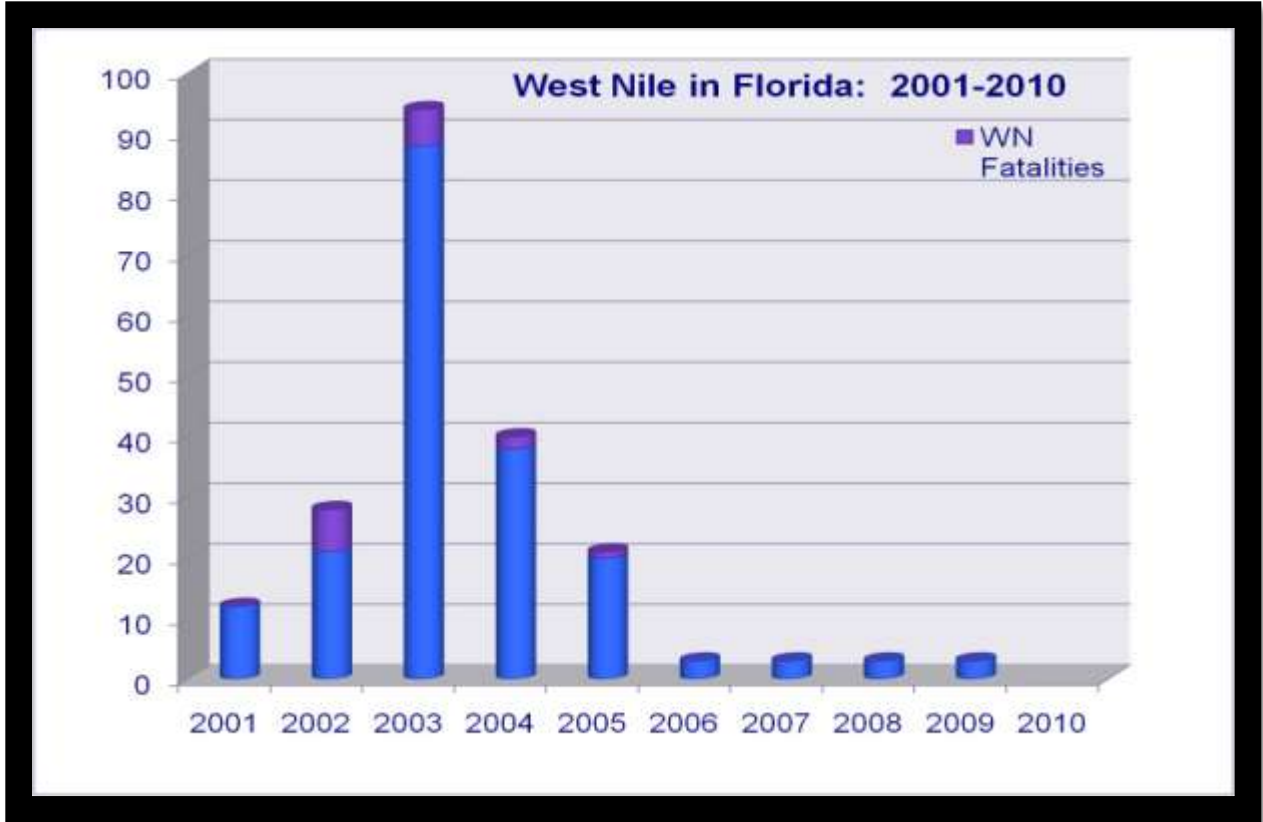
People over the age of 50 are more likely to develop serious symptoms from infection with WNV if they do get sick and should take special care to avoid mosquito bites. Age is by far the most important risk factor for developing neuroinvasive WNV infection.

All donated blood is checked for WNV before being used. The risk of getting WNV through blood transfusions and organ transplants is very small, and should not prevent people who need surgery from having it. If you have concerns, talk to your doctor.

Pregnancy and nursing do not increase the risk of becoming infected with WNV. The risk that WNV may present to a fetus or an infant infected through breast milk is still being evaluated. Talk with your care provider if you have concerns.

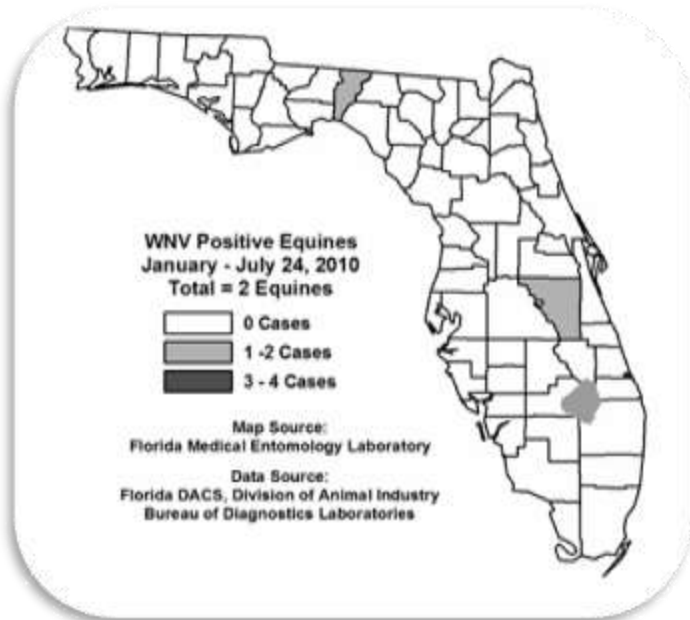
Historical for Florida





Florida 2010 Situation (July 31, 2010)

Two WNV-positive horses were reported: Osceola (1); Jefferson (1)



Protection from Mosquito Bites

The U.S. Centers for Disease Control and Prevention (CDC) recommends the use of products containing active ingredients which have been registered by the U.S. Environmental Protection Agency (EPA) for use as repellents applied to skin and clothing. EPA registration of repellent active ingredients indicates the materials have been reviewed and approved for efficacy and human safety when applied according to the instructions on the label.

CDC evaluation of information contained in peer-reviewed scientific literature and data available from EPA has identified several EPA registered products that provide repellent activity sufficient to help people avoid the bites of disease carrying mosquitoes. Products containing these active ingredients typically provide reasonably long-lasting protection:

Efficacy of repellents varies among individuals and is affected by:

- Temperature
- Perspiration
- Humidity
- Activity level
- Exposure to water
- Mosquito species
- Other factors

DEET (Chemical Name: N,N-diethyl-m-toluamide or N,N-diethyl-3-methyl-benzamide)

Picaridin (KBR 3023, Chemical Name: 2-(2-hydroxyethyl)-1-piperidinecarboxylic acid 1-methylpropyl ester)

Oil of Lemon Eucalyptus* or **PMD** (Chemical Name: para-Menthane-3,8-diol) the synthesized version of oil of lemon eucalyptus

IR3535 (Chemical Name: 3-[N-Butyl-N-acetyl]-aminopropionic acid, ethyl ester)

In general, higher concentrations of active ingredient provide longer duration of protection, regardless of the active ingredient, although concentrations above ~50% do not offer a marked increase in protection time. Products with <10% active ingredient may offer only limited protection, often from 1-2 hours. Products that offer sustained release or controlled release (micro-encapsulated) formulations, even with lower active ingredient concentrations, may provide longer protection times. Regardless of what product you use, if you start to get mosquito bites reapply the repellent according to the label instructions or remove yourself from the area with biting insects if possible.

* Note: This recommendation refers to EPA-registered repellent products containing the active ingredient oil of lemon eucalyptus (or PMD). "Pure" oil of lemon eucalyptus (e.g. essential oil) has not received similar, validated testing for safety and efficacy, is not registered with EPA as an insect repellent, and is not covered by this CDC recommendation.

Repellents for use on clothing:

Certain products containing **permethrin** are recommended for **use on clothing, shoes, bed nets, and camping gear**, and are registered with EPA for this use. Permethrin is highly effective as an insecticide and as a repellent. Permethrin-treated clothing repels and kills ticks, mosquitoes, and other arthropods and retains this effect after repeated laundering. The permethrin insecticide should be reapplied following the label instructions. Some commercial products are available pretreated with permethrin.

EPA recommends the following precautions when using insect repellents:

- Apply repellents only to exposed skin and/or clothing (as directed on the product label.) Do not use repellents under clothing.
- Never use repellents over cuts, wounds or irritated skin.
- Do not apply to eyes or mouth, and apply sparingly around ears. When using sprays, do not spray directly on face—spray on hands first and then apply to face.
- Do not allow children to handle the product. When using on children, apply to your own hands first and then use the material on your hands to apply it to the child. You may not want to apply materials to children’s hands to avoid the chance they could transfer the materials to the eyes and mouth.
- Use just enough repellent to cover exposed skin and/or clothing. Heavy application and saturation are generally unnecessary for effectiveness. If biting insects do not respond to a thin film of repellent, then apply a bit more.
- After returning indoors, wash treated skin with soap and water. This is particularly important when repellents are used repeatedly during the day or on consecutive days. Also, wash treated clothing before wearing it again. (This precaution may vary with different repellents—check the product label.)
- If you or your child gets a rash or other reaction from an insect repellent, stop using the repellent, wash the repellent off with mild soap and water, and call a local poison control center for further guidance. If you go to a doctor because of the repellent, take the repellent with you to show the doctor.

Note that the label for products containing oil of lemon eucalyptus specifies that they should not be used on children under the age of three years. Other than those listed above, EPA does not recommend any additional precautions for using registered repellents on children or on pregnant or lactating women.

For additional information regarding the use of repellent on children, please see CDC's Frequently Asked Questions about Repellent Use.

[\[http://www.cdc.gov/ncidod/dvbid/westnile/qa/insect_repellent.htm\]](http://www.cdc.gov/ncidod/dvbid/westnile/qa/insect_repellent.htm)

The University of Florida's Florida Medical Entomology Laboratory has tested and published the results on the efficacy of the following repellents. Average Complete Protection Time is the time that elapses between the proper application of a repellent until the first mosquito lands on the protected area.

Products	Active Ingredient	Average Complete Protection Time
OFF! Deep Woods	23.8% DEET	5 hours
Sawyer Controlled Release	20% DEET	4 hours
OFF! Skintastic	6.65% DEET	2 hours
Repel Lemon Eucalyptus Insect Repellent	Oil of lemon eucalyptus; p-menthane 3,8-diol (PMD)	2 hours
Bite Blocker for Kids	2% Soybean Oil	1.5 hours
OFF! Skintastic for Kids	4.75% DEET	1.5 hours
Skin-So-Soft Bug Guard Plus	7.5% IR3535	23 minutes
Natrapel	10% Citronella	20 minutes
Herbal Armor	12% Citronella; 2.5% peppermint oil; 2% cedar oil; 1% lemongrass oil; 0.05% geranium oil	19 minutes
Green Ban for People	10% Citronella; 2% peppermint oil	14 minutes
Buzz Away	5% Citronella	14 minutes
Skin-So-Soft Bug Guard	0.1% Citronella	10 minutes
Skin-So-Soft Bath Oil	Active Ingredient not known	10 minutes
Skin-So-Soft Moisturizing Suncare	0.05% Citronella	3 minutes
Gone Original Wristband	9.5% DEET	0
Repello Wristband	9.5% DEET	0
Gone Plus Repelling Wristband	25% Citronella	0

Resources

EDIS Fact Sheets

Dengue <http://edis.ifas.ufl.edu/in699>

Eastern equine encephalitis <http://edis.ifas.ufl.edu/in179>

Mosquito Repellents <http://edis.ifas.ufl.edu/in419>

West Nile Virus <http://edis.ifas.ufl.edu/in117>

Mosquito Information Website <http://mosquito.ifas.ufl.edu>

Encephalitis Information System <http://eis.ifas.ufl.edu>

(Available in English and Spanish)

Florida Mosquito Control Association www.floridamosquito.org

American Mosquito Control Association www.mosquito.org

Arboviral Epidemic Risk for Florida
http://mosquito.ifas.ufl.edu/MWTD_Risk_Model.htm

Link to websites for Florida Mosquito Control Programs (by county)
http://mosquito.ifas.ufl.edu/Florida_Mosquito_Control_Districts.htm