



Arboviral Diseases in Pre and Post Disaster Situations

Brunswick County Mosquito Control

Abram Young





Arboviral Diseases in Pre and Post Disaster Situations

- Overview:
 - Brunswick County Surveillance Program
 - ArboNet
 - News releases
 - Mosquito Abatement Quick Guide
 - FEMA APPENDIX G: MOSQUITO ABATEMENT
 - CDC GUIDELINES FOR ARBOVIRUS SURVEILLANCE PROGRAMS IN THE UNITED STATES



Brunswick County Surveillance Program

- Surveillance Program Reports:
 - Historical data
 - Citizen request
 - Landing counts
 - Daily light traps (3 locations)
 - CDC light traps
 - EEE & WNV
 - GIS mapping





Brunswick County Surveillance Program

- Historical data
 - What mosquitoes are active?
 - Trap data
 - Past seasonal events and weather conditions
 - Past problem areas
 - Past control methods
 - Additional information
- Citizen request
 - What are the citizens saying?
 - Location of request
 - Multiple request
 - Larvicide locations
 - Landing count stations
 - Are mosquitoes the real issue?
 - Additional information for mosquito tech



Brunswick County Surveillance Program

Landing counts

- Landing counts
 - Current landing rate
 - Multiple stations covering the county
 - Pre and Post event
 - Pre and Post application
 - *Aedes albopictus*
 - Mosquito field ID
 - *Aedes albopictus*

Landing counts

- Mosquito Habitats
 - Salt Marsh
 - *Oc. sollicitans & taeniorhynchus*
 - Woodland Pool
 - *Ps. ciliata*
 - Permanent Water
 - *An. quadrimaculatus*
 - Flood Plain
 - *Oc. atlanticus*
 - Pasture
 - *Ps. columbiae*
 - Container
 - 2 types (natural or man made)
 - *Ae. albopictus*



Brunswick County Surveillance Program

- Daily light traps (3 locations)
 - Current trap date
 - 24/7 365 days a year
 - Pre and post event
 - Pre and post application
 - Seasonal trend
 - Builds historical record





Brunswick County Surveillance Program

- CDC light traps

- Virus activity
- EEE and WNV
- Week 38-42
 - But may adjust trapping depending on seasonal factors
- Pre and post event
- Pre and post application





Brunswick County Surveillance Program

CDC light traps

EEE

- Normal seasonal conditions
- Incubation periods
- 4 to 10 days
- *Cs melanura* (EEE)
 - Wild Birds

WNV

- Drought conditions
- Incubation periods
- 2 to 6 days but ranges from 2 to 14 days.
- *Cx. pipiens* (WNV)
 - Wild Birds



Brunswick County Surveillance Program

GIS Mapping

- 2ft Contours
- Wetlands
- Soils
- Major Hydrology
- Minor Hydrology
- Structures
- Parcels
- Primary Roads
- Streets
- County Boundary
- Orthoimagery
- 2018 BRU DS Islands
- County ULV Routes
- Citizen Requests
- Do Not Spray List
 - Bee keeper
 - Call before spray
 - Do not spray
 - Do not spray call before
 - Fish farm
- Larvicide Registry
- Historical Mosquito Projects



Brunswick County Surveillance Program

Storing Records

By law, ALL application records must be kept for a minimum of 3 years.

- Adulticiding Records
- Larviciding Records
- Citizen Requests
- Reports

- Number of Mosquito Species
 - World **3,000+** *species*
 - United States **176** *species*
 - North Carolina **64** *species*
 - Brunswick County **49** *species*



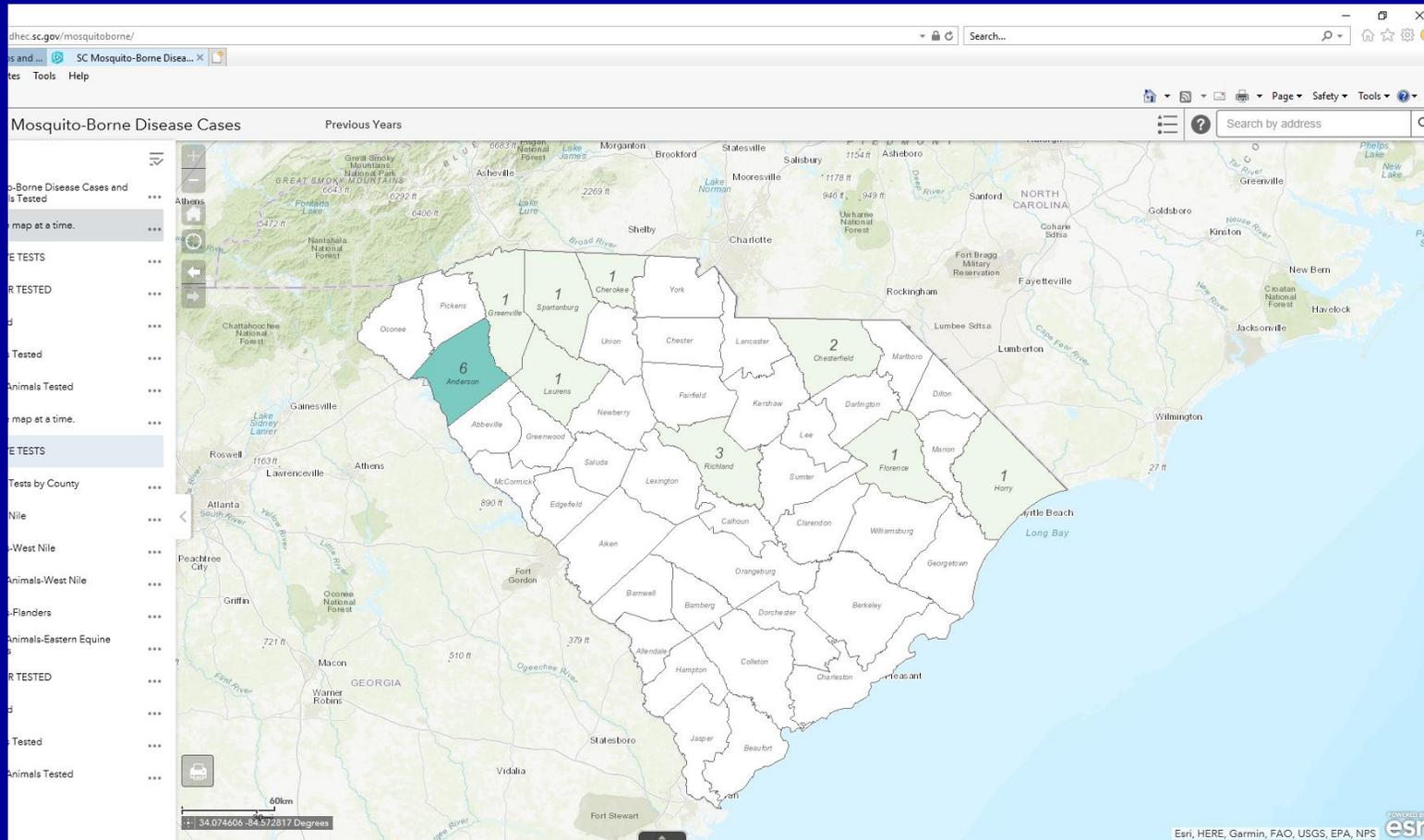
Brunswick County and Surrounding area Arbovirus Activity

Surveillance Program



2018 Arbovirus Activity in South Carolina

Source: SC DEHEC



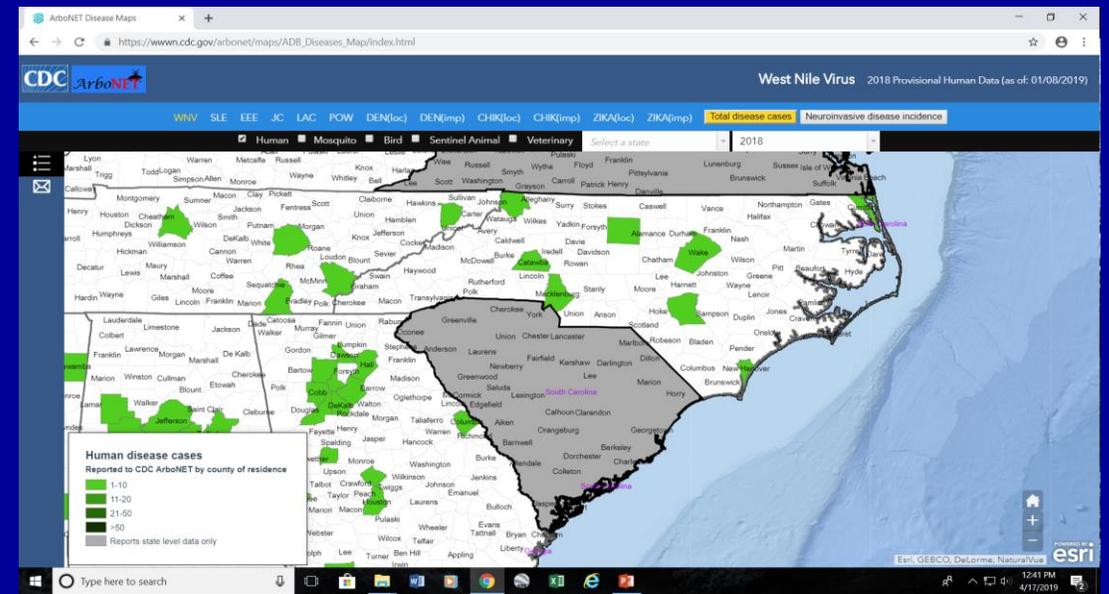
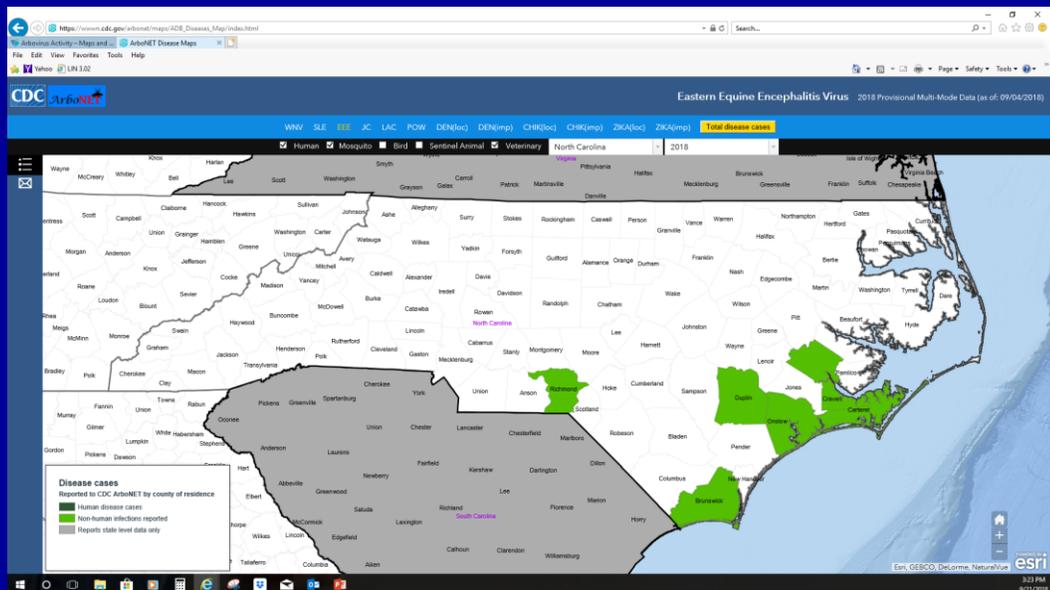


2018 Arbovirus Activity in North Carolina

CDC ArboNet 2018

EEE Humans 1
 EEE Horses 5
 Mosquito pools 7

WNV 10 cases
 and 2 deaths

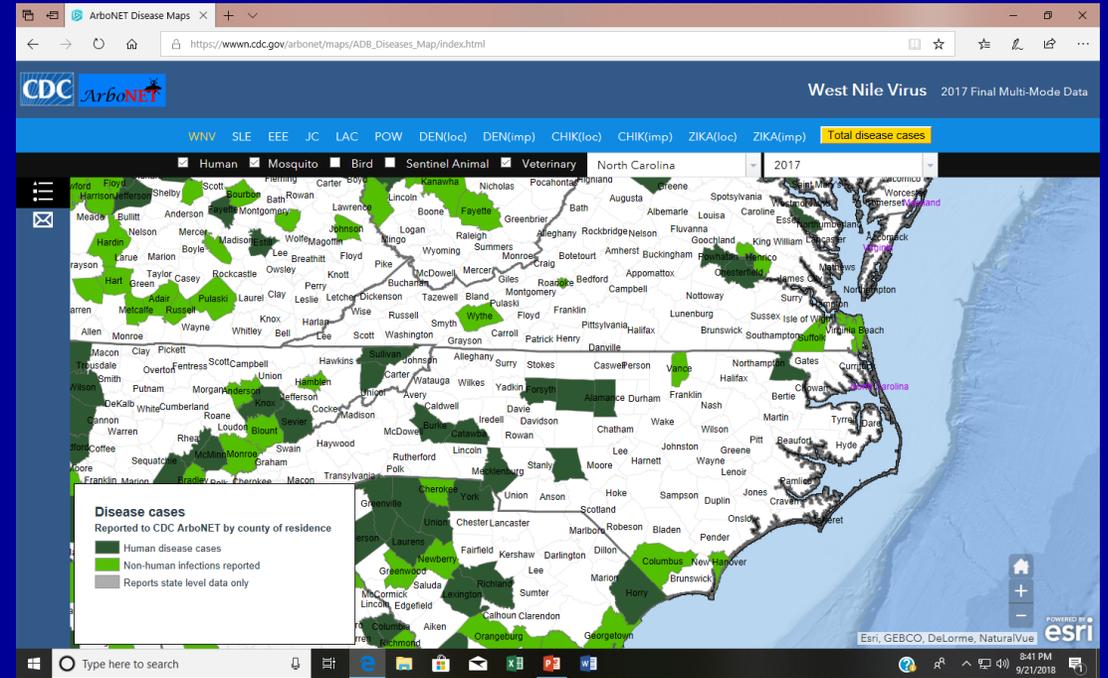
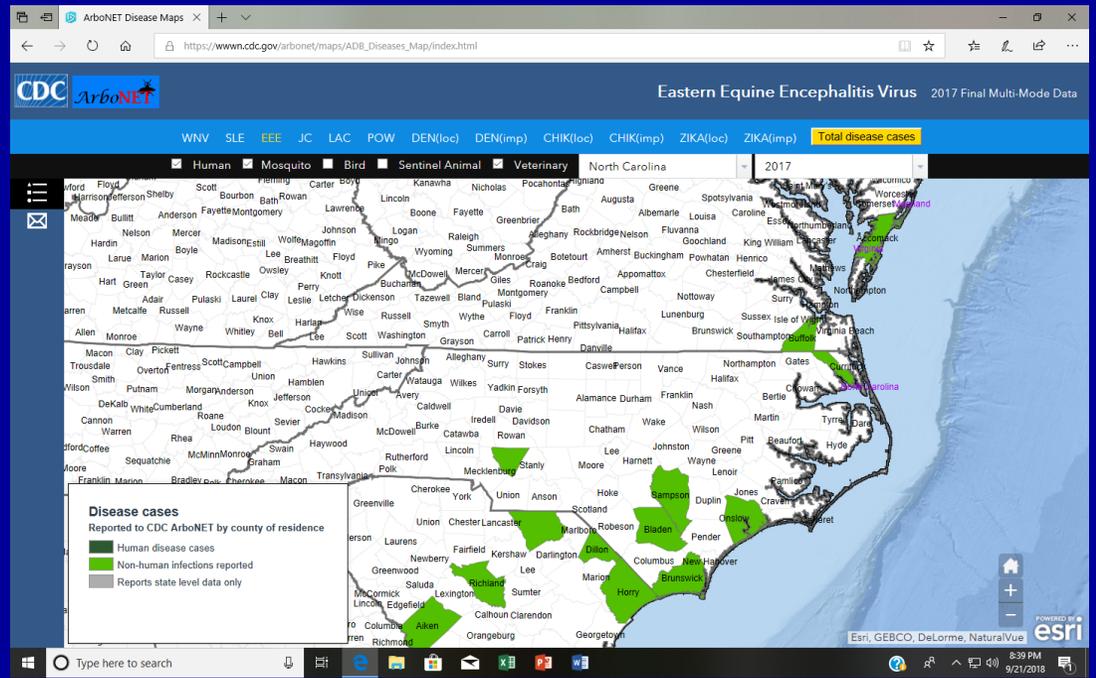




2017 Arboviruses

EEE

WNV

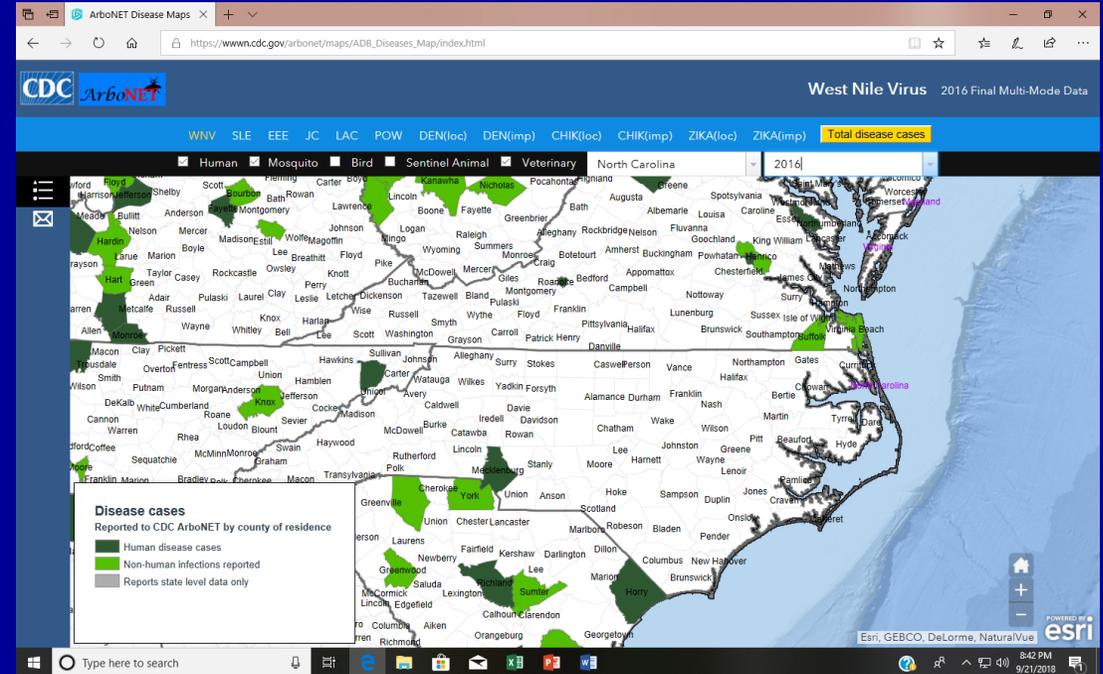
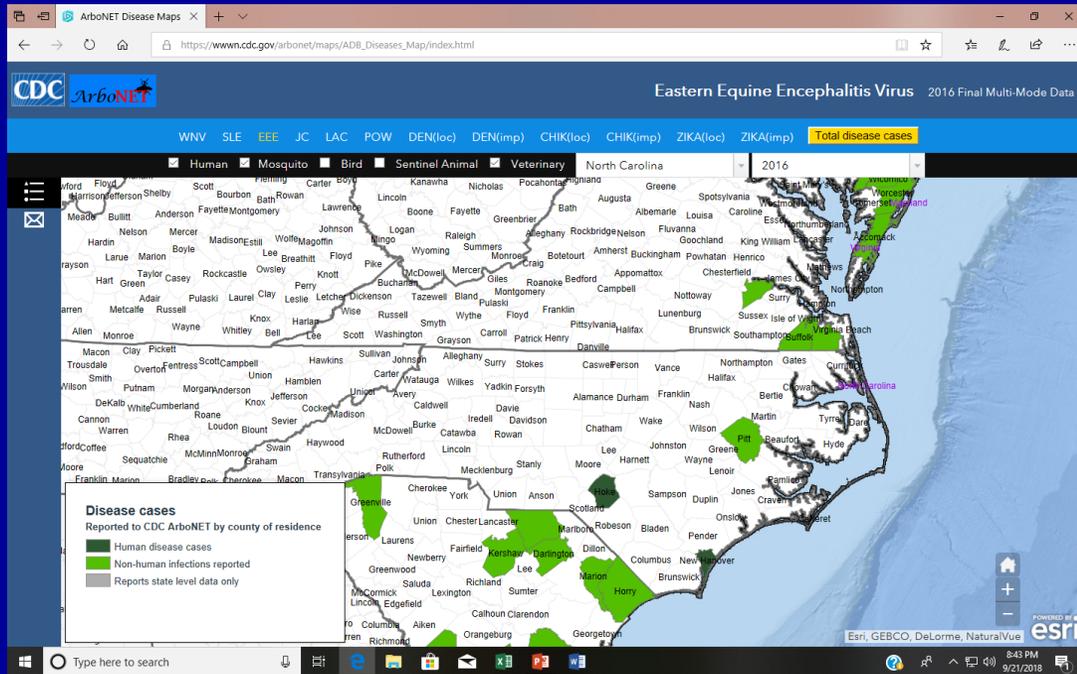




2016 Arbovirus

EEE

WNV

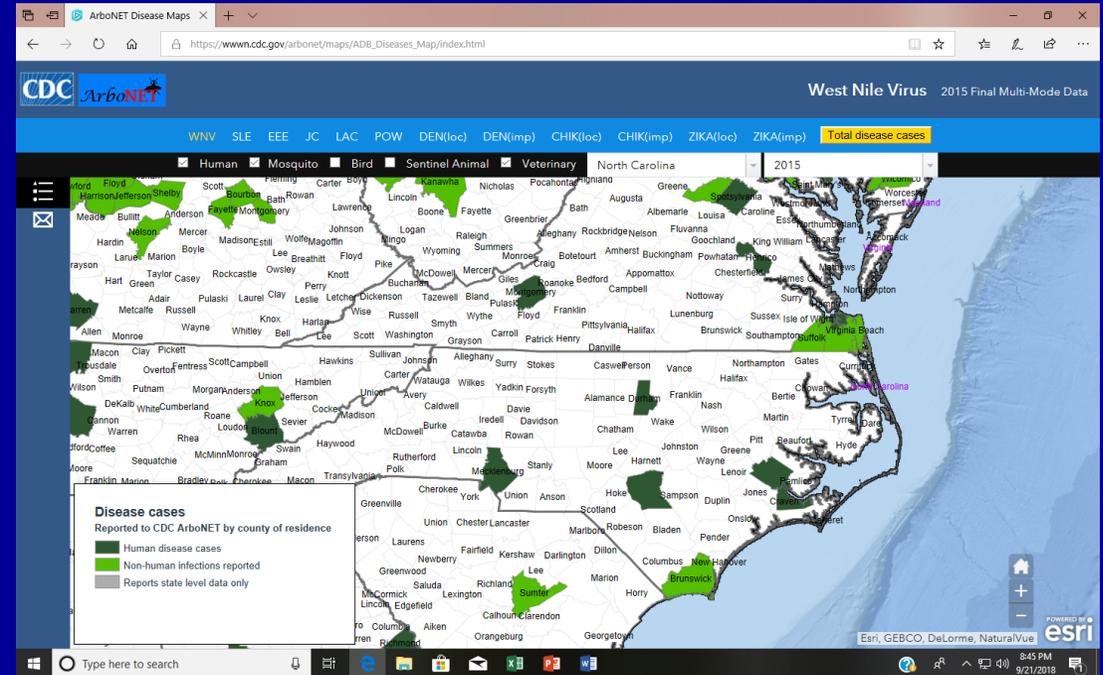
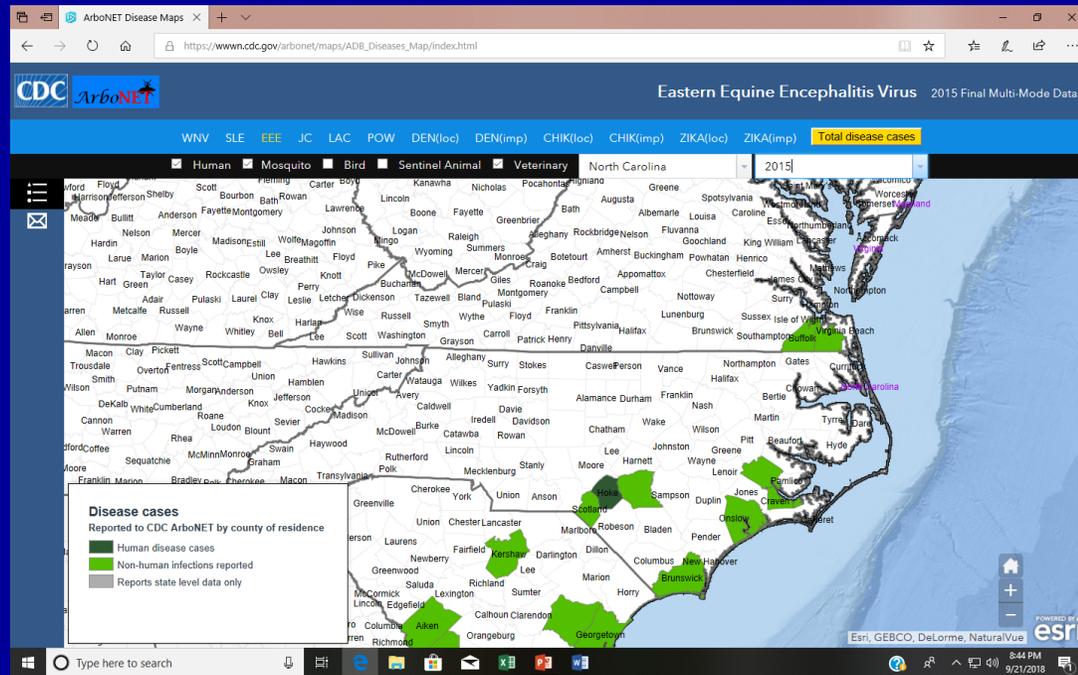




2015 Arbovirus

EEE

WNV

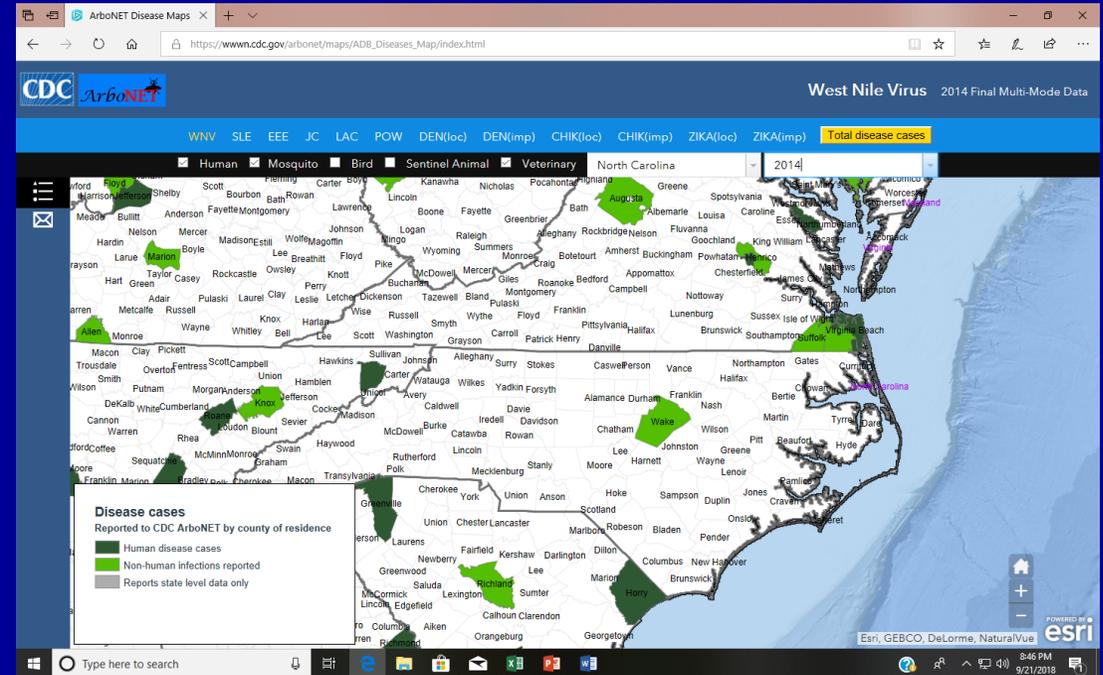
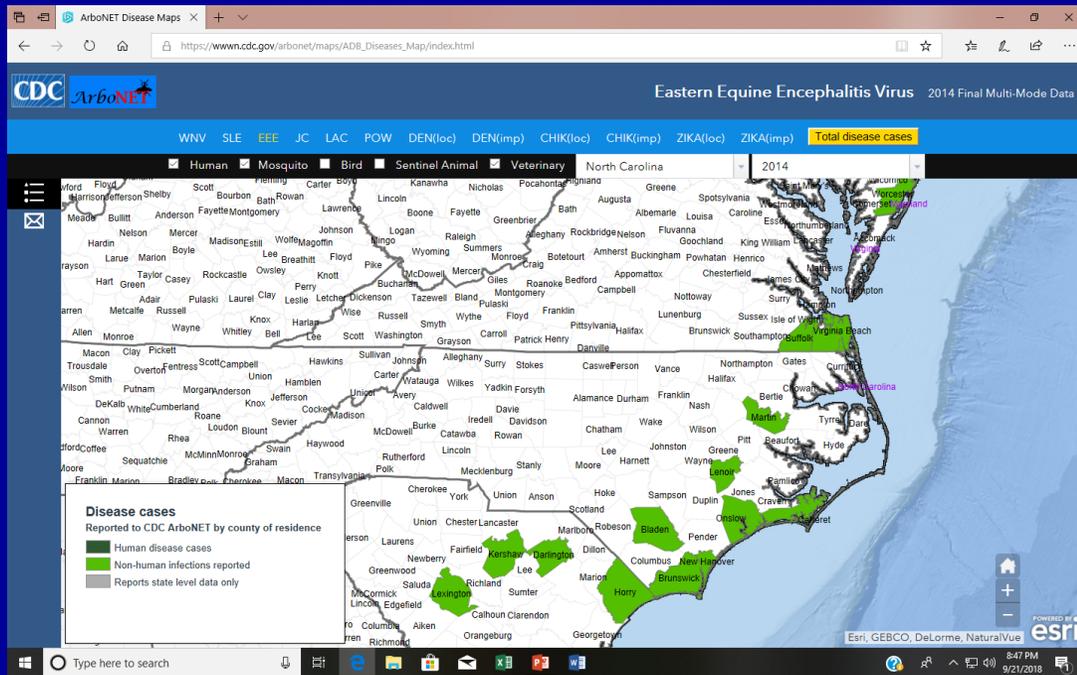




2014 Arbovirus

EEE

WNV

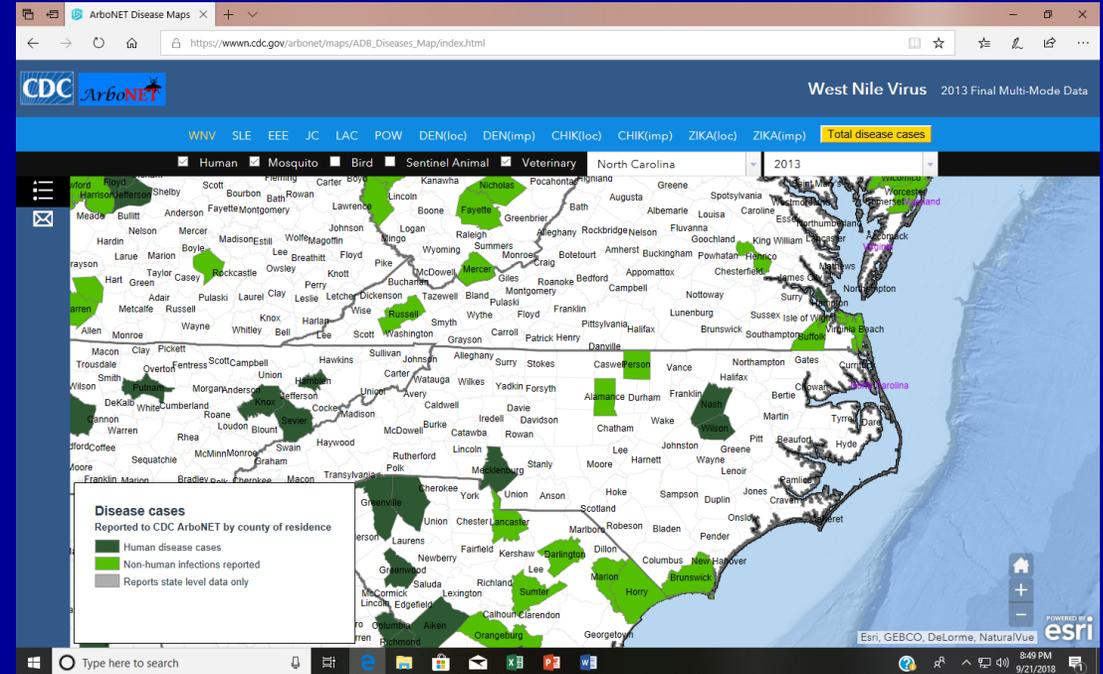
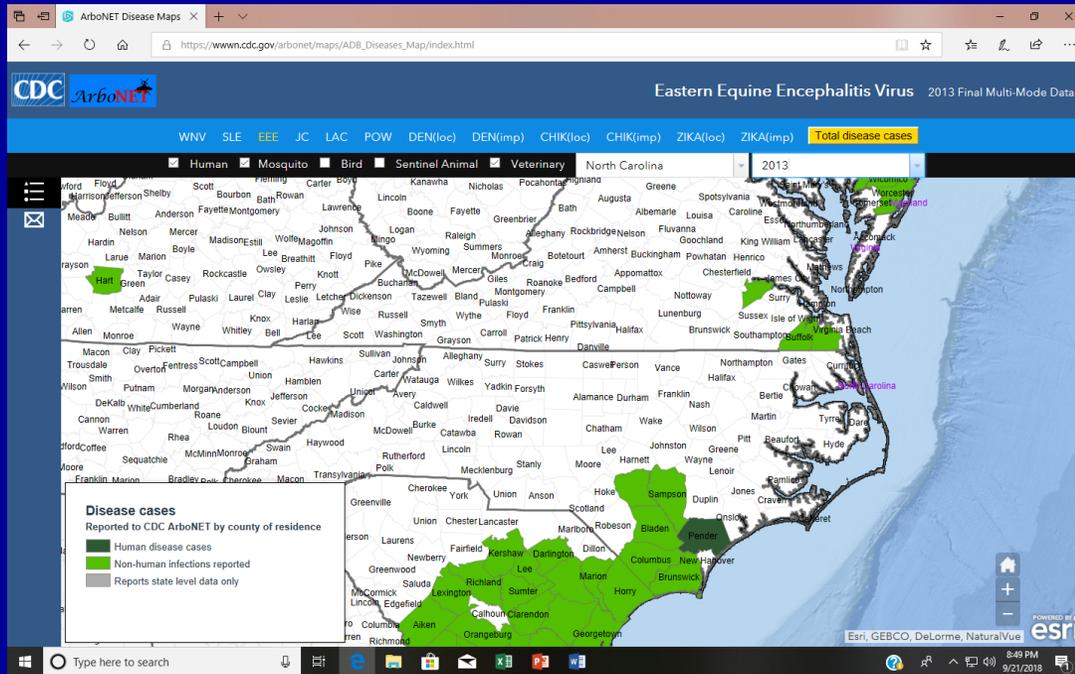




2013 Arbovirus

EEE

WNV

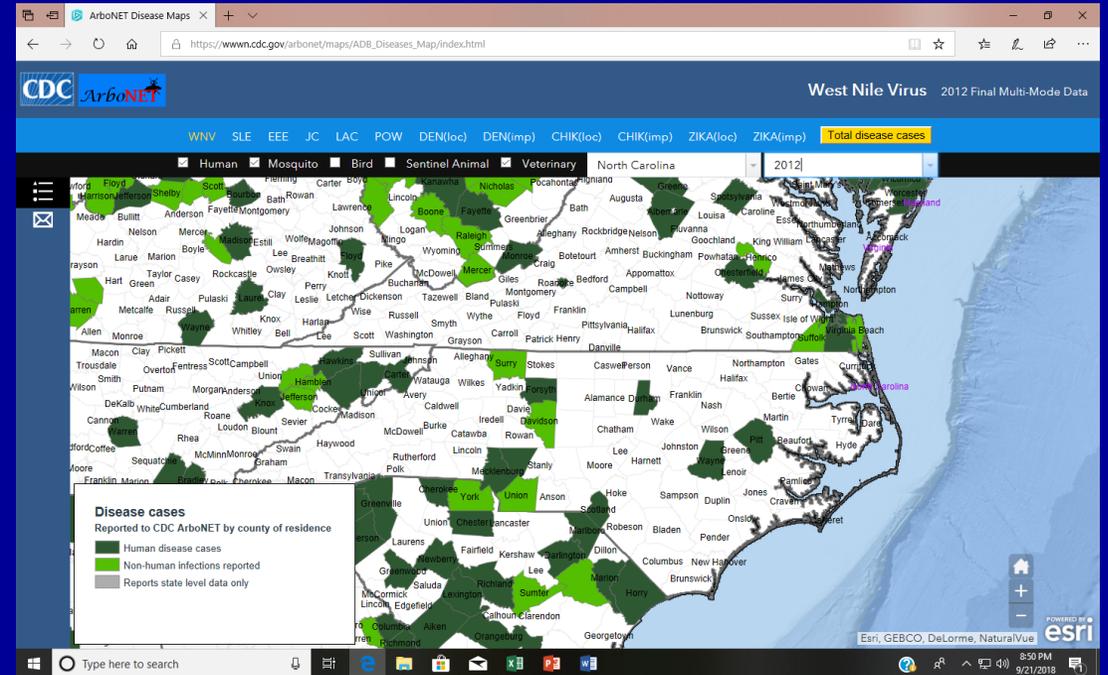
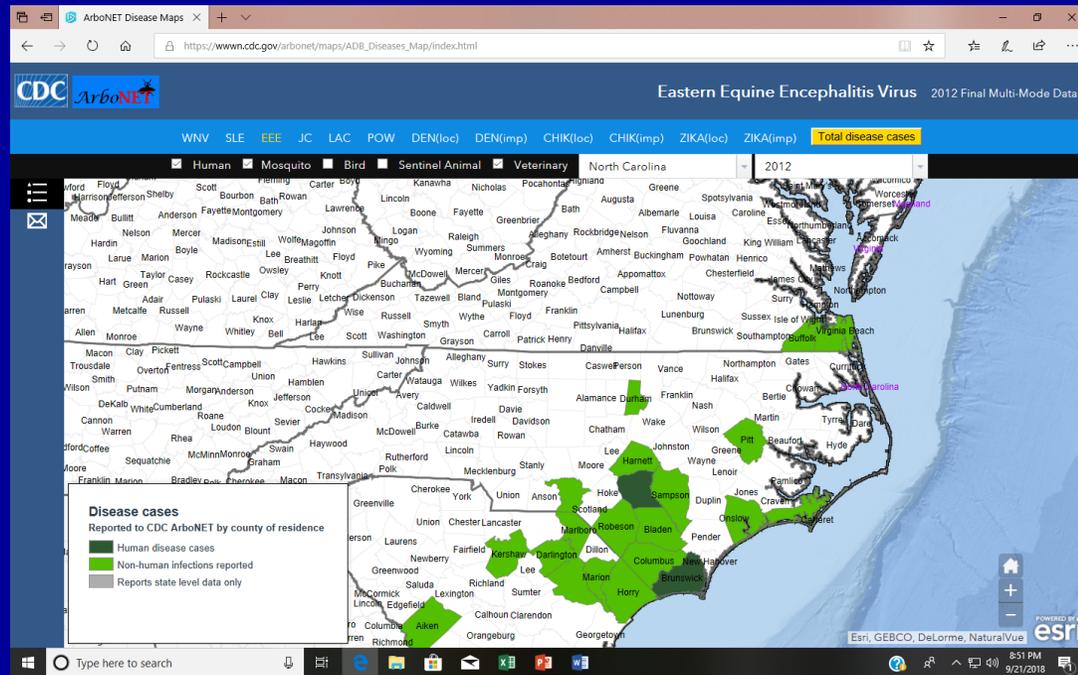




2012 Arbovirus

EEE

WNV





Brunswick County Surveillance Program

The screenshot shows a web browser window with the following elements:

- Browser Tabs:** "Technical Fact Sheet | La Crosse e X", "NC NCDHHS: DHHS Reports State's | X", and a plus sign for more tabs.
- Address Bar:** "https://www.ncdhhs.gov/news/press-releases/dhhs-reports-state's-first-death-year-related-west-nile-virus"
- Header:** NCDHHS logo, search bar "Search All DHHS Websites...", and links for "NC.GOV", "AGENCIES", "JOBS", "SERVICES".
- Navigation Menu:** Home, Assistance, Divisions, Documents, Providers, News, About, Contact.
- Breadcrumbs:** News » Press Releases » DHHS Reports State's First Death This Year Related to West Nile Virus
- Section Header:** "DHHS Reports State's First Death This Year Related to West Nile Virus" with a green underline.
- Text:** "Raleigh", "Jul 20, 2018", "State health officials are encouraging residents and visitors to take precautions to prevent mosquito-borne illnesses following the death of a North Carolina resident from West Nile virus infection last week. This is the state's first death from and first confirmed case of West Nile virus in 2018.", "The individual was an adult living in the southeastern part of the state. To protect patient confidentiality, the department is not releasing additional details."
- Right Sidebar:** A red vertical button labeled "Donate to Hurricane Recovery".
- Taskbar:** Windows search bar, taskbar icons for various applications, and system tray showing "11:04 AM 4/9/2019".



Brunswick County Surveillance Program

Technical Fact Sheet | La Crosse e x DHEC identifies state's first West x +

← → ↻ https://www.scdhec.gov/news-releases/dhec-identifies-states-first-west-nile-virus-death-2018-season ☆ ⌵ ⋮

☰ Full Menu Environment Health Vital Records Maps & Apps 🔍 🌐

dhec

Home \ News Releases \ Current Page

📄 News Releases

DHEC identifies state's first West Nile Virus death of the 2018 season

FOR IMMEDIATE RELEASE

September 10, 2018

COLUMBIA, S.C. - A Greenville County individual has died from West Nile Virus, the first such occurrence in South Carolina this year.

In 2018, the Department of Health and Environmental Control has confirmed seven human cases of West Nile Virus. Five of the seven confirmed human cases are from the Upstate region. Along with the human cases, there have been the detection of West Nile Virus in five birds and one horse.

The risk of serious illness or death from West Nile Virus is low. Less than one percent of people infected

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Recently Published

DHEC Closes Wallace Creek Shellfish Harvesting

Type here to search

11:12 AM 4/9/2019



Brunswick County Surveillance Program

Technical Fact Sheet | La Crosse | Florence resident contracts West Nile Virus after being bitten by mosquito

Not secure | www.wmbfnews.com/2018/09/27/florence-resident-contracts-west-nile-virus-after-being-bitten-by-mosquito/

NEWS WEATHER SPORTS INVESTIGATE CRIME SC WEEKEND TRAFFIC ABOUT US

Florence resident contracts West Nile Virus after being bitten by mosquito



A Florence resident has contracted West Nile Virus after being bitten by a mosquito (Source: Pixabay)

September 27, 2018 at 11:20 AM EDT - Updated September 27 at 2:58 PM

FLORENCE, SC (WMBF) - A Florence resident has contracted West Nile Virus after being bitten by a mosquito, according to a news release from the city of Florence.

The city received the notification from the South Carolina Department of Environmental Control. City crews will continue to run normal mosquito operation of a fogger truck which follows a regular weekly route and also respond to work orders submitted by residents, the release says. In addition, the city



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Mosquito surveillance will help
provide the answers for the
paperwork to come.



Mosquito Abatement Quick Guide

Mosquito Abatement Quick Guide

Please review the following guidelines for reimbursement of mosquito abatement costs you may incur as a result of a disaster. The North Carolina Emergency Management Agency (NCEMA) and the Federal Emergency Management Agency (FEMA) are providing this information early in an effort to maximize applicant opportunities for federal reimbursement of eligible mosquito abatement activities following a Presidential Declaration. Take the necessary actions to prevent a health and safety threat as soon as possible, but know the rules for reimbursement.

1. **The Public Assistance Program and Policy Guide, Version 3.1 (FP 104-009-2/April 2018, page 72)** states:

- a. Mosquito abatement measures may be eligible when a State, Territorial, Tribal, or local government public health official validates in writing that a mosquito population poses a specific health threat as discussed further in Appendix G: Mosquito Abatement. FEMA consults with the CDC to determine the eligibility of mosquito abatement activities. FEMA only provides PA funding for the increased cost of mosquito abatement. This is the amount that exceeds the average amount based on the last 3 years of expenses for the same period.
- b. To be eligible for Public Assistance (PA) funding, insecticide formulations must be among those approved and registered by the U.S. Environmental Protection Agency for use in urban areas for mosquito control, and must be applied according to label directions and precautions by appropriately trained and certified applicators. Furthermore, mosquito abatement measures must comply with all Federal, State, Territorial, and local laws, ordinances, and regulations concerning vector control.

2. **Eligibility Requirements**

You must be an Eligible Applicant as defined in the Public Assistance Program Policy Guide (page 9) and have the legal responsibility (page 20) to perform mosquito abatement. <http://www.fema.gov/public-assistance-policy-and-guidance>. The FEMA mosquito abatement guidance may be found in Appendix G (pages 184-185).

3. **Procedure and Documentation Requirements**

- a. **Before spraying**, collect trap data or landing rates (for adulticide use) or dip data (for larvicide use) to verify the hazard.
- b. **Before spraying**, contact FEMA EHP Point of Contact (#5 below) to identify spray exclusions areas due to the presence of endangered or threatened or critical habitat.
- c. Obtain a letter from the county health department indicating the presence of a serious health threat or a mosquito nuisance that is severely hampering the recovery effort.
- d. Follow manufacturer's label on EPA-approved chemicals for mosquito abatement by certified employees. The pesticide also must be registered in NC by the NC Department of Agriculture & Consumer Services (NCDA&CS). Provide documentation of the chemical, application method and concentration used.
- e. For aerial spraying, check with NCDA&CS Pesticide Section to make sure the plane and pilot are in compliance with all applicable rules and regulations of the NC Pesticide Law.
- f. Provide spray or larvicide area maps detailing the zones affected/treated.
- g. Provide date(s) of application.

4. **Do not delay**

- a. Start collecting data as soon as a potential threat is identified to establish a baseline trap, landing rate, or dip count. Data is only valid for a period of two weeks.
- b. Counties or communities that do not have a mosquito abatement program may request technical assistance with surveillance and personal protective measures from the North Carolina Division of Public Health by viewing https://epi.publichealth.nc.gov/cd/diseases/mosquito_spray.html or contact the Raleigh office at 919-733-3419.

5. **Points of Contact**

For more information, please contact: Michael Doyle at 919-546-1637 (michael.doyle@dhhs.nc.gov) or Carl Williams 919-546-1660 (carl.williams@dhhs.nc.gov), or email FEMA-R4EHP@fema.dhs.gov and cc Chelsea Klein at Chelsea.Klein@fema.dhs.gov.



Mosquito Abatement Quick Guide

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Mosquito Abatement Quick Guide

- The Public Assistance Program and Policy Guide (PAPPG)
 - A. Discussed further in **Appendix G: Mosquito Abatement.**
 - B. Insecticide approved by EPA
- Eligibility Requirements



Mosquito Abatement Quick Guide

• Procedure and Documentation Requirements

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Mosquito Abatement Quick Guide

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- **Chelsea Klein** your FEMA-R4EHP at Chelsea.Klein@fema.dhs.gov.



FEMA APPENDIX G: MOSQUITO ABATEMENT

APPENDIX G: MOSQUITO ABATEMENT

FEMA may provide reimbursement for mosquito abatement measures at the written request of the State, Territorial, Tribal, or local public health officials after FEMA consults with the Centers for Disease Control and Prevention (CDC), based on:

- Evidence of:

- Higher levels of disease transmitting mosquitoes in the disaster area following the event;
- A significant number of disease-carrying mosquitoes in the area due to the increase in event-related standing water; or
- The potential for disease transmission and human exposure to disease carrying mosquitoes based on the detection of arboviral diseases in sentinel organisms (poultry, wild birds, mosquito pools) in the impacted area prior to the storm event, discovered during surveillance as part of mosquito abatement activities, or reported human cases in which transmission occurred prior to the storm event.

- A determination that a significant increase in the mosquito population and/or the change of biting mosquito species poses a threat to emergency workers who are required to work out-of-doors, thereby significantly hampering response and recovery efforts.

Such evidence may include an abnormal rise in landing rates or trap counts, significant changes in species composition or estimate of infection rates, when compared to pre-disaster surveillance results.

- Verification from medical facilities within the affected area that an increase in the general public's exposure to mosquitoes has directly resulted in secondary infections, especially among those with weakened immune systems such as the elderly, the very young, or the sick.

This may occur when increased numbers of residents in disaster areas with extended power outages are forced to open buildings for air circulation.

Where possible, a determination of the need for vector control measures should be based on surveillance data provided by local agencies, or on surveillance conducted as a component of the



Terminology

An **arbovirus** is a virus utilizing arthropods as vectors and is transmitted via their feeding to a definitive host.

The **landing rate**, expressed as number of mosquitoes landing per minute, is used as an adult mosquito surveillance measure utilizing human volunteers as bait.

Methoprene Briquettes are formulated with methoprene (compound that mimics the action of an insect growth-regulating hormone and prevents the normal maturation of insect larvae) growth inhibitor and a timed-release carrier that resembles a charcoal briquette.

A **sentinel organism** is an organism, usually fowl, purposely exposed to mosquito bites outdoors to monitor pathogen transmission by mosquitoes.

Seroconversion is the development of detectable antibodies in the blood of a sentinel organism directed against an infectious agent.

Trap count is the number of female mosquitoes captured in a trap receptacle each night the traps are set.

emergency response. Similarly, termination of control efforts should be based on mosquito density and disease transmission monitoring, and on the degree of exposure to mosquitoes of residents and responders. Information useful in determining the need for emergency mosquito control measures includes:

- The local jurisdiction's mosquito population density estimates pre- and post-disaster, including information about species composition
- Arbovirus transmission activity indices, including information about the location of surveillance activities; indices may consist of:
 - Infection rates in mosquitoes
 - Seroconversion in sentinel chickens
 - Equine case
 - Human cases
- The amount and type of flooding (e.g., saltwater/freshwater, coastal/inland)
- The extent and location of damage to housing
- The extent, location, and anticipated duration of power interruption
- The anticipated extent and duration of cleanup and recovery operations
- A description of the type of mosquito management required (e.g., aerial or ground-based adulticide applications, larvicide applications), and duration of application to reduce the threat and the areas where the interventions are needed

To be eligible for Public Assistance (PA) funding, insecticide formulations must be among those approved and registered by the U.S. Environmental Protection Agency for use in urban areas for mosquito control, and must be applied according to label directions and precautions by appropriately trained and certified applicators. Furthermore, mosquito abatement measures must comply with all Federal, State, Territorial, and local laws, ordinances, and regulations concerning vector control. Mosquito abatement measures include, but are not limited to the following:

- Adulticiding – The ground or aerial spraying of insecticides to kill adult mosquitoes
- Larviciding – The application of chemicals, including methoprene briquettes, by ground or air to kill mosquito larvae or pupae
- Breeding habitat removal or alteration – The modification of potential breeding habitat to make it unsuitable for mosquito breeding or to facilitate larval control, including:
 - Draining or removing standing water in close proximity to homes, schools, sheltering facilities, and businesses
 - Increased dewatering through the pumping of existing drainage systems
 - Dissemination of information (e.g., inserting flyers with resident's water bills, public service announcements, newspaper campaigns) to direct residents to remove the mosquito breeding habitat



FEMA APPENDIX G: MOSQUITO ABATEMENT



- FEMA may provide reimbursement for mosquito abatement measures at the written request of the State, Territorial, Tribal, or local public health officials after FEMA consults with the Centers for Disease Control and Prevention (CDC), based on:
 - Evidence
 - Surveillance data
 - A description of the type of mosquito management required
 - Mosquito abatement measures



FEMA APPENDIX G: MOSQUITO ABATEMENT

- Evidence of:
 - Higher levels of disease transmitting mosquitoes in the disaster area following the event;
 - A significant number of disease carrying mosquitoes in the area due to the increase in event-related standing water; or
 - The potential for disease transmission and human exposure to disease carrying mosquitoes based on the detection of arboviral diseases in sentinel organisms (poultry, wild birds, mosquito pools) in the impacted area prior to the storm event, discovered during surveillance as part of mosquito abatement activities, or reported human cases in which transmission occurred prior to the storm event.



FEMA APPENDIX G: MOSQUITO ABATEMENT

- A determination that a significant increase in the mosquito population and/or the change of biting mosquito species poses a threat to emergency workers who are required to work out-of-doors, thereby significantly hampering response and recovery efforts. Such evidence may include an abnormal rise in landing rates or trap counts, significant changes in species composition or estimate of infection rates, when compared to pre-disaster surveillance results.



FEMA APPENDIX G: MOSQUITO ABATEMENT

- **Verification from medical facilities** within the **affected area** that an increase in the general public's exposure to mosquitoes has directly resulted in secondary infections, especially among those with weakened immune systems such as the elderly, the very young, or the sick. This may occur when increased numbers of residents in disaster areas with extended power outages are forced to open buildings for air circulation.



FEMA APPENDIX G: MOSQUITO ABATEMENT

- Surveillance data:
 - Mosquito population density pre- and post-disaster
 - Arbovirus transmission activity indices
 - Infection rates in mosquitoes
 - Seroconversion in sentinel chickens
 - Equine case
 - Human cases
 - The amount and type of flooding (e.g., saltwater/freshwater, coastal/inland)
 - The extent and location of damage to housing
 - The extent, location, and anticipated duration of power interruption
 - The anticipated extent and duration of cleanup and recovery operations



FEMA APPENDIX G: MOSQUITO ABATEMENT

- A description of the type of mosquito management required (e.g., aerial or ground based adulticide applications, larvicide applications), and duration of application to reduce the threat and the areas where the interventions are needed
- Eligible for Public Assistance
 - All insecticide formulations must be approved and registered by the EPA
 - For use in urban areas for mosquito control
 - Applied according to label by a certified applicator
 - Mosquito abatement measures must comply with all Federal, State, Territorial, and local laws, ordinances, and regulations concerning vector control



FEMA APPENDIX G: MOSQUITO ABATEMENT

Mosquito abatement measures

- **Adulticiding**
 - Ground or Aerial
- **Breeding habitat removal or alteration**
 - Draining or removing standing water
 - Increased dewatering through the pumping of existing drainage systems
 - Dissemination of information (e.g., inserting flyers with resident's water bills, public service announcements, newspaper campaigns) to direct residents to remove the mosquito breeding habitat



CDC GUIDELINES FOR ARBOVIRUS SURVEILLANCE PROGRAMS IN THE UNITED STATES



- Chapter 1:
- Natural disasters and encephalitis outbreaks: Natural disasters such as floods and hurricanes can create a potential for epidemics of vector-borne disease.
- https://www.cdc.gov/ncezid/dvbd/pdf/arboguid_508.pdf



CDC GUIDELINES FOR ARBOVIRUS SURVEILLANCE PROGRAMS IN THE UNITED STATES



- The Federal Emergency Management Agency (FEMA), which oversees all federal disaster activities, calls upon CDC to evaluate the risk of vector-borne disease.
- Reimbursement for vector control depends on the presence of a clear risk of vector-borne disease that can be related to the emergency or disaster.



CDC GUIDELINES FOR ARBOVIRUS SURVEILLANCE PROGRAMS IN THE UNITED STATES



- In order for CDC to rapidly and accurately evaluate the risk of vector-borne disease, it is important for state and local health and vector control agencies to have readily accessible as much data as possible.
- **Historical data** should be available for comparison with **current data**, to show how the disaster is related to **any increase in vector or virus activity**.
- The types of information that are needed to estimate the risk of an epidemic are the following:



CDC GUIDELINES FOR ARBOVIRUS SURVEILLANCE PROGRAMS IN THE UNITED STATES



- a) **Mosquito population indices** (Are vector species present? How do light trap indices compare with previous years and with this year prior to the current disaster?)
- b) **Virus infection rates in mosquitoes** (What is the minimum infection rate (MIR) this year? How does it compare with MIRs in epidemic years? Is virus activity localized or is it widespread?)
- c) **Evidence of increased virus transmission in vertebrate amplifying hosts** (What temporal and spatial patterns are seen and how do they compare with the norm for this locality?)
- d) **Evidence of disease in equines (WEE/EEE)**
- e) **Rainfall and temperature data** (Is there any evidence to show an association between past outbreaks/epidemics and specific weather patterns?)
- f) **Time of year** (Is it relatively early in the virus transmission season for this locality?)
- g) **Risk to the human population** (Is virus activity near populated areas? Is vector movement between areas of virus activity and populated areas?)



Questions?



Additional Information

- **FEMA Mosquito Abatement Quick Guide**
 - https://www.fema.gov/media-library-data/1537104190831-4fb60e06b100ca7fd2982aad2d439d5b/DR-4393-NC_20180914_MosquitoAbatementQuickGuide.pdf
- **FEMA APPENDIX G: MOSQUITO ABATMENT**
 - http://www.ncalhd.org/wp-content/uploads/2018/10/10-Public-Assistance-Program-and-Policy-Guide-V3.1_Mosquito-Abatement.pdf
- **CDC GUIDELINES FOR ARBOVIRUS SURVEILLANCE PROGRAMS IN THE UNITED STATES**
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