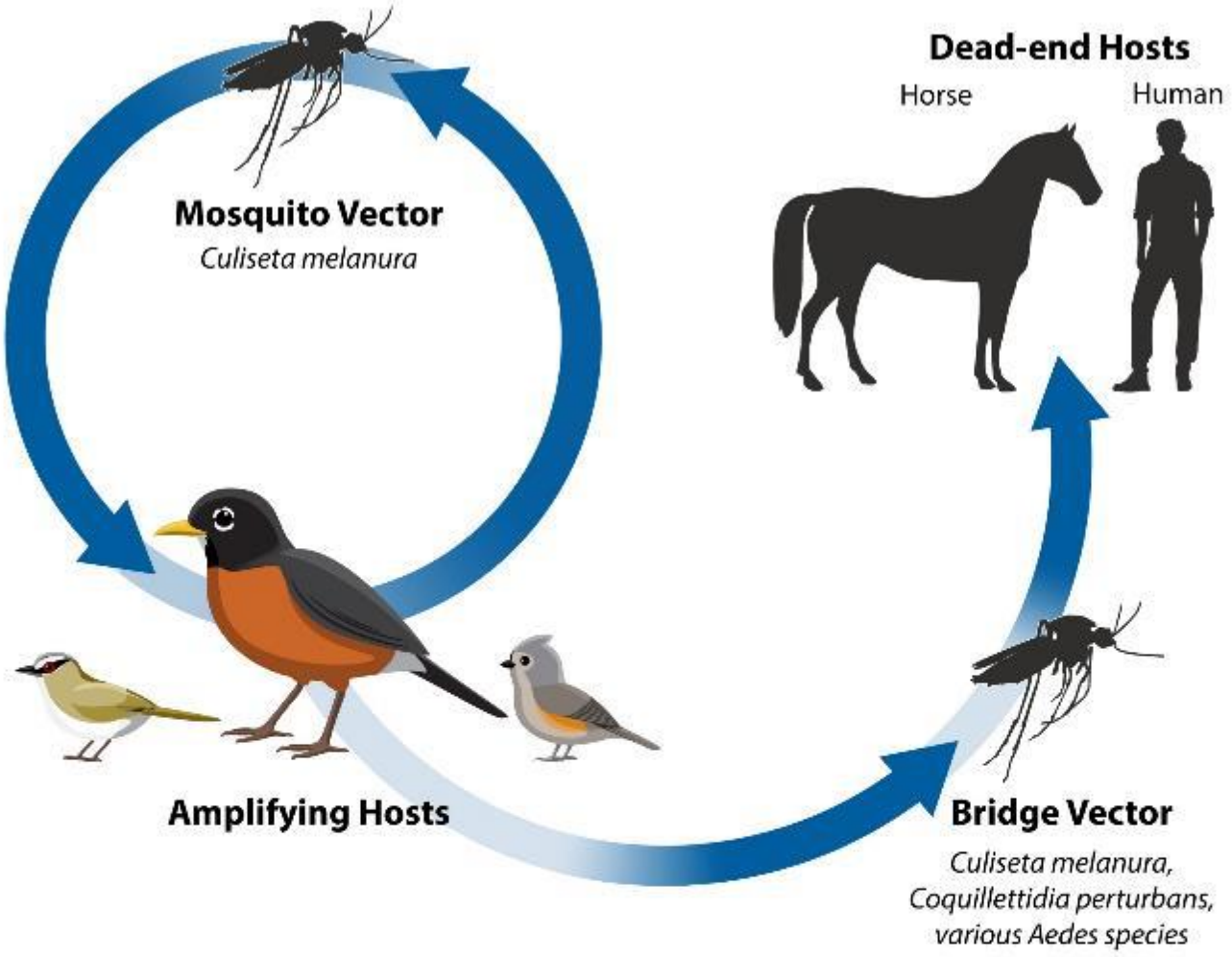
EASTERN EQUINE ENCEPHALITIS

MICHIGAN 2020 OVERVIEW

Coquillettidia perturbans

EASTERN EQUINE ENCEPHALITIS (EEE)

- EEE is an ***arboviral illness*** – a virus that is carried and spread by mosquitoes.
- In nature, EEE is carried by birds and mosquitoes that like to bite birds. When a mosquito bites a bird with EEE, the mosquito becomes infected and can pass the virus on to the next animal it bites. Mammals and people can get EEE if they are bitten by an infected mosquito.
- You can't get EEE from a sick person or animal; only from the bite of an infected mosquito.
- Michigan usually has 0-3 human cases of EEE per year.
- 2019 and 2020 were unusual years for EEE in Michigan and nationwide.



Eastern Equine Encephalitis Transmission

The Eastern equine encephalitis virus **cycles between mosquitoes and birds**. The *Culiseta melanura* mosquito, which primarily bites birds, is responsible for spreading the virus among birds. The virus then multiplies in the birds' bloodstream.

People and other animals, like horses, become infected with the virus when mosquito species that feed on many kinds animals, feed on infected birds and then bite people. People and horses are considered **dead-end hosts** because unlike birds, they don't develop high levels of virus in their bloodstream and cannot pass the virus on to other biting mosquitoes.

CS 318140

EEE IN HUMANS

- Illness begins 4-10 days after a bite from an infected mosquito
- Abrupt onset of fever, chills, achiness and/or joint and muscle pain
- When the brain is infected, onset can be swift and include fever, headache, and confusion – this is referred to as "neuroinvasive" disease
- 1/3 of cases result in death, typically within 2-10 days of illness onset
- Those who survive often have long-lasting brain damage; many become disabled and some require lifelong care

EEE IN ANIMALS

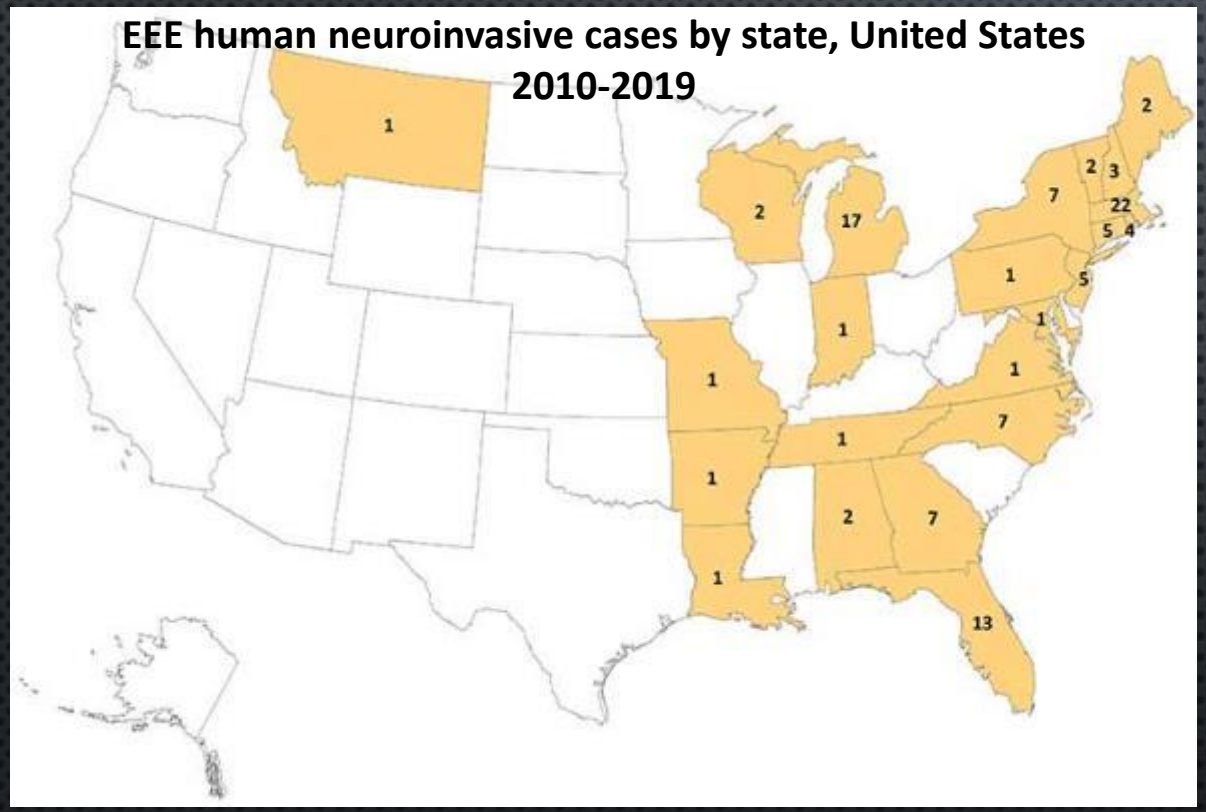
- Other mammals can become ill from EEE
- EEE is especially severe in horses
  - If a horse becomes ill with EEE, it means that there is also a risk to people in that area
  - MDHHS works with the Michigan Department of Agriculture and Rural Development to monitor for EEE in horses
  - There is a EEE vaccine available for horses
- MDHHS also works with the Michigan Department of Natural Resources to monitor EEE in wild animals, such as deer

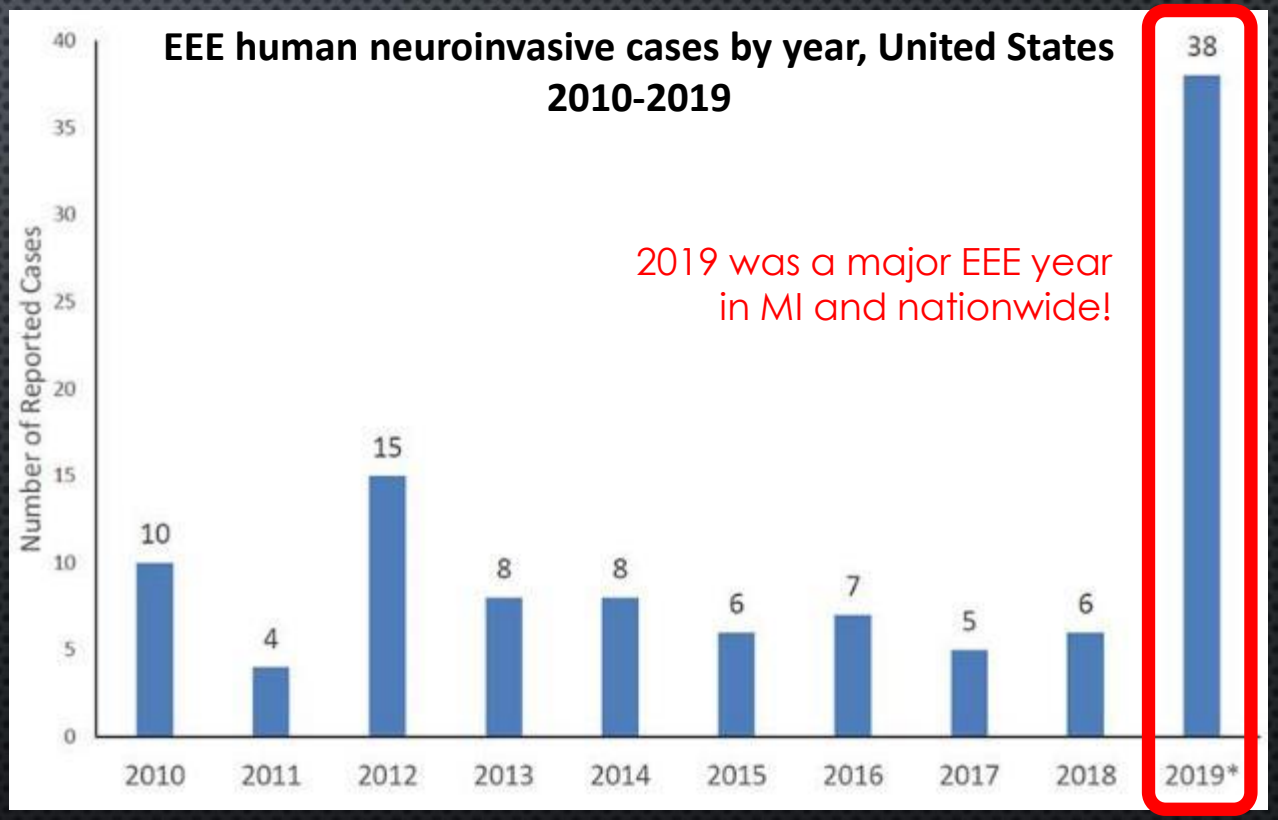
DIAGNOSIS

- When a doctor suspects that a patient might have EEE, they can order testing from the MDHHS Bureau of Laboratories (free of charge), or from a commercial lab
  - Testing is performed on blood (serum) and/or spinal fluid
  - Testing should also be done for other similar arboviral diseases, like West Nile virus
  - If testing is ordered from a commercial lab, additional testing at MDHHS may be needed for confirmation
- Animals that are suspected to have EEE can be tested at Michigan State University's Veterinary Diagnostic Lab

In some cases, laboratory confirmation can take **several weeks**

EEE IN THE UNITED STATES: HUMAN NEUROINVASIVE† CASES 2010-2019

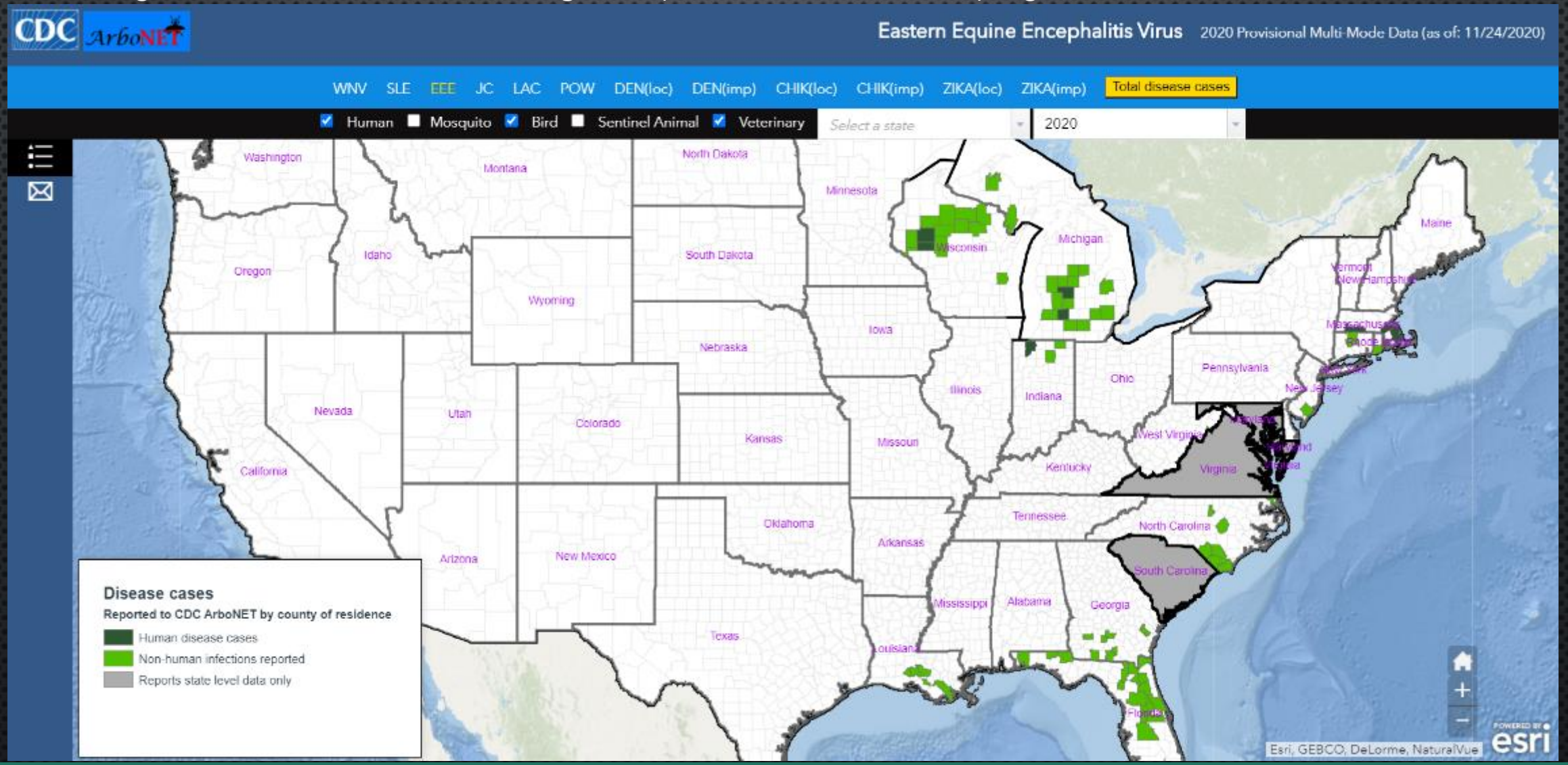




†Neuroinvasive means "affecting the brain or spinal cord"
*2019 data are provisional and subject to change

2020 EEE OUTBREAK

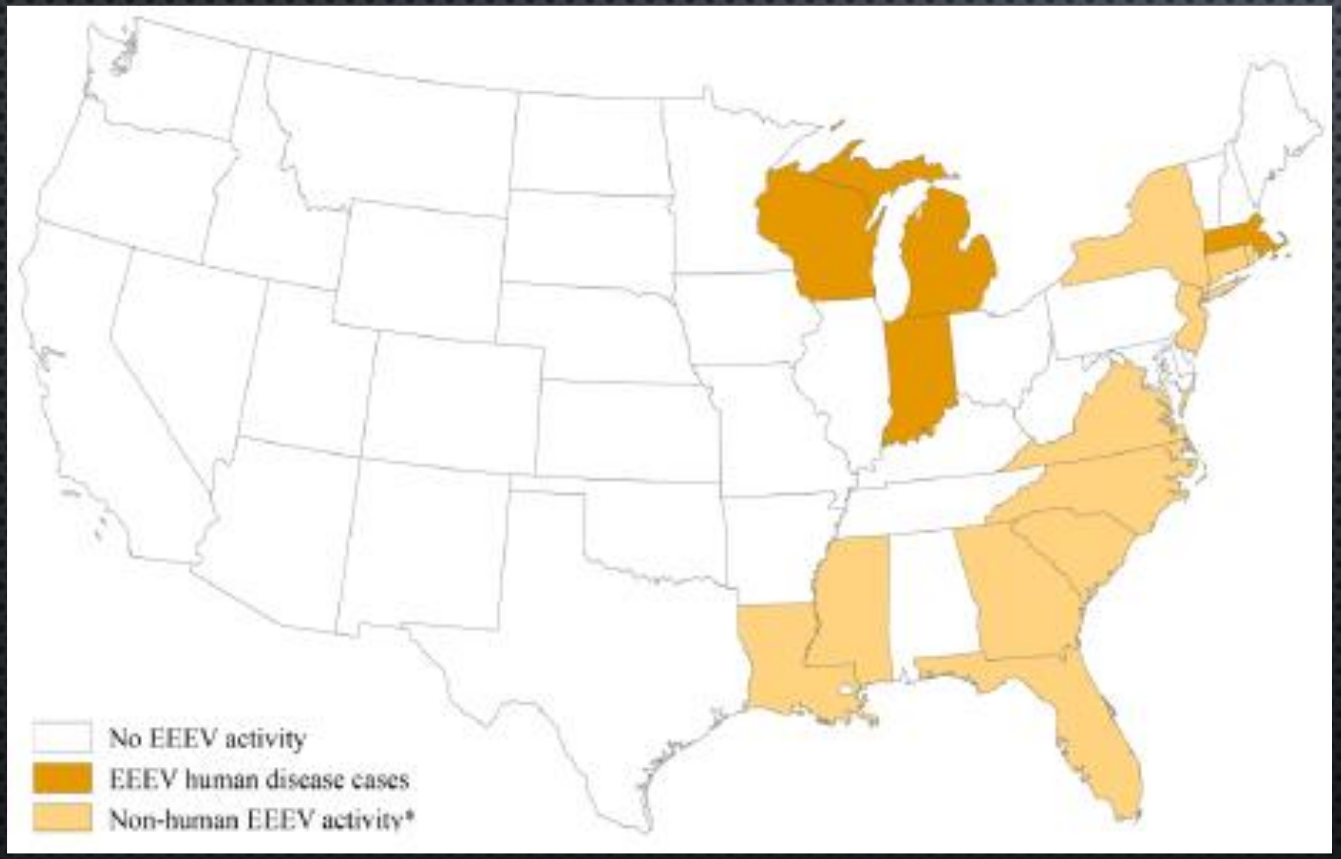
In 2020, Michigan and several other states **again** experienced an unusually high number of animal and human EEE cases



2019

EEE IN THE U.S.
HUMAN NEUROINVASIVE CASES, 2020

CDC ArboNET



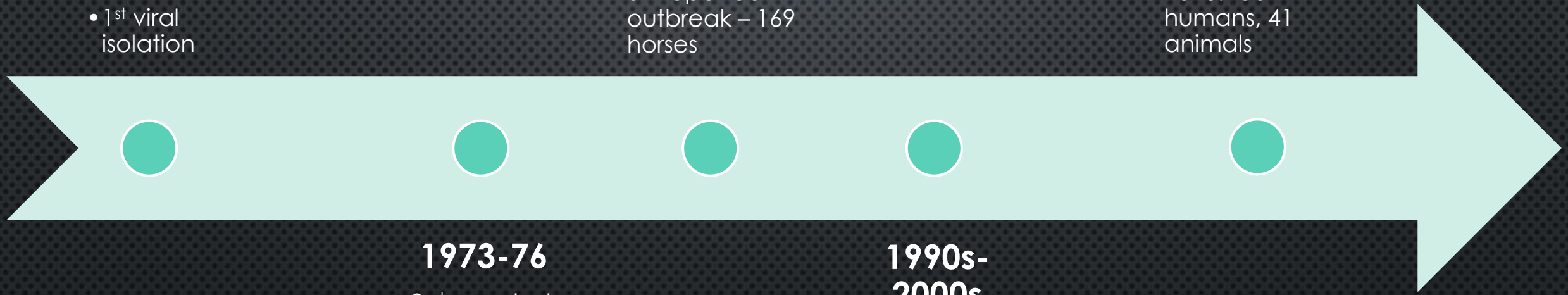
State	Neuroinvasive disease cases	Deaths
Indiana	1	0
Massachusetts	4	1
Michigan	**4**	**2**
Wisconsin	2	1
Total	11	4

Data as of April 13, 2020

BRIEF HISTORY OF EEE IN MICHIGAN

- **1942-43**: Large horse outbreak in SW Michigan, 469 horse cases
  - EEE virus isolated from brain tissue of dead horses in 1942 and 1943
- **1973-75**: Second outbreak of EEE in Michigan horses. Started in Oakland County, extended widely with scattered horse cases in SE Michigan. First mosquito and bird investigations.
- **1980:** First human case of EEE in Michigan, in a 10-year-old boy from St. Joseph County
- **1980-83**: Third outbreak of EEE in Michigan. EEE virus isolated from mosquitoes in state for first time, second human case.
- **1989, 1991**, other years: outbreaks among animals
- **1991**: SE & SW Michigan outbreak, two human cases
- **1990s-2000s**: Several sporadic cases and outbreaks, 1995 in particular
- **2010:** Outbreak with three human cases and 132 horse cases.
- **2019**: Largest human outbreak ever: 10 human cases (6 fatal), 50 animals
- **2020**: Outbreak with four human cases (2 fatal), 41 animals

BRIEF HISTORY OF EEE IN MICHIGAN



1942-43

- 1st reported outbreak - 469 horses in SW MI
- 1st viral isolation

1973-76

- 2nd reported outbreak – 44 horses in south MI

1980-84

- 1980: 1st reported human case
- 3rd reported outbreak – 169 horses

1990s-2000s

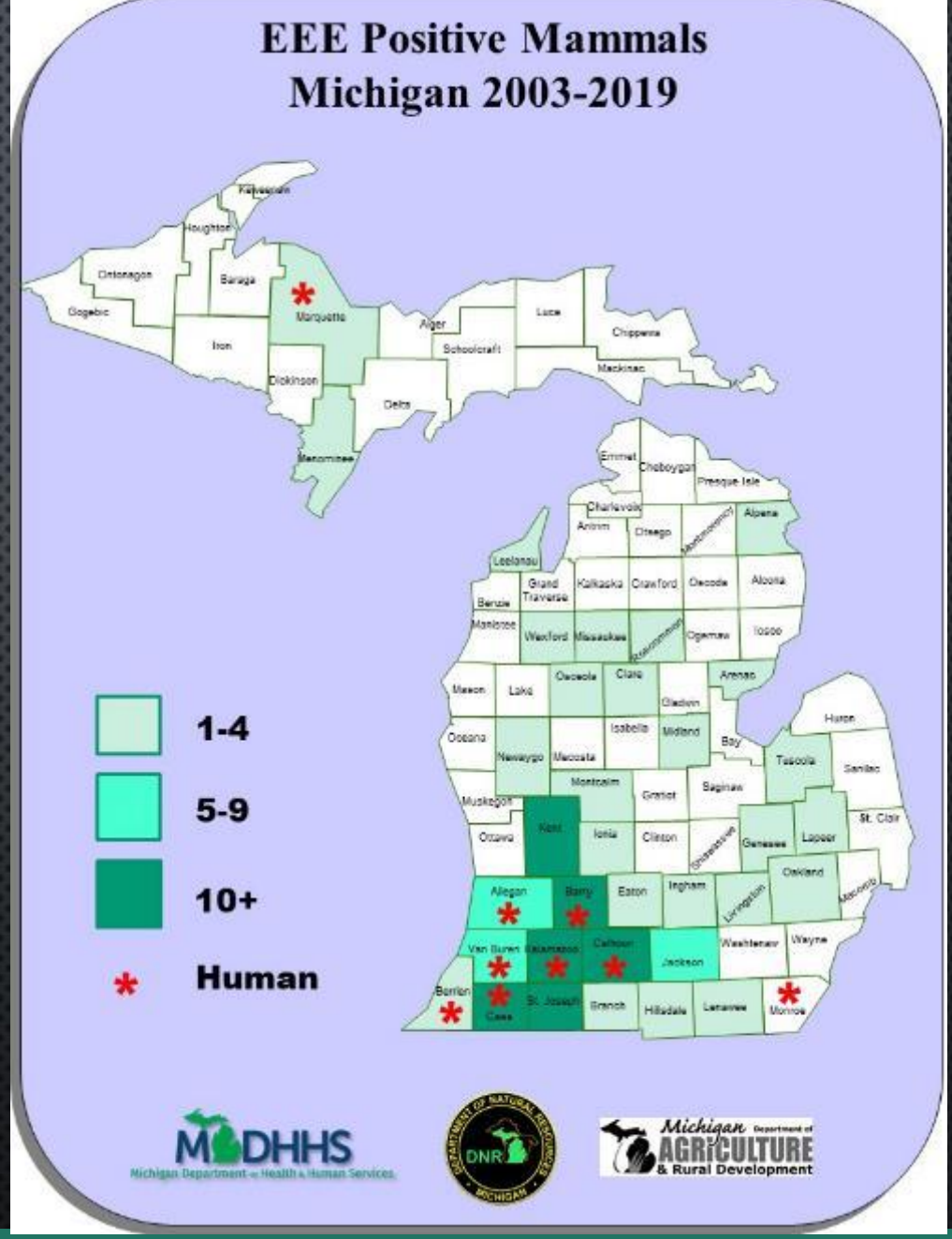
- Sporadic cases, outbreaks

2010s

- **2010:** three humans,134 horses
- **2019**: 10 humans, 50 animals
- **2020**: four humans, 41 animals

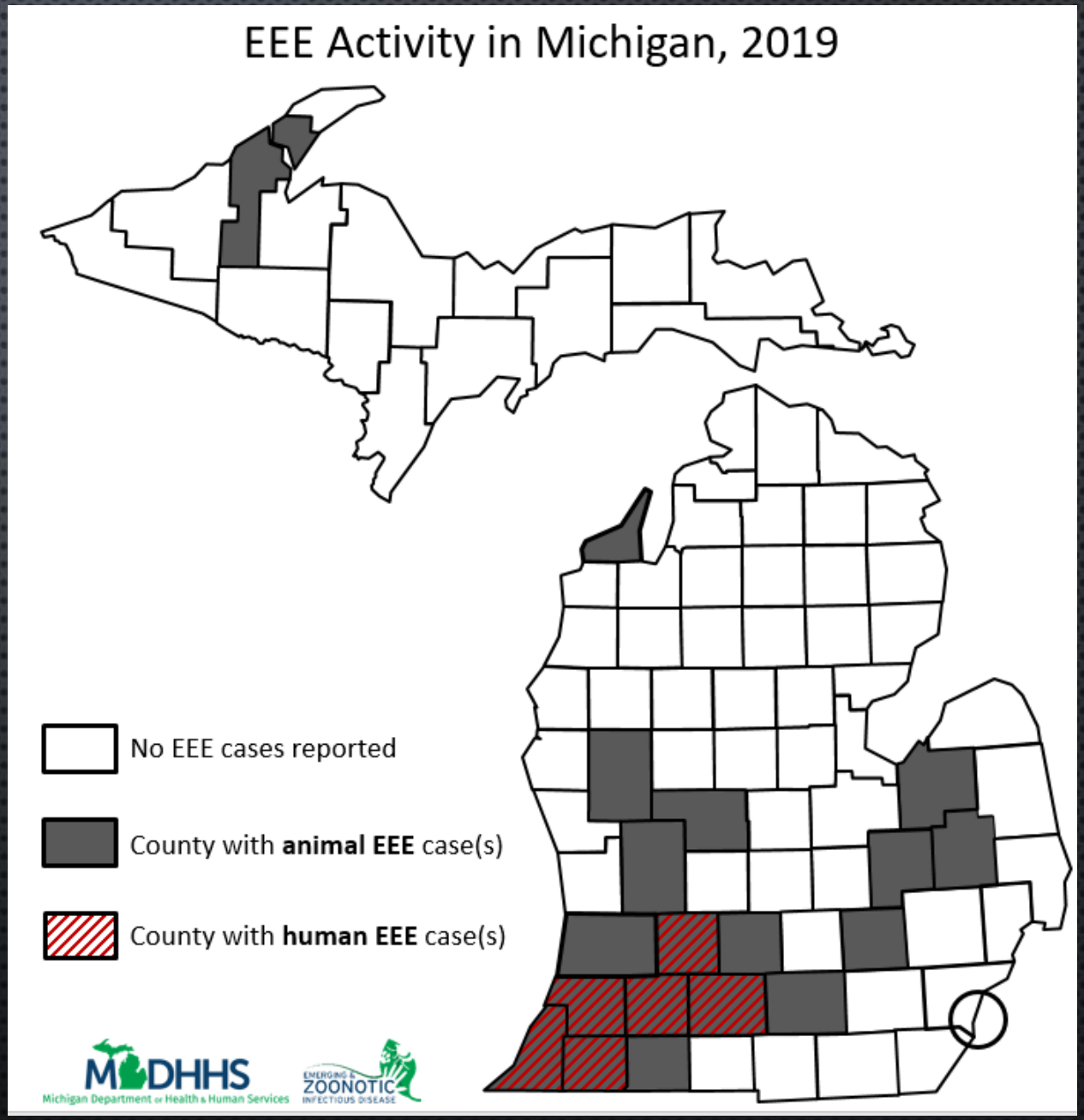
GEOGRAPHY OF EEE IN MICHIGAN

- SW MI has had greatest number of human and animal cases
- This is likely related to the area having lots of swamps and bogs, which provide habitat for the mosquitoes that transmit EEEV & bird hosts



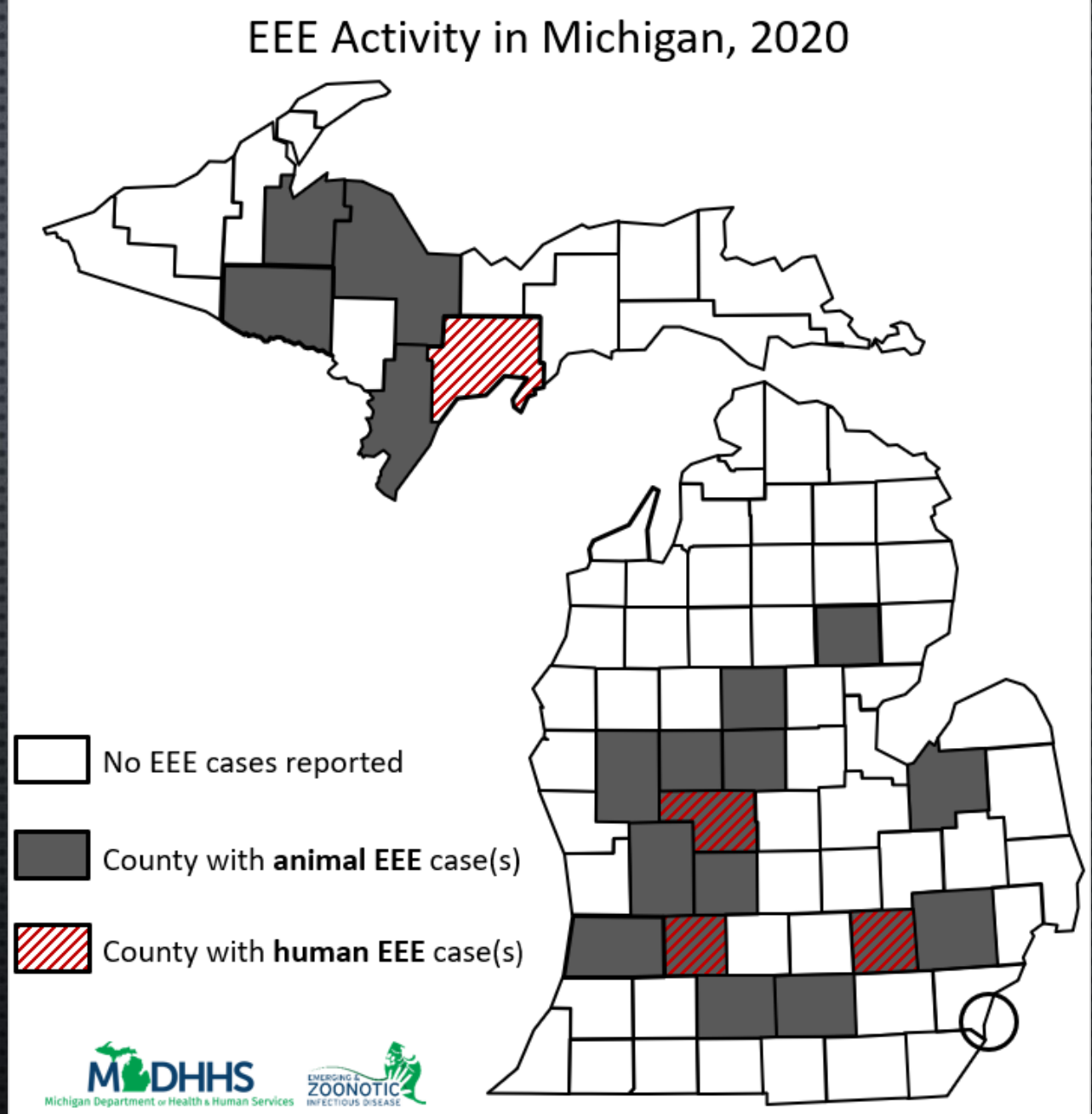
2019 EEE ACTIVITY IN MICHIGAN

- 10 human cases, 6 were fatal
- 50 animals tested positive, across 20 counties
  - Most cases occurred in SW
- Positive animals included birds, horses, deer, & wolves
- Onset dates: July 22 – Oct 11

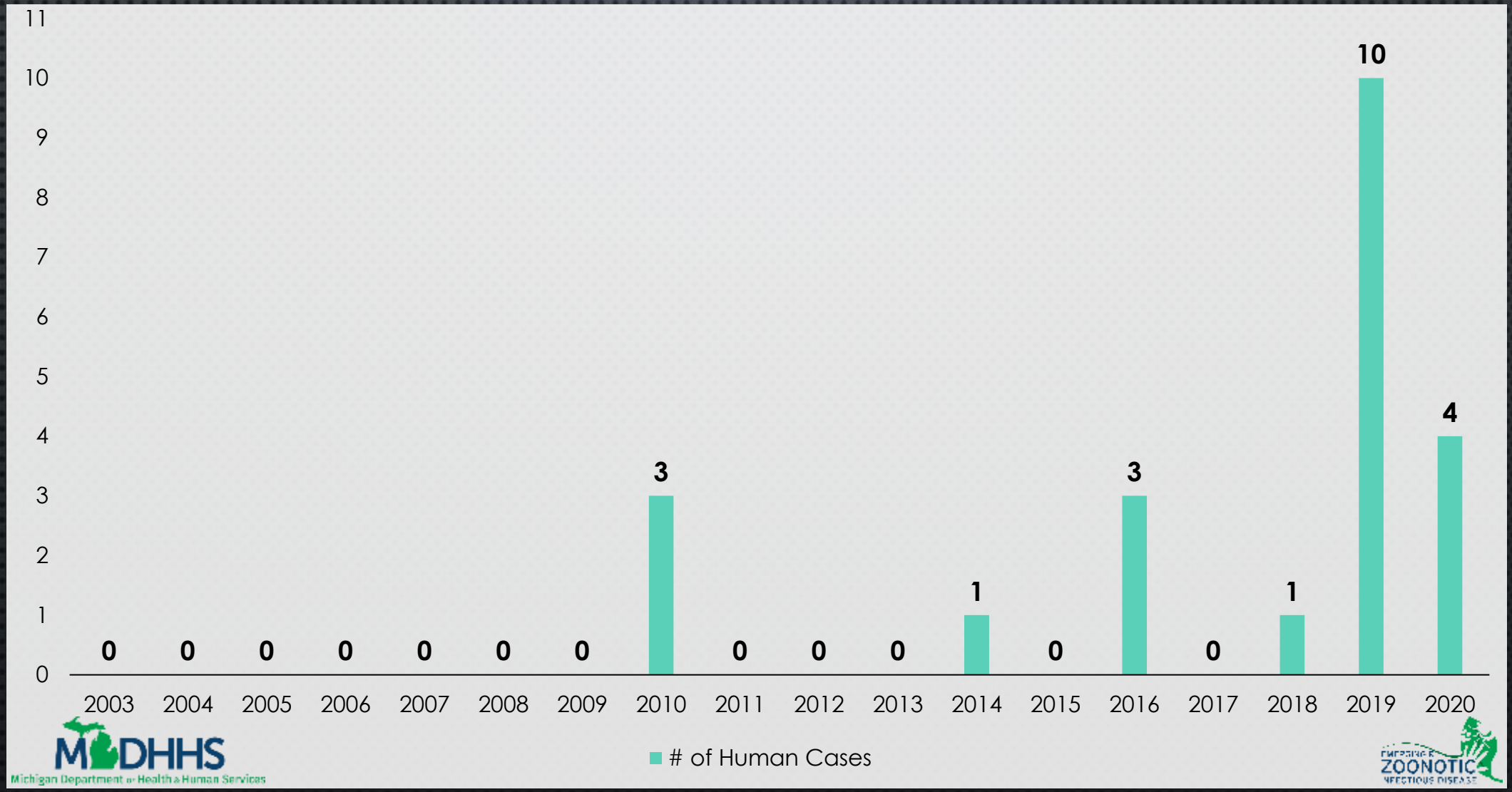


2020 EEE ACTIVITY IN MICHIGAN

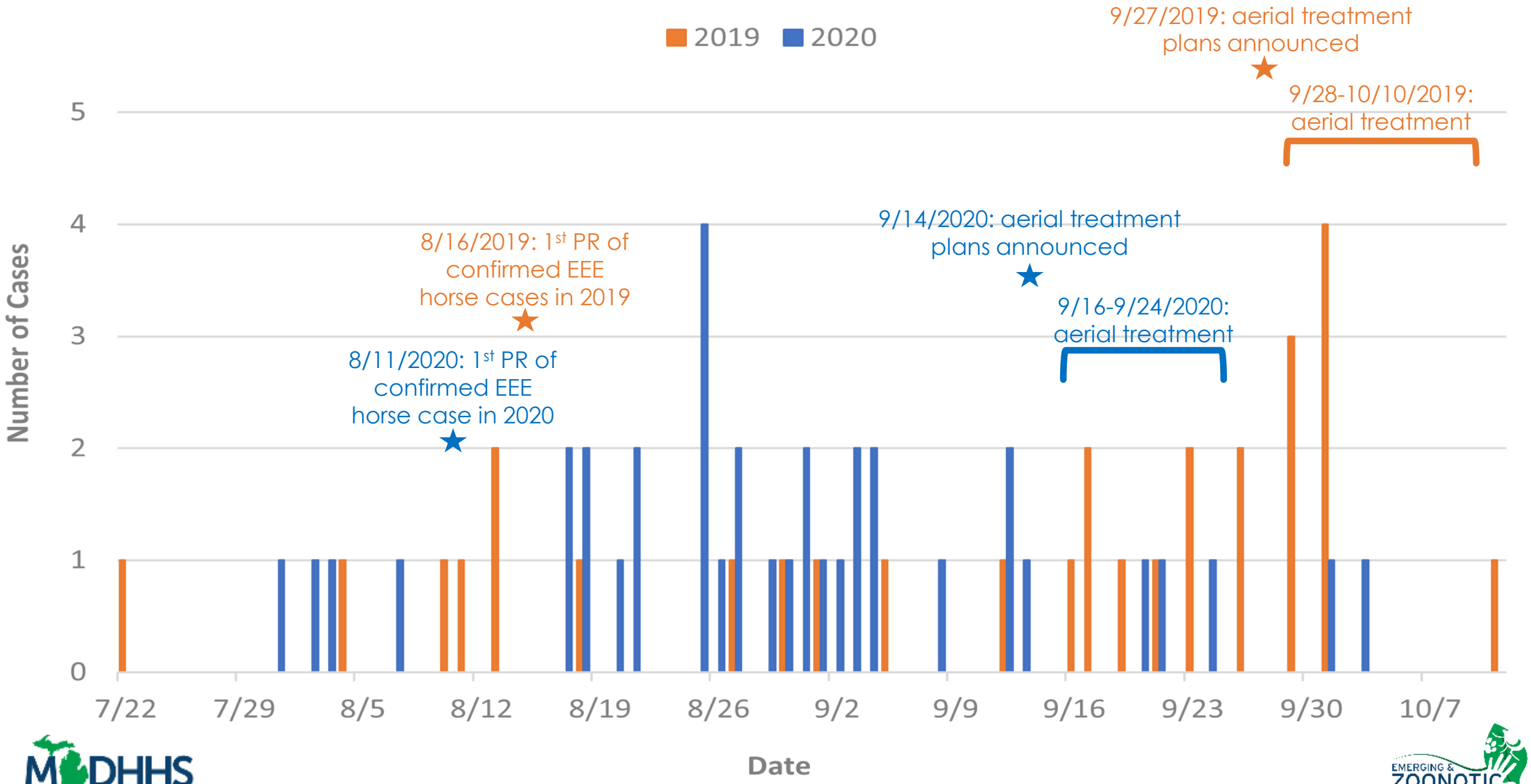
- 4 human cases, 2 fatal
- 41 animals across 19 counties tested positive
  - Most cases occurred in mid-MI
- Positive animals included horses, deer, birds
- Onset dates: July 31 – Oct 18
- Surveillance affected by COVID-19



HUMAN CASES OF EEE IN MICHIGAN, 2003-2020



Equine Case Onset Days 2019 vs 2020



MDHHS Michigan Department of Health & Human Services

EMERGING & ZOONOTIC INFECTIOUS DISEASE

2019 & 2020 EEE MOSQUITO SURVEILLANCE

- Without regular mosquito surveillance and control to give an early warning of mosquito-borne disease risk, MDHHS must assess risk by identifying cases in humans and horses.
- MSU & MDHHS conducted surveillance for EEE mosquitoes in 2019 and 2020 after first horse cases were identified. EEE-positive horses in 2019 & 2020 did not travel before becoming ill, indicating risk was localized
  - EEE vector mosquitoes were found, indicating ongoing risk to humans & animals

Culiseta melanura

Coquillettidia perturbans

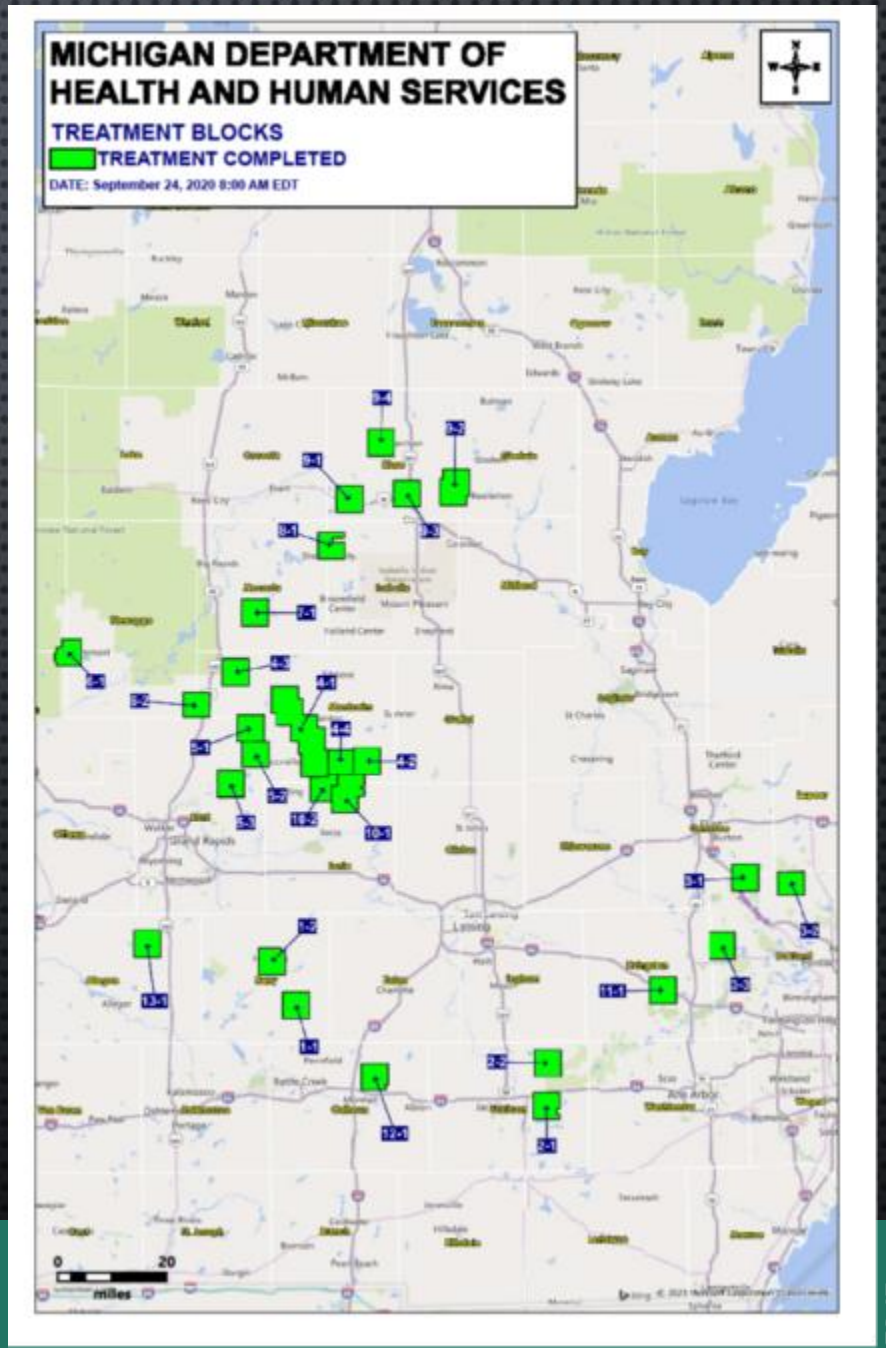
MDHHS Michigan Department of Health & Human Services

EMERGING & ZOONOTIC INFECTIOUS DISEASE

DECISION TO INITIATE AERIAL TREATMENTS

- By mid-Sept. 2020, Michigan had twice as many animal cases of EEE as we did in mid-Sept. 2019.
- The species of mosquito that transmits EEE was still being caught in traps
- MDHHS determined that a public health emergency existed
- Identified a contractor to perform treatments, obtained needed permits and waivers for pesticide (Merus 3.0) application
- Notified the public
- Michigan Department of Agriculture and Rural Development issued an emergency rule temporarily amending the rule for notification and participation for community pesticide applications for aerial treatment across affected counties

2020 Mosquito Treatment Areas



AERIAL TREATMENT, 9/16-9/24/2020

- Updated treatment maps daily based on weather conditions
- Daily calls with internal and external response partners
- Monitor weather for potential flight plan each day
- Alert local health of proposed treatment areas & product (Merus 3.0); put out daily press releases, updated website
- Monitored poison control, hospital data each day
- Approx. 462,000 acres treated

AERIAL TREATMENT DETAILS

- Aerial treatment involves the use of specially equipped airplanes, which spray a very fine mist of product as they fly. The tiny droplets drift through the air and kill adult mosquitoes that are flying around.
- In an outbreak, aerial treatment is the most effective control method when large areas must be treated quickly.
- Spraying from an aircraft allows treatment to be applied in places where trucks can't go (like swamps and wooded areas).
- Aerial treatment has been used in many other states.
- Monitoring of poison control and hospitals found no human illness associated with the treatment.
- No large-scale pollinator deaths were reported.

Perspective

Eastern Equine Encephalitis Virus — Another Emergent Arbovirus in the United States

David M. Morens, M.D., Gregory K. Folkers, M.S., M.P.H., and Anthony S. Fauci, M.D.

November 21, 2019
N Engl J Med 2019; 381:1989-1992
DOI: 10.1056/NEJMp1914328

"In the absence of vaccines or specific treatments, state and local health departments can provide early warning of imminent human infections by surveilling equids, birds, and mosquitoes; however, even these blunt prevention tools are continuously threatened by underfunding of public health efforts."

"Arbovirus threats are not easily thwarted by piecemeal efforts."

"Although EEE is not yet a disease of major national importance, this year's spike in cases exposed our inadequate preparation for emergent disease threats. Though the best way to respond to these threats is not entirely clear, to ignore them completely and do nothing would be irresponsible."

TAKE-HOME MESSAGES

- 2019 marked the most human cases Michigan has ever recorded in a single year
- 2020 – had high EEE risk in expanded geographic area. Mid-MI emerged as a new high risk area.
- Arboviral illnesses are reported every year in Michigan
- Outbreaks of EEE can occur in large areas of the state
  - Risk varies each year
  - Weather and geography influence both historical and regional risk
- More mosquito surveillance is needed to better anticipate disease risk
- Controlling mosquitoes & arboviral diseases is complicated work that requires community support and sustained funding
- Preventing human disease requires a One Health coordinated approach

SELECTED REFERENCES

- MDHHS. EEE and Aerial Treatment Frequently Asked Questions. https://www.michigan.gov/documents/emergingdiseases/EEE_Response_FAQs_2020_Final_702159_7.pdf
- CDC. Eastern Equine Encephalitis: Frequently Asked Questions. https://www.cdc.gov/easternequineencephalitis/gen/qa.html
- CDC. Eastern equine encephalitis virus: statistics & maps. Fort Collins, CO: US Department of Health and Human Services, CDC; 2019. https://www.cdc.gov/easternequineencephalitis/tech/epi.html
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- CDC. Eastern Equine Encephalitis: Information on Aerial Spraying. https://www.cdc.gov/westnile/vectorcontrol/aerial-spraying.html
- Clarke. Merus 3.0 Adulticide: Frequently Asked Questions. https://www.clarke.com/filebin/productpdf/Merus_3.0_FAQ_FINAL_9-27-19.pdf
- Boyce WM, Lawler SP, Schultz JM, McCauley SJ, Kimsey LS, Niemela MK, Nielsen CF, Reisen WK. 2007. Nontarget effects of the mosquito adulticide pyrethrin applied aerially during a West Nile virus outbreak in an urban California environment. *Journal of the American Mosquito Control Association 23*(3): 335-339.

For additional information, visit:
www.michigan.gov/eee

Michigan Emerging Disease Issues

Diseases that may affect humans or animals.

Search

- MI Disease Mapper
- Ticks and Your Health
- Mosquitoes and Your Health
- Being Safe Around Animals
- Bed Bugs, Head Lice, and Scabies
- Diseases affecting wildlife

EMERGING DISEASE ISSUES

Eastern Equine Encephalitis

2020 EEE Outbreak Information

As of Oct. 1, EEE has been confirmed in 36 animals in 15 counties – 34 equine and two deer. To date, there is one confirmed human case in Barry County. There is an EEE vaccine available for horses, but not for people. Protecting horses with approved EEE vaccines is an important prevention measure.

In an effort to prevent spread of Eastern Equine Encephalitis (EEE), MDHHS has announced plans to conduct aerial mosquito control treatment in certain high-risk areas of Michigan. To prevent the loss of life and protect public health, MDHHS has determined a targeted aerial treatment plan is necessary. When there are high rates of animal infections, humans are just as at risk.

EEE is one of the most dangerous mosquito-borne diseases in the United States, with a 33 percent fatality rate in people who become ill. People can be infected with EEE from one bite of a mosquito carrying the virus. Persons younger than age 15 and over age 50 are at greatest risk of severe disease following infection. More than 25 percent of the nation's EEE cases last year were diagnosed in Michigan. The risk of bites is highest for people who work and play outdoors in affected areas.

Update for Thursday, September 24

Aerial treatment to help prevent the spread of Eastern Equine Encephalitis resulted in nearly 27,000 acres being treated in Blocks 4-4 and 10-2 on Wednesday, Sept. 23. Nearly 462,000 acres have been treated to date.

At this time, no additional treatment is planned. MDHHS will continue to monitor the situation and treatment zones could be added if new cases are found and aerial treatment would be effective to reducing risk of exposure.

The most up-to-date information will be posted here at Michigan.gov/EEE.

Arbovirus* Activity, Including West Nile Virus and Eastern Equine Encephalitis:

Daily Outbreak Summary, Michigan 2020

*Arboviruses are viruses transmitted by mosquitoes or other insects

Updated: [redacted], 2020

Mosquito pools testing positive for West Nile virus infection

Birds testing positive for West Nile virus infection

Human cases of West Nile virus or other arboviruses reported

2020 Michigan Arbovirus Surveillance
(click links below to see cases by county)

West Nile virus Positive Mosquito Pools	[redacted]
Total Number of Mosquito Pools Tested	
Total Number of Mosquitoes Tested	
Human WNV cases	[redacted]
Human California Group virus cases	[redacted]
WNV asymptomatic, viremic blood donor	[redacted]
Equine/Other Animal WNV cases reported	[redacted]
Avian WNV cases reported	[redacted]
Human Eastern Equine Encephalitis cases reported	[redacted]
Animal Eastern Equine Encephalitis cases reported	[redacted]

Highlights

- For 2020, West Nile Virus (WNV) has been reported in [redacted] bird from [redacted] County. No other mosquito-borne virus infections have been reported in any other species to date.
- In 2019, Eastern Equine encephalitis virus (EEE) infected: 10 Michigan residents (1 Barry, 2 Berrien, 1 Calhoun, 2 Cass, 3 Kalamazoo, and 1 Van Buren) with 6 fatalities; 50 animals (2 Allegan, 5 Barry, 1 Berrien, 3 Calhoun, 4 Cass, 1 Genesee, 1 Eaton, 1 Houghton, 5 Jackson, 9 Kalamazoo, 2 Kent, 1 Lapeer, 1 Leelanau, 1 Livingston, 1 Montcalm, 1 Newaygo, 1 Ontonagon, 7 St. Joseph, 1 Tuscola, and 2 Van Buren).
- West Nile virus (WNV) sickened 12 Michigan residents and 3 were infected with a California group virus.

Human Cases

Animal Cases

MDHHS Michigan Department of Health & Human Services
Bureau of Epidemiology & Population Health
Emerging & Zoonotic Infectious Diseases (EZID) Section

For more information
www.michigan.gov/westnile

MDHHS Michigan Department of Health & Human Services

EMERGING & ZOONOTIC INFECTIOUS DISEASE