Georgia Department of Public Health

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Status of Arboviral Disease Surveillance in Georgia, 2001-2019

Three arboviral diseases are currently endemic in Georgia: LaCrosse Encephalitis, Eastern Equine Encephalitis, and West Nile virus. We continue to monitor travel-related arboviral cases in order to reduce the risk of local mosquitoes becoming infected.

Eastern equine encephalitis virus (EEE) is transmitted to humans by the bite of any number of different infected mosquitoes. This virus is maintained in birds and is endemic is South Georgia. Eastern equine encephalitis (EEE) only rarely causes illness in humans due to its somewhat complex life cycle. Infection with EEE virus begins with the sudden onset of headache, high fever, chills, and vomiting. The illness may then progress into disorientation, seizures, or coma. EEE is one of the most severe mosquito-transmitted diseases in the United States with approximately 33% mortality and significant brain damage in most survivors. There is no specific treatment for EEE; care is based on symptoms.

The primary vector for La Crosse encephalitis virus (LAC) is *Ochlerotatus triseriatus*, the treehole mosquito. This virus is maintained in small mammals such as chipmunks and squirrels. Many people infected with LAC have no apparent symptoms. Among people who become ill, initial symptoms include fever, headache, nausea, vomiting, and tiredness. Some of those who become ill develop severe neuroinvasive disease (disease that affects the nervous system). Severe LAC disease often involves encephalitis and can include seizures, coma, and paralysis. Severe disease occurs most often in children under the age of 16. In rare cases, long-term disability or death can result from La Crosse encephalitis. Children who have had LAC often fall behind in school.

West Nile virus (WNV) is a mosquito-borne viral pathogen that was introduced into the United States in 1999. Within four years following its initial detection in New York, WNV was detected in states from the East and West coasts as well as in Mexico and Canada.

West Nile virus is maintained in birds. It occasionally infects humans who are bitten by mosquitoes that have been feeding on birds. Most people (approximately 80%) infected with WNV do not develop symptoms. About one in five infected people experiences a mild illness, often termed “West Nile Fever” (WNF), characterized by fever, headache, muscle weakness or myalgia, arthralgia, and sometimes rash. Less than one percent of persons infected with WNV develop neurologic illness (“West Nile Neurologic Disease” or WNND) in the form of meningitis, encephalitis, or possibly acute flaccid paralysis. Approximately three to fifteen percent of WNND cases are fatal. Risk of WNND is associated with increasing age and the presence of underlying medical conditions.

The presence of WNV in Georgia was first confirmed in July 2001 when an American crow from Lowndes County tested positive for the virus. In 2001, 322 WNV-positive birds were found in 55 of the 127 counties that submitted birds for testing; 7 birds tested positive for Eastern Equine Encephalitis virus (EEE). Two counties conducted mosquito surveillance in 2001; one of these counties had WNV-positive mosquitoes detected. There were 64 WNV-positive horses reported from 25 counties. Six

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human cases of WNV were reported, with one death.

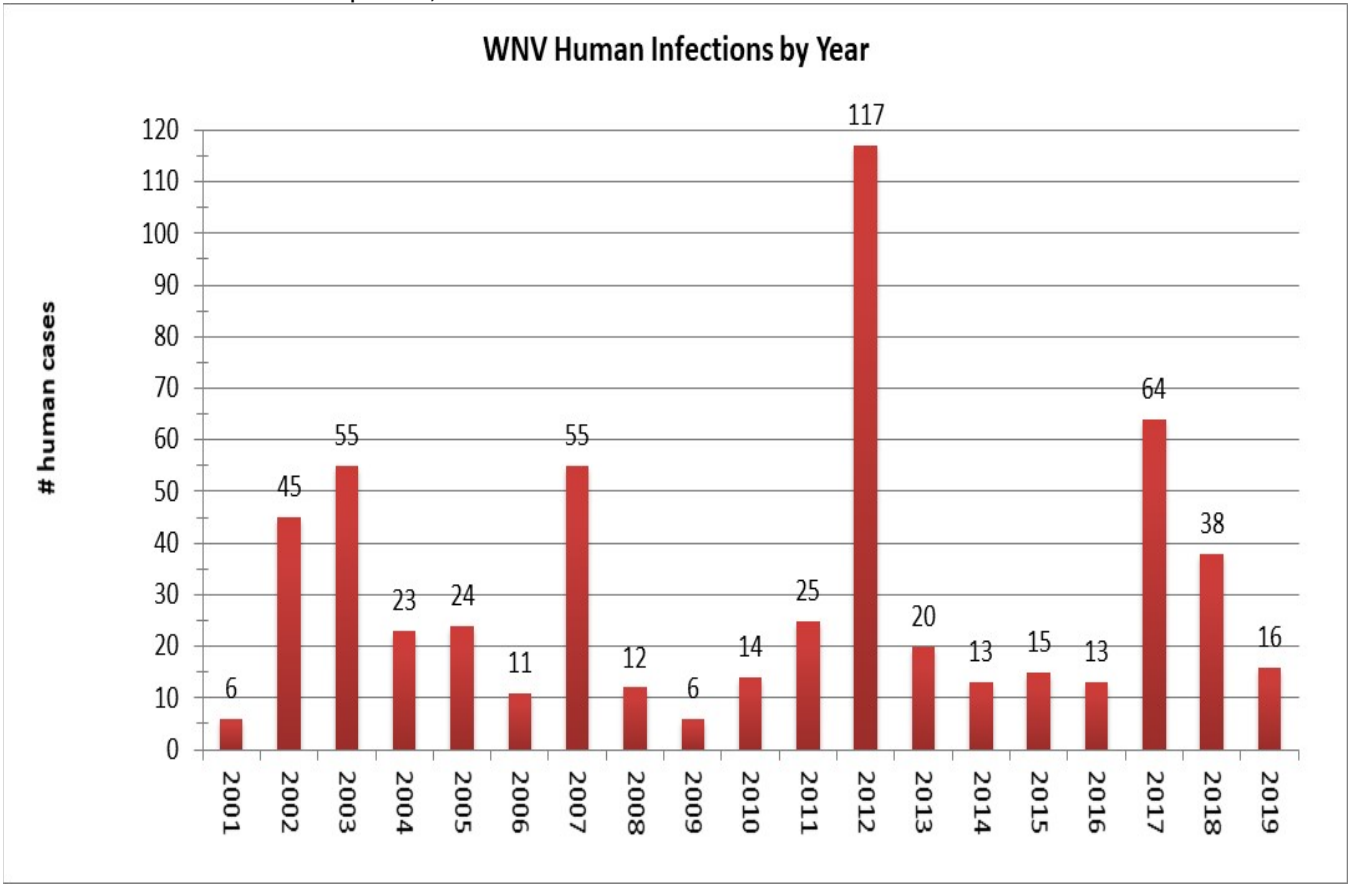

Figure 1: WNV+ Human Cases, 2001-2019

In 2002, 934 WNV-positive birds were found in 93 of the 113 counties that submitted birds for testing. Twelve counties conducted mosquito surveillance in 2002, and 7 of these counties had WNV-positive mosquitoes detected; over 90% of the positive mosquitoes were *Culex quinquefasciatus*, the southern house mosquito. There were 175 WNV-positive horses reported from 69 counties. There were 36 WNV human cases, with 7 deaths.

In 2003, 479 birds tested positive for WNV from 65 of 114 counties that submitted birds for testing. Nineteen birds from 12 counties tested positive for EEE. Some level of mosquito surveillance was done in 28 counties, with 7 counties detecting WNV-positive mosquitoes. Again, the majority of the mosquitoes found positive for WNV were *Culex quinquefasciatus*. EEE was found in 4 mosquito pools from 3 counties. There were 60 cases of WNV reported in horses, and 81 cases of EEE reported. This

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number was well above our mean of 5 EEE-positive horses per year. In 2003, Georgia reported 55 verified cases of West Nile virus infection, including 4 deaths. Five of these cases were asymptomatic, 29 experienced WNV neurologic disease, and 21 were diagnosed with WN fever. Two cases of EEE were reported as well, with one death.

In 2004, 105 WNV-positive birds were found in 24 of the 71 counties that submitted birds for testing. Five hundred and eighty-one birds were submitted for testing. Sixty counties conducted some level of mosquito surveillance in 2004, and 7 of these counties had WNV-positive mosquito pools detected; over 90% of the positive mosquitoes were *Culex quinquefasciatus*, the southern house mosquito. Two EEE-positive mosquito pools were detected. There were 3 WNV-positive horses and 7 EEE-positive horses reported. There were 22 human cases of WNV, with 1 death. One of these cases was asymptomatic, 14 experienced WNV neurologic disease, and 7 were diagnosed with WN fever. Five cases of LaCrosse Encephalitis were reported, with no deaths.

In 2005, 310 birds were submitted for testing from 51 counties; 23 tested positive for WNV. EEE was also detected in a flock of quail in South Georgia in 2005. Some level of mosquito surveillance was done in 59 counties, with WNV-positive mosquitoes detected in 5 counties. Intensive mosquito surveillance was conducted in fewer than 10 counties. Ninety-six percent of all WNV-positive mosquito pools consisted of *Culex quinquefasciatus*, the southern house mosquito. EEE was isolated from 8 mosquito pools from 2 counties. There were 20 EEE-positive horses detected in 2005, as well as one WNV-positive horse, and one horse that was determined to be both WNV and EEE positive. Twenty-four verified human cases of WNV were reported, with 2 deaths. Fifty percent of these cases experienced neurologic illness, 4 cases were viremic donors who never developed disease. One case of LaCrosse and one case of EEE were also reported. There were 5 cases of internationally-acquired dengue fever.

In 2006, 282 birds were submitted for testing from 38 counties; 15 (from 7 counties) tested positive for WNV. Pigeon paramyxovirus was detected in one bird. Some level of mosquito surveillance was done in 27 counties, with WNV-positive mosquitoes detected in 5 counties. All WNV-positive mosquito pools consisted of *Culex quinquefasciatus*, the southern house mosquito. There were 4 EEE-positives horses detected in 2006; no WNV-positive horses were detected. Eight confirmed cases of human disease were reported, including one death. One positive viremic blood donor was also identified. Twenty-five percent of these cases developed neurologic symptoms, while 63% were diagnosed with West Nile fever. One case of LaCrosse and one case of EEE were also reported. There was 1 case of internationally-acquired dengue fever reported.

In 2007, 99 birds were submitted for testing from 21 counties; 12 (from 5 counties) tested positive for WNV. Some level of mosquito surveillance was done in 28 counties, with WNV-positive mosquitoes detected in 7 counties. All WNV-positive mosquito pools consisted of *Culex quinquefasciatus*, the southern house mosquito. No WNV+ horses were reported in 2007, but 6 horses were reported positive for EEE. Fifty-two confirmed human cases of WNV infection, including 1 death were reported. Three positive viremic blood donors were also identified. A fourth blood donor went on to develop WNV symptoms and was counted as one of the 52 confirmed cases. Twenty five (48%) of the 52 cases experienced WNV neurologic illness (altered mental status, encephalitis, and/or meningitis) and 25

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(48%) were diagnosed with WNV fever. The remaining two cases (4%) were asymptomatic. Three viremic blood donors were lost to follow up and symptoms were never recorded. In addition to WNV, two confirmed cases and one suspect case of LaCrosse Encephalitis were reported in Georgia in 2007. One suspect case of Eastern Equine Encephalitis was also reported. There were 11 internationally-acquired Dengue cases and 1 case of internationally-acquired Chikungunya reported.

In 2008, 20 birds were submitted from 10 counties; 5 (from 2 counties) tested positive for WNV. Some level of mosquito surveillance was done in 28 counties with WNV-positive mosquitoes detected in 5 counties. Mosquitoes found WNV+ were *Cx quinquefasciatus, Cx restuans, and Ochlerotatus triseriatus;* the mosquitoes most commonly found positive were *Cx quinquefasciatus*. No WNV+ horses were reported in 2008, but 23 horses and 1 dog were reported positive for EEE. Eight confirmed human cases of WNV infection were reported. Four positive viremic blood donors were also identified, but are not counted as part of the 8 confirmed cases. Five (62%) of the 8 cases experienced WNV neurologic illness (altered mental status, encephalitis, and/or meningitis) and 3 (38%) were diagnosed with WNV fever. The four viremic blood donors remained asymptomatic. In addition to WNV, two confirmed cases of LaCrosse Encephalitis were reported in Georgia in 2008. Two internationally-acquired cases of Dengue were also reported.

In 2009, 21 birds were submitted for testing from 7 counties; 1 bird tested positive for WNV. Some level of mosquito surveillance was done in 27 counties with WNV-positive mosquitoes detected in 4 counties. Mosquitoes found WNV+ were *Cx quinquefasciatus* and *Cx restuans;* the mosquitoes most commonly found positive were *Cx quinquefasciatus*. One horse and 2 dogs tested positive for WNV in 2009, and 44 horses, 1 calf, and 1 dog were reported positive for EEE. Four confirmed human cases of WNV infection were reported. Two positive viremic blood donors were also identified, but are not counted as part of the 4 confirmed cases. All of the WNV+ cases experienced WNV neurologic illness (altered mental status, encephalitis, and/or meningitis). The two viremic blood donors remained asymptomatic. In addition to WNV, two confirmed cases of LaCrosse Encephalitis were reported in Georgia in 2009. Five internationally-acquired cases of Dengue were also reported.

In 2010, 9 birds were submitted for testing from 3 counties; 4 birds tested positive for WNV. Some level of mosquito surveillance was done in 24 counties with WNV-positive mosquitoes detected in 5 counties. Mosquitoes found WNV+ were *Aedes albopictus, Culex quinquefasciatus* and *Cx restuans;* the mosquito species most commonly found positive (96%) was *Cx quinquefasciatus*. Two horses tested positive for WNV in 2010, and 11 horses were reported positive for EEE. Thirteen confirmed human cases of WNV infection were reported. One positive viremic blood donor were also identified, but is not counted as part of the 13 confirmed cases. Nine of the cases were fever case, while 4 experienced WNV neurologic illness (Guillain-Barre Syndrome, encephalitis, and/or meningitis). The viremic blood donor remained asymptomatic. In addition to WNV, two confirmed cases of LaCrosse Encephalitis were reported in Georgia in 2010. Nine internationally acquired cases of Dengue were also reported, as were 2 cases of Dengue Hemorrhagic Fever and one case of Chikungunya.

In 2011, 6 birds were submitted for testing from 3 counties; 1 bird tested positive for WNV in DeKalb County. Some level of mosquito surveillance was done in 18 counties with WNV-positive mosquitoes

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detected in 7 counties. Mosquitoes found WNV+ were *Aedes albopictus, Culex quinquefasciatus* and *Cx restuans;* the mosquito species most commonly found positive was *Cx quinquefasciatus*. Four hundred and thirty-eight WNV+ mosquito pools were reported. Three horses tested positive for WNV in 2011, and no horses were reported positive for EEE. Eight confirmed and 14 probable human cases of WNV were reported in 2011. Three positive viremic blood donors were also identified, but are not counted as any of the 22 cases.

In 2012, only the six counties and one city holding independent contracts with SCWDS were able to send birds and mosquitoes in for testing. Ten birds were submitted for testing from 3 counties; 1 bird, sent in for testing by the veterinarian, tested positive for WNV in Mitchell County. The six counties and one city sent mosquitoes in for testing in 2012, and WNV-positive mosquitoes were detected in 5 counties. One hundred and twenty-five WNV+ mosquito pools were reported. Mosquitoes found WNV+ were *Culex quinquefasciatus* and *Cx nigripalpus;* the mosquito species most commonly found positive was *Cx quinquefasciatus*. Eleven horses tested positive for WNV in 2012, and 10 horses were tested positive for EEE. One hundred human cases of WNV were reported in 2012, with 6 deaths. Seventeen positive viremic blood donors were also identified, but are not counted as any of the 100 cases.

In 2013, only the six counties and one city holding independent contracts with SCWDS were able to send birds and mosquitoes in for testing. No birds tested positive for any arboviral diseases in 2013. Mosquitoes found WNV+ (150 pools) were *Aedes albopictus, Culex quinquefasciatus*, *Cx nigripalpus, Cx restuans*, and *Ochlerotatus triseriatus,* as well as unidentified Culex spp; the mosquito species most commonly found positive (82.7%) was *Cx quinquefasciatus*. An additional 16 pools of mosquitoes were reported to be WNV+, but no other information is available on these mosquitoes. In addition to WNV, 1 pool was found to be EEE+ (Lowndes County). Georgia confirmed 10 cases of WNV, with 0 deaths, in 2013. An additional 7 cases were reported, but were lost to follow-up. Three positive viremic blood donors were also identified, but are not counted as any of the 17 cases. Four (23.5%) of the 17 cases experienced WNV neurologic illness (altered mental status, paralysis, encephalitis, and/or meningitis) and 6 (35.3%) were diagnosed with WNV fever. Seven (41.2%) had no additional data. The viremic blood donors remained asymptomatic.

In 2014, Georgia reported 13 cases of WNV, with 1 death. Eleven (84.6%) of the 13 cases experienced WNV neurologic illness (altered mental status, paralysis, encephalitis, and/or meningitis) and 2 (15.3%) were diagnosed with WNV fever. There were no viremic blood donors reported. The average age of cases was 53 years (range 9-86). The average age of those with WNV neurologic illness was 49 years (range 9-76). Nine (69.2%) of the 13 cases were male. The majority of cases were reported in July, August, and September. No horses tested positive for WNV in 2014, but 7 horses tested positive for EEE. No birds were reported as being submitted for testing in 2014. A total of 5038 pools of mosquitoes (107967 individuals) were sent for testing with results reported to the GDPH. Mosquitoes found WNV+ (56 pools) were *Aedes albopictus* and *Culex quinquefasciatus*, as well as unidentified Culex spp; the mosquito species most commonly found positive (96.4%) was *Cx quinquefasciatus*. In addition to WNV, 2 pools were found to be EEE+ (Lowndes & Chatham counties).

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In the United States, a total of 2,122 cases of West Nile virus disease in people, including 85 deaths, were reported to CDC in 2014. There were also 337 presumptive viremic blood donors reported. Of the cases, 1,283 (60.5%) were classified as neuroinvasive disease (such as meningitis or encephalitis) and 839 (39.5%) were classified as non-neuroinvasive disease.

In 2015, Georgia reported 15 cases of WNV and 2 WNV presumptive viremic blood donors (PVD), with no deaths. Thirteen (86.7%) of the 15 cases experienced WNV neurologic illness (altered mental status, paralysis, encephalitis, and/or meningitis) and 2 (15.3%) and 2 (13.3%) were diagnosed with WNV fever. The average age of cases was 60.8 years (range 26-90). The average age of those with WNV neurologic illness was 59.5 years (range 26-89). Ten (66.7%) of the 15 cases were male. The majority of cases were reported in July and September. In addition to WNV, two cases of California Encephalitis (LAC) were reported from Macon and Franklin counties. No horses tested positive for WNV in 2015, but 6 horses tested positive for EEE. No birds were reported as being submitted for testing in 2015. A total of 3366 pools of mosquitoes (73234 individuals) were sent for testing with results reported to the GDPH. The only species found WNV+ (40 pools) was *Culex quinquefasciatus*. No other viruses were reported from mosquito pools in 2015.

In the United States, a total of 2,175 cases of West Nile virus disease in people, including 146 deaths, were reported to CDC in 2015. There were also 345 presumptive viremic blood donors reported. Of the cases, 1455 (66.9%) were classified as neuroinvasive disease (such as meningitis or encephalitis) and 720 (33.1%) were classified as non-neuroinvasive disease.

In 2016, Georgia reported 7 cases of WNV and 6 WNV presumptive viremic blood donors (PVD), with no deaths. Five (%) of the 7 cases experienced WNV neurologic illness (altered mental status, paralysis, encephalitis, GBS and/or meningitis) and 2 (%) were diagnosed with WNV fever. The average age of cases was 69.4 years (range 34-85). The average age of those with WNV neurologic illness was 79.6 years (range 79-85). All (100%) of the 7 cases were male. The majority of cases were reported in August. There was also one case of Eastern Equine Encephalitis (EEE) reported from South Georgia in July. No cases of LaCrosse Encephalitis (LAC) were reported in 2016. No horses tested positive for WNV in 2016, but 5 horses tested positive for EEE. No birds were reported as being submitted for testing in 2016. A total of 5620 pools of mosquitoes (113376 individuals) were sent for testing with results reported to the GDPH. Two species were found to be WNV+, Culex quinquefasciatus (35 pools) and Aedes albopictus (1 pool). No other viruses were reported from mosquito pools in 2016.

In the United States, a total of 2,038 cases of West Nile virus disease in people, including 94 deaths, were reported to CDC in 2016. There were also 275 presumptive viremic blood donors reported. Of the cases, 1140 (55.9%) were classified as neuroinvasive disease (such as meningitis or encephalitis) and 898 (44.1%) were classified as non-neuroinvasive disease.

In 2017, Georgia reported 48 cases of WNV and 16 WNV presumptive viremic donors (PVD), with 7 deaths. Forty-three (89.5%) of the 48 cases experienced WNV neurologic illness (altered mental status, paralysis, encephalitis, GBS and/or meningitis) and 5 (10.2%) were diagnosed with WNV fever. The average age of cases was 61.4 years (range 17-87). The average age of those with WNV neurologic

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illness was 64.6 years (range 26-87). Forty (83.3%) of the 48 cases were male. The majority of cases were reported in July, August, and September, with the peak in August. There were 2 cases of LAC reported in Georgia in 2017. In 2017, two confirmed cases of EEE and one PVD were reported in Georgia. Eleven horses tested positive for WNV in 2017, and 7 horses tested positive for EEE. In 2017, 5 birds were submitted for testing from one county; 1 tested WNV+. A total of 6418 pools of mosquitoes (119735 individuals) were sent for testing with results reported to the GDPH. Three species were found to be WNV+, *Culex nigripalpus* (2 pools), *Cx quinquefasciatus* (262 pools) and *Cx restuans* (1 pool). There were also 11 pools of unspecified *Culex* spp found WNV+. Two EEE+ pools were reported from *Culiseta melanura* in 2017.

In the United States, a total of 47 states and the District of Columbia reported West Nile virus infections in people, birds, or mosquitoes in 2017. Overall, 2,002 cases of West Nile virus disease in people have been reported to CDC. Of these, 1,339 (67%) were classified as neuroinvasive disease (such as meningitis or encephalitis) and 663 (33%) were classified as non-neuroinvasive disease.

In 2018, Georgia reported 36 cases of WNV and 2 WNV presumptive viremic donors (PVD), with 2 deaths. In 2018, one confirmed case of EEE was reported in Georgia. There were no cases of LAC reported in Georgia in 2018; however, there was one case of JCV reported in Georgia in 2018. In 2018, one case of SLE was reported in Georgia. Three horses tested positive for WNV in 2018. Seven horses tested positive for EEE in 2018. In 2018, 7 birds were submitted for testing from one county; 1 tested WNV+. In addition, Chatham County Mosquito Control reported 3 WNV+ and 1 EEE+ sentinel chicken. A total of 6598 pools of mosquitoes (122017 individuals) were sent for testing with results reported to the GDPH. Four species were found to be WNV+, *Aedes albopictus* (1 pool), *Culiseta melanura* (1 pool), *Culex nigripalpus* (17 pools), and *Cx quinquefasciatus* (276 pools). There were also 15 pools of unspecified *Culex spp* found WNV+. Three EEE+ pools were reported in 2018, 2 from *Cs melanura* and 1 from *Cx quinquefasciatus*. In 2018, some level of surveillance was done in every county in Georgia. However, mosquitoes were only sent for testing from 6 counties.

In 2019, Georgia reported 14 cases of WNV and 2 WNV presumptive viremic donors (PVD), with one death. Overall, 14 WNV disease cases were reported from 9 counties in 8 public health districts. Among these cases, 9 (64%) were neuroinvasive, 11 (78%) patients had illness onset during July-September and 12 (86%) cases were male. The average patient age of all WNV disease cases was 52.8 (range: 10-85) and the average patient age of all neuroinvasive cases was 51.2 (range: 10-82). The majority of cases were reported in August and September, with a peak in September.

In 2019, one confirmed case of EEE was reported in Georgia.

California serogroup (CS) viruses, including California encephalitis, Keystone, La Crosse, Jamestown Canyon (JCV), snowshoe hare, and trivittatus, belongs to the Bunyaviridae family of viruses. In the United States, La Crosse virus (LACV) is the most common of the California serogroup viruses. There was one case of LAC reported in Georgia in 2019.

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The first travel associated case of Zika was reported in Georgia in December 2015. In 2016, there were 113 travel-associated cases reported in Georgia. In 2017, there were a total of 11 travel-associated cases, 8 of which were asymptomatic. In 2018, a total of 2 asymptomatic travel associated ZIKV cases were reported. In 2019, there were 5 travel associated ZIKV cases reported, 4 of which were asymptomatic, and 1 case of occupationally acquired ZIKV. To date there have been no locally transmitted (mosquito to human) cases of Zika. Travel associated Dengue (6) and Chikungunya (1) cases were reported in 2019, but no locally acquired cases were reported.

No horses tested positive for WNV in 2019. Four horses tested positive for EEE in 2019. Eastern equine encephalitis is endemic in the Coastal and Coastal Plains areas of Georgia. During an average year, four or five EEE+ horses are reported from these areas. The true number of horse cases is probably higher, and lack of reporting is due primarily to under-testing, although subclinical infections can occur with EEE.

In 2019, 2 birds were submitted for testing from one county: 1 tested WNV+.

A total of 5532 pools of mosquitoes (128899 individuals) were sent for testing in 2019, with results reported to the GDPH. Three species were found to be WNV+, *Culex nigripalpus* (1 pool), *Cx restuans* (2 pools), and *Cx quinquefasciatus* (223 pools). There were also 17 pools of unspecified *Culex* spp found WNV+. In 2019, the first WNV+ mosquitoes were detected in Lowndes County in late April. The last WNV+ pools were collected in Chatham and Glynn counties in October. Peaks in numbers of WNV+ pools occurred in July. One WNV+ pool was collected from a CDC light trap. The rest (242) of the WNV+ mosquitoes were caught in gravid traps. In 2019, mosquitoes were sent for testing from 12 counties. An additional 121930 mosquitoes were collected from all 159 of Georgia's counties but were not sent for testing.

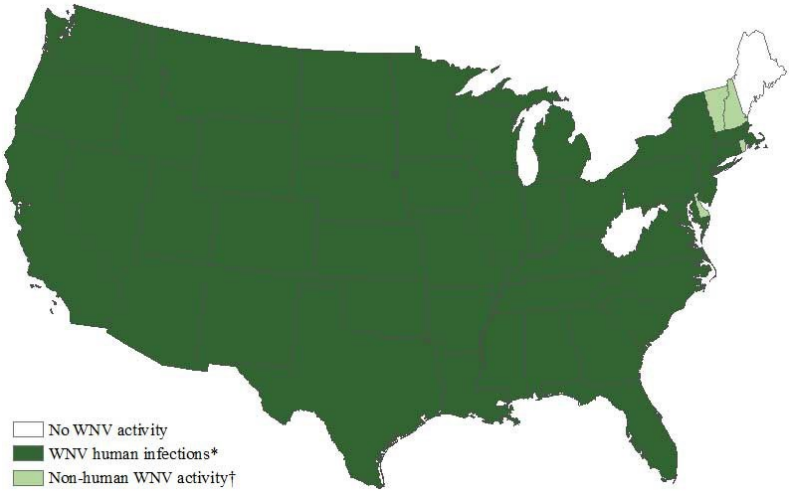

Figure 2: West Nile Virus Activity by State – United States, 2019 (as of January 7, 2020)

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Arbovirus Surveillance during the Winter Months:
Although cold winter temperatures will reduce mosquito activity in Georgia, some mosquitoes will fly and blood feed when temperatures rise above 50° F. However, cooler temperatures generally mean a lower risk of mosquito-borne disease transmission because mosquitoes are less active, and virus does not replicate well. Also, people tend to spend less time outdoors during winter months, and typically wear more clothing or heavier clothing while they are outdoors.

During unseasonably warm winters, mosquitoes that overwinter as adults will often be out and biting.

District or county health departments that are able to collect and identify mosquitoes will be able to use those data to help determine risk of disease transmission. Information on identifying Georgia mosquito species can be found at http://www.GAmosquito.org.

What to Expect During 2020:
There has been a fair amount of rain this winter and the temperature has ranged from higher than normal to lower than normal. However, there are still abnormally dry conditions in parts of South Georgia. If weather conditions continue with this trend, it is likely that WNV risk will be high, as the vector will be out and biting sooner.

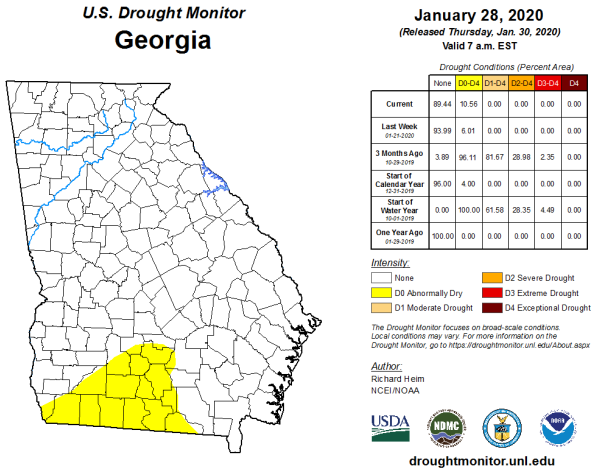

Figure 3: US Drought Monitor, Georgia (January 30, 2020)

Equine surveillance will continue throughout 2020 in cooperation with the Georgia Department of Agriculture and the University of Georgia Veterinary Diagnostic Laboratories. Equine arbovirus surveillance has traditionally been an important indicator of EEE activity in Georgia and has been used as an indicator of human risk. Equine surveillance plays an important role in determining the risk of WNV activity, but because reported cases of WNV in horses continue to decrease, strengthening relationships with local veterinarians will provide better information on horse cases locally. Because clustering of human cases around positive horse sites indicates that these are sites of high human risk, education of horse owners plays an important role in reducing the risk of mosquito-borne diseases.

Mosquito surveillance will also occur in response to both endemic and travel-related arboviral risk. This is an important component of an arbovirus surveillance and control program. **Information obtained from these surveillance efforts should lead to responsible and informed decisions about**

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mosquito control as well as public education about elimination of mosquito breeding habitats and prevention of mosquito bites. To-date WNV activity has been a yearly occurrence and is considered endemic throughout the state. Surveillance is useful as a trigger for public education messages reminding people to wear repellent and to dump out standing water.

Continued surveillance also makes it much more likely that the next new virus introduced into the area will be identified before human cases occur. Where mosquito control is available, data should be shared between public health and the mosquito control program. Mosquito control targeting vector species will reduce the risk of disease transmission. We also have competent vectors for dengue, CHIK, and ZIKA viruses. This makes it imperative for local health departments to work closely with mosquito control when cases of travel-associated are reported. Because of the long lag-time in confirming these cases, information about where possible cases live needs to be shared with mosquito control as soon as possible to minimize the risk of local transmission.

As Georgia begins its 20th year of WNV transmission, surveillance for the sake of locating and responding to increases in vector populations through community education and mosquito control continues to be an important tool in reducing human risk of disease. Currently, it is recommended that mosquito surveillance start in April (or earlier) to determine baseline vector populations and continue through October (or later). Mosquito surveillance traps can be placed where human cases, or positive horse, birds, or mosquito pools have been found previously, where mosquito complaints occur, where at-risk populations live, or where public use areas are located. *Culex quinquefasciatus*, the mosquito most associated with WNV in Georgia, has an average flight range of approximately one-half mile from its site of breeding habitat. The flight range of *Aedes albopictus* and *Aedes aegypti* is considerably shorter.

Integrated mosquito management (IMM) practices for mosquito control include education, surveillance, source reduction, larviciding, and adulticiding as the means to reduce mosquito populations below a threshold amount. Reminding the public at the start of mosquito season that wearing repellent reduces the risk of WNV is important. It is also important to remind people of their role in reducing mosquito populations by eliminating mosquito-breeding areas in their yards and in their neighborhoods. Applying larvicide to catch basins and other locations starting in March or April will help reduce populations of *Culex* spp mosquitoes. Additional larviciding and education in response to positive birds or increased numbers of vector species undoubtedly has the effect of minimizing the risk of human disease in areas where virus is actively circulating. When adult mosquito populations begin to rise, it is important to consider adulticiding in an effort to reduce mosquito populations. Where nuisance mosquito control is already being conducted, coordinating these activities with bird and mosquito surveillance may aid in further reducing human risk. Communication between agencies and with the public is an essential part of the arboviral disease risk reduction effort. Mapping of surveillance and control activities provides additional information that can be used to direct activities to make the best use of resources. Education should occur whenever anyone talks to a member of the public, be it answering the phone, larviciding, or setting a mosquito trap. It is important to do as many of these activities simultaneously as is possible to use worker time more efficiently.

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In addition to surveillance, the DPH is conducting insecticide resistance testing throughout Georgia. Eggs from *Cx quinquefasciatus* and *Ae albopictus* are collected, reared to adult stage, and tested using the CDC Bottle Bioassay protocol with the various pesticides commonly used in Georgia (https://www.cdc.gov/malaria/resources/pdf/fsp/ir_manual/ir_cdc_bioassay_en.pdf). Preliminary data from several central and southern counties showed *Ae albopictus* to be exhibiting varied levels of resistance to permethrin and deltamethrin but were susceptible at varied levels to bifenthrin and deltamethrin used along with the synergist, PBO. *Culex quinquefasciatus* showed varied levels of resistance to permethrin, lambda cyhalothrin, and deltamethrin; they were susceptible to malathion.

Thank you for your hard work in making Georgia's arbovirus surveillance program successful. Please visit the GDPH website (http://dph.georgia.gov/mosquito-borne-viral-diseases) and the GMCA website (http://www.GAmosquito.org) often for maps, updates, presentations, guidance documents, forms, and summaries.