

## **APPENDIX D: MOSQUITO-BORNE DISEASES THAT MAY OCCUR IN COLORADO**

There are currently four arboviruses found in Colorado that are transmitted by mosquitoes: WNV, Western Equine Encephalitis, St. Louis Encephalitis, and California Encephalitis. Arbovirus, which is short for arthropod-borne virus, is a group of viruses that are spread mainly by blood-sucking insects, such as mosquitoes. Encephalitis is an acute inflammation of the brain tissue. It can be caused by a variety of agents, but viruses are the most common cause. The following chapter describes these viruses.

### **Western Equine Encephalitis**

Western Equine Encephalitis (WEE) is found throughout North, Central, and South America. However, the majority of the cases in North America have been reported from the rural western United States. WEE is spread mainly by the vector mosquito *C. tarsalis*. Birds are the primary hosts for WEE because of their ability to act as reservoirs to the virus and allow it to replicate easily (Leighton 2000). Birds are infected in the spring by virus-carrying mosquitoes; the virus replicates and amplifies in the birds, other mosquitoes feed on the birds, the newly infected mosquitoes can infect more birds, and the cycle continues. WEE is common in the summer, with peaks in July and August when populations of the vector mosquito are the highest (Nadalur and Urban 2002). The risk of disease in humans and horses varies from year to year depending on the number of infected mosquitoes. A vaccine is available for horses, but there is no vaccine for general use in humans because of the small amount of verified WEE cases.

### **Saint Louis Encephalitis**

The St. Louis Encephalitis (SLE) virus was first recognized in 1933 in St. Louis, Missouri. Currently, the virus occurs throughout the United States, with higher concentrations in the Mid-West and Southern states with small (fewer than 30 people affected), isolated regional outbreaks (CDC 2001). Birds are immune hosts of the virus, which is transmitted between birds and from birds to humans and other animals by the blood-sucking mosquitoes (CDC 2001). The virus is transmitted and spread primarily by mosquitoes of the genus *Culex*. As with WEE, humans are a dead-end host for SLE. Most humans that are infected never show any symptoms of the disease. Currently, there is no vaccine against SLE.

### **California Encephalitis**

The California Encephalitis (CE) virus was first named after a human case diagnosed in 1946 in Kern County, California (Soliman, No date). Since that time, most cases have been linked with the La Crosse virus. The La Crosse virus occurs in north-central states, primarily in the upper Mississippi River Valley, and is transmitted by the treehole mosquito, *Aedes triseriatus*. The vertebrate hosts of the virus are primarily small woodland mammals, such as squirrels and chipmunks, which harbor the virus until it is passed to other mosquitoes. The virus is able to survive the winter within the vector mosquito (CDC 2001). Only about 70 cases of La Crosse encephalitis are reported annually.

### **West Nile Virus**

West Nile Virus (WNV) was first found in the United States in 1999 in New York City and has since spread to 43 states (U.S. Geological Survey [USGS] 2002). The virus is carried long distances by infected birds and then spread locally by mosquitoes that bite the infected birds. The virus is primarily transmitted by mosquitoes of the genus *Culex*. In Colorado, the mosquito species *Culex tarsalis* and *Culex pipiens* are known to be involved in the transmission cycle of the virus. *C. tarsalis* is considered more likely to transmit the

virus to mammals, such as horses and humans, which are dead-end hosts. Humans and horses are described as dead-end hosts for the virus because, once it has been contracted, they cannot transmit the disease.

The highest risk of WNV infection for humans is usually August through early September. Because the status of WNV in Colorado is changing rapidly, the most current information on WNV in the state can be found by referring to the WNV educational campaign web page at: <http://www.fightthebitecolorado.com>. For additional information on WNV, refer to the Centers for Disease Control and Prevention (CDC) web page at: <http://www.cdc.gov/ncidod/dvbid/westnile/index.htm> or by calling the Colorado Health Education Line for the Public at 1-877-462-2911. The statewide, toll-free hotline, which is staffed by trained operators, is open from 7 a.m. to 11 p.m. seven days a week. Callers to the hotline will be able to obtain information in English and Spanish on a wide variety of topics relating to WNV, including the following:

- Information on repellants and how they should be used both on adults and children.
- Symptoms of WNV, however, hotline operators will not be able to help diagnose whether a person has contracted WNV. Rather such individuals will be referred to their personal physician for diagnosis and treatment.
- Methods of preventing WNV.
- How pets might be affected by WNV.

### **West Nile Virus Pathway**

WNV is carried long distances by infected birds on seasonal migration patterns and then spread locally by mosquitoes that bite the infected birds. The virus is primarily transmitted by mosquitoes of the genus *Culex*. In the Boulder Area, the primary species of *Culex* are *Culex tarsalis* and *Culex pipiens*. These two species are considered the most likely to transmit the virus to mammals, such as horses and humans, which are dead-end hosts. Humans and horses are described as dead-end hosts for the virus because; once it has been contracted, they cannot transmit the disease due to inadequate amounts of viremia, or virus circulation in the bloodstream to infect other mammals or mosquitoes. Mosquito of the *Culex* genus overwinter and; therefore, can continue the disease the following spring.

### **West Nile Virus in the U.S.**

WNV was first isolated in 1937 and known to cause asymptomatic infection and fevers in humans in Africa, West Asia and the Middle East. First detected within the U.S. in the state of New York in 1999, WNV has spread from East to West across the United States by mosquito hosts and carrier birds. During 1999 and 2000, WNV encephalitis was found in U.S. residents in three northeastern states with a total of 83 human cases and 9 reported deaths. WNV spread westward in 2001 occurring in 10 states having 66 cases and 9 deaths. As of 2005 WNV has been detected in all states except for Alaska and Hawaii. There is currently no WNV vaccine for humans, but there is for horses.

### **West Nile Virus in Colorado**

In 2002, Colorado had its first cases of humans infected by WNV with 14 documented human cases and no reported WNV-related deaths (CDPHE 2004). These 14 cases occurred despite a severe drought. Additionally, 138 bird, 3 sentinel chicken flocks, and 380 horses tested positive for WNV in 2002 (CDPHE 2004). During the 2003 mosquito season, Colorado lead the nation in WNV human cases (2,945) and WNV-related deaths (55) (CDPHE 2004). This is likely due primarily to Colorado's wet spring and hot summer

increasing mosquito breeding populations and earlier emergence as described earlier. The onset of human symptoms was first documented with less than 10 cases on June 30, 2003, by CDPHE. The number of cases from June to September followed a Bell shaped curve with the major peak in August that year.

#### **West Nile Virus in Boulder County**

By the end of 2003 there were 430 WNV infections reported to Boulder County Public Health, 378 were diagnosed with WNV Fever and 52 with either WNV Encephalitis or Meningitis. Based on monitoring data among human cases from 2003, it is estimated that there were approximately 7,800 individuals infected with WNV in Boulder County (only 430 reported illnesses) (Harmon 2004).