

West Nile Virus Surveillance Report, 2019: June 22

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1. West Nile virus transmission risk (week ending June 22, 2019)

- *Culex tarsalis* mosquitoes have not yet been detected in Saskatchewan.
- WNV transmission risk is minimal to low, but is expected to rise in July.
- *Culex tarsalis* numbers will increase rapidly with warm weather and precipitation.
- Use appropriate mosquito repellents and cover up with light coloured, loose fitting, long-sleeved tops and long pants when outdoors.

The risk of acquiring West Nile virus (WNV) infection in humans depends on various factors including time of year, number and location of infected *Culex tarsalis* mosquitoes, and number of days with sufficient heat. *Culex tarsalis* is a common summer mosquito throughout the agricultural portions of Saskatchewan, and is abundant in the southern areas of the province where it is hotter and drier. It is rarely found in the northern forested areas.

The risk of WNV transmission is low in the spring but often rises through the early and midsummer period, reaching a peak during the latter part of July and August. Infected, overwintered *Culex tarsalis* females may pose a small risk of transmission in spring.

The WNV risk levels may vary from minimal, when *Culex tarsalis* mosquitoes are rare and the weather has not been conducive for virus to cycle in mosquitoes and birds, to high when there are high numbers of infected mosquitoes and the weather and habitat conditions have been optimal for mosquito development, biting activity and transmission of the virus to humans.

Risk levels are determined in Saskatchewan through mosquito surveillance indicators such as *Culex tarsalis* numbers and infection rates, degree day or heat accumulation and other relevant weather factors such as precipitation.

The level of risk in mosquitoes is determined by using infection rates in mosquitoes (expressed as the number of infected mosquitoes/1000) and risk index calculated as: the infection rate X the average *Culex tarsalis* per trap night/1000).

Other relevant factors that help determine risk to humans include: time of year, the status of mosquito larval populations, past and predicted weather patterns, adult mosquito population age and trend, proximity to populated areas and other indicators such as positive birds or horses.

West Nile Virus Risk

Minimal - The mosquito species that carries WNV has not been detected. This does not mean risk is zero.

Low - The mosquito species that carries WNV has been detected in small numbers. There is a low probability of being bitten by an infected mosquito.

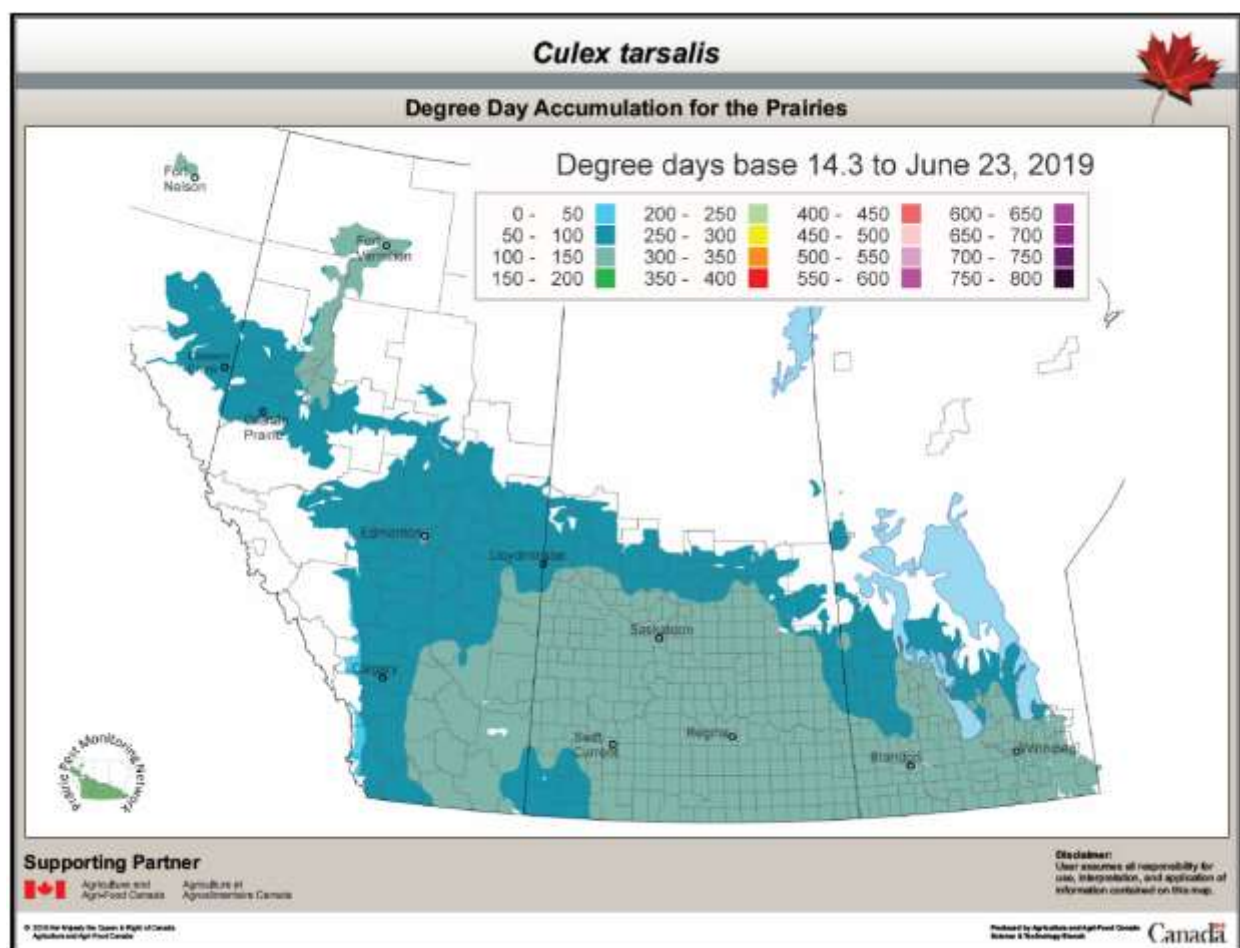
Moderate - WNV mosquitoes have been detected in numbers where there is a moderate probability of being bitten by an infected mosquito.

High - High numbers of WNV positive mosquitoes have been identified and are widespread. There is an increasing and high probability of being bitten by an infected mosquito.

2. Degree day accumulations

- An early spring and warm dry conditions in May resulted in a rapid accumulation of degree day heat units. However, the rate of accumulation slowed with the cooler temperatures that occurred throughout much of the province in early June.
- The highest accumulation of degree days this season has been in Aspen Parkland, Moist-Mixed Grassland, Mixed Grassland and a small portion of the Boreal Transition ecoregions of the province (Figure 1).
- *Culex* activity is generally observed once the 150-200 degree day threshold is met; usually beginning in the southeast of the province.

Figure 1: Degree day accumulations Prairie Provinces (June 23, 2019)



Note: The map covers the agricultural portion of Prairie Provinces. There is more habitat and higher numbers of *Culex tarsalis* in the southern portion of this area. *Culex tarsalis* is rarely found in forested areas. Map courtesy of Agriculture and Agri-food Canada.

Degree day: a measurement of heat accumulation from April 1. The threshold temperature below which WNV development and transmission is unlikely to occur in *Culex tarsalis* mosquitoes is 14.3°C. Degree days are calculated by subtracting the threshold or base temperature from the daily mean temperature. These are then summed to provide the total accumulation for the season.

Example: Mean daily temperature = 19.3°C; threshold temperature = 14.3°C; $19.3 - 14.3 = 5.0$ degree days.

Degree days are used in two ways. First, to predict *Culex tarsalis* development throughout the season by recording the total of accumulated degree days. On average, it takes approximately 250 to 300 degree days

(base 14.3° C) before the second generation of *Culex tarsalis* emerges. Females of this generation are most numerous and are largely responsible for transmission of WNV to humans. A total of 109 degree days are required for virus development to be completed within a particular population and for potential transmission to occur.

The second use of degree days is to determine the WNV transmission risk of infected mosquitoes. The risk of WNV transmission increases with increasing degree day accumulation. Moreover, consistently warmer temperatures will significantly shorten virus development time in the mosquitoes. This increases the potential risk of WNV transmission, if the virus is present and other conditions are favourable.

3. Mosquito surveillance results, 2019

- Total mosquito numbers are below normal in most areas due to the dry, cool weather conditions in May that significantly reduced mosquito habitat. Numbers will rise in areas that have received significant rainfall and those areas that will receive rain in the coming weeks.
- The first generation of *Culex tarsalis* has not yet emerged. With increased warm weather and precipitation the emergence of *Culex tarsalis* is expected within one week, which is consistent with the five-year average.
- Dry conditions and cool nighttime temperatures limit biting and egg-laying activities to a few hours in the evening and early overnight period.

Number of *Culex tarsalis* mosquitoes

Table 1: Average number of *Culex tarsalis* mosquitoes captured by date and ecological risk area, 2019

Surveillance Week ending	(1) Boreal Forest ^{‡§}	(2) Boreal Transition [§]	(3) Moist Mixed-Grass Prairie – Aspen Parkland	(4) Mixed-Grass Prairie
Jun 8	-	-	0	0
Jun 15	-	-	0	0
Jun 22	-	-	0	0
Jun 29	-	-		
Jul 6	-	-		
Jul 13	-	-		
Jul 20				
Jul 27				
Aug 3				
Aug 10				
Aug 17				
Aug 24				
Aug 31				
Sep 7				
Average	-	-	0	0

Notes:

*Averages are determined by dividing the total number of *Culex tarsalis* mosquitoes caught by the total number of trapping nights.

‡ Due to extremely low numbers of *Culex* mosquitoes, trapping is generally not done in the Boreal Forest ecological risk area.

§ Trapping does not begin in the Boreal Forest and Transition ecological risk areas until mid-July.

Number of mosquito pools testing positive

Table 2: Number of WNV positive mosquito pools *, percent positive pools and total number of pools tested by date and ecological risk area, 2019

Week Ending	(1) Boreal Forest ^{‡§}			(2) Boreal Transition [§]			(3) Moist Mixed-grass Prairie-Aspen Parkland			(4) Mixed-grass Prairie			Weekly Totals		
	Positive	Tested	%	Positive	Tested	%	Positive	Tested	%	Positive	Tested	%	Positive	Tested	%
Jun 8	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
Jun 15	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
Jun 22	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
Jun 29	-	-	-	-	-	-									
Jul 6	-	-	-	-	-	-									
Jul 13	-	-	-	-	-	-									
Jul 20															
Jul 27															
Aug 3															
Aug 10															
Aug 17															
Aug 24															
Aug 31															
Sep 7															
Total	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0

Notes:

* **Mosquito Pool** - Mosquitoes of the same species, collected from the same trap on the same date are pooled together for the purposes of laboratory testing. *Culex* mosquitoes (including *Culex tarsalis*, *Culex restuans* and *Culex territans*) collected from one trap on a given night are placed in pools of 1 - 50 mosquitoes for WNV testing. Other species, most notably *Culiseta inornata*, are occasionally placed in pools and tested as well. When more than 50 mosquitoes are collected from the same trap, multiple pools are tested. A positive pool refers to the detection of WNV in one or more mosquitoes collected from a given trap.

Percent positive pools are calculated as follows:

$$\frac{(\text{Number of positive pools})}{(\text{Total number tested})} \times 100 = \text{Percent positive pools}$$

‡ Due to extremely low numbers of *Culex* mosquitoes, trapping is generally not done in the Boreal Forest ecological risk area.

§ Trapping does not begin in the Boreal Forest and Transition risk areas until mid-July.

4. West Nile virus animal cases, 2019

Infections in animals such as horses are seasonal and often occur later in the season. The virus is well established in mosquito vectors in Saskatchewan. As WNV infections in horses lag behind infections in mosquitoes, mosquito surveillance provides more timely information about the risk to the general public. Infections in horses can provide an indication that infections in humans may be occurring as well.

Table 3: Number of WNV positive horses by date and ecological risk area, June 2 2019 to the week ending June 22 2019

Week ending	(1) Boreal Forest	(2) Boreal Transition	(3) Moist Mixed-Grass Prairie-Aspen Parkland	(4) Mixed-Grass Prairie	Weekly totals
Jun 8	0	0	0	0	0
Jun 15	0	0	0	0	0
Jun 22	0	0	0	0	0
Jun 29					
Jul 6					
Jul 13					
Jul 20					
Jul 27					
Aug 3					
Aug 10					
Aug 17					
Aug 24					
Aug 31					
Sep 7					
Total	0	0	0	0	0

5. West Nile virus human cases, 2019 and 2003–2018

As with horses, human infections are seasonal and are often not detected until later in the season. Mosquito surveillance and other environmental risk indicators provide a more timely indication of risk.

Table 4: WNV surveillance in humans, June 2 2019 to the week ending June 22 2019

Number of WNV Positive Lab Tests*	WNV Neuroinvasive Disease †	WNV Deaths
0	0	0

Notes:

* Includes tests done by the Roy Romanow Provincial Laboratory and Canadian Blood Services. Personal information including clinical symptoms and exposure histories is not available. There may be multiple positive

tests for one person. A positive laboratory test does not necessarily indicate a current WNV infection - it may show a WNV infection from the previous year or a cross-reaction with other viruses. As WNV infection may be transmitted through blood products, Canadian Blood Services screens all blood donations.

† The most useful indicator for the burden of disease in the general population is WNV neuroinvasive disease. For every case of WNV neuroinvasive disease there are approximately 150 WNV infections in humans. The vast majority of people with WNV infections do not seek medical care.

Table 5: Saskatchewan Human WNV neuroinvasive cases 2003–2018*

Year	Neuroinvasive Cases	Deaths
2003	63	7
2004	0	0
2005	6	3
2006	3	0
2007	76	6
2008	1	0
2009	0	0
2010	0	0
2011	0	0
2012	0	0
2013	7	1
2014	1	0
2015	0	0
2016	0	0
2017	1	0
2018	3	1
Total	161	18

Note:

*Deaths are included in WNV Neuroinvasive disease case numbers except for 2003 when two deaths occurred in people with non-neuroinvasive West Nile Fever.