West Nile Virus Surveillance Report, 2017: August 19

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1. West Nile virus transmission risk (week ending August 19, 2017)

- *Culex tarsalis* mosquito numbers have likely peaked in south and central Saskatchewan.
- Infected West Nile virus positive mosquitoes remain in the environment; positive mosquitoes were found again this past week.
- West Nile virus transmission risk remains moderate in the southern mixed grass ecological risk area (zone 4) and low in the more northerly boreal transition and moist mixed grass ecological risk areas (zones 2 and 3). Conditions remain optimal for the transmission of WNV to people.
- *Culex tarsalis* mosquitoes are most active on warm evenings and between dusk and dawn. People are advised to take precautions (i.e. using mosquito repellents, limiting time outside during peak times of mosquito activity) to reduce their risk of exposure to mosquito bites and West Nile virus.

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.

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.

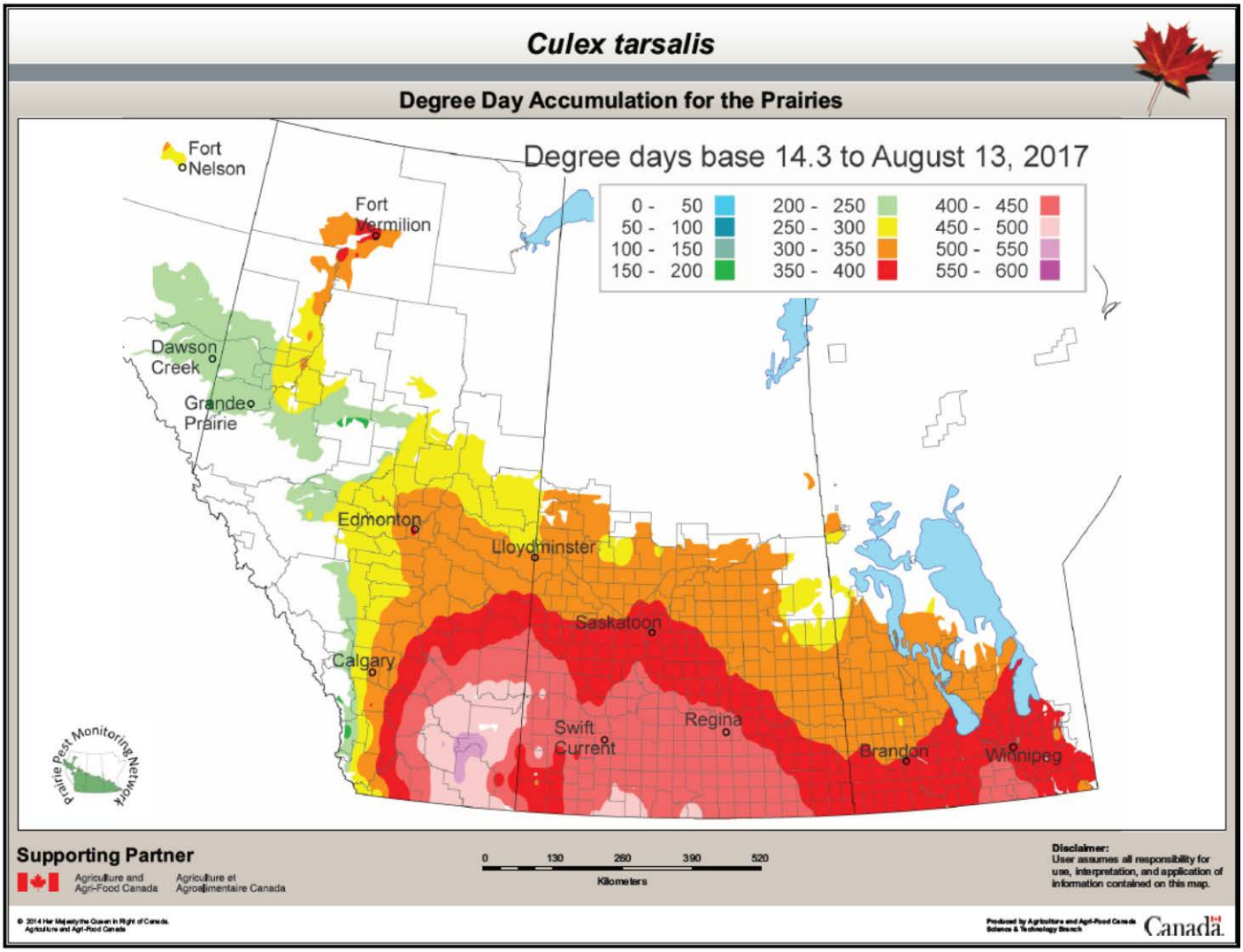
Moderate – WNV positive mosquitoes have been detected in numbers where there is a moderate probability of being bitten by an infected mosquito.

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

- Degree-day accumulations have been slowing with the cooler night-time temperatures in central and eastern areas but remain high in southern and western Saskatchewan. However, conditions remain optimal for *Culex tarsalis* biting activity and virus transmission in all areas, except for the boreal forest ecological risk area.
- Degree-day accumulations are most advanced in south central Saskatchewan with over 400 degree-days accumulated in this area (Figure 1).

Figure 1: Degree day accumulations Prairie Provinces (August 13, 2017)



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, during the season a running total of accumulated degree-days is recorded. 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 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 favorable.

3. Mosquito surveillance results, 2017

- Numbers of *Culex tarsalis* have likely peaked in southern and central Saskatchewan and an increasing number of newly-emerged females will enter diapause, or hibernation. However, this species still represents a high proportion of the total mosquito population (Table 1). *Culex tarsalis* will actively bite on warmer evenings and throughout the night. It is most active when evening and night-time temperatures are greater than 15° C. It is important to note that *Culex tarsalis* will become active earlier in the evening now that dusk is occurring earlier at this time of year.
- Total mosquito numbers are low in southwestern Saskatchewan and are beginning to decline in those areas that received higher amounts of rainfall in July and early August.

Number of *Culex tarsalis* mosquitoes

Table 1: Average number of *Culex tarsalis* mosquitoes captured by date and ecological risk area, 2017

Surveillance Week ending	**(1) Boreal Forest** (Mamawetan Churchill River, Keewatin Yatthé Health Regions) ₸	**(2) Boreal Transition** (Prince Albert Parkland, Kelsey Trail Health Regions) §	**(3) Moist Mixed-Grass Prairie (**Sunrise, Saskatoon, Prairie North Health Regions)	**(4) Mixed-Grass Prairie** (Sun Country, Regina Qu'Appelle, Five Hills, Cypress, Heartland Health Regions)
Jun 10	-	-	0	1.38
Jun 17	-	-	0	3.77
Jun 24	-	-	0.08	0.75
Jul 1	-	-	0.15	0.79
Jul 8	-	-	0.1	4.98
Jul 15	-	1.0	0.31	8.15
Jul 22	-	0.25	0.65	4.98
Jul 29	-	0.67	1.16	7.69
Aug 5	-	1.5	6.4	16.34
Aug 12	-	0.8	3.63	7.17
Aug 19				
Aug 26				
Sep 2				
Average *	-	0.42	1.25	5.64

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 Transition ecological risk area until mid- July.

Number of mosquito pools testing positive

Table 2: Number of WNV positive *Culex tarsalis* mosquito pools *, percent positive pools and total number of pools tested by date and ecological risk area, 2017 ₮

Week Ending	(2) Boreal Transition §			(3) Moist Mixed-grass Prairie			(4) Mixed-grass Prairie			Weekly Totals		
	Positive	Tested	Percentage	Positive	Tested	Percentage	Positive	Tested	Percentage	Positive	Tested	Percentage
Jun 10	-	-	-	0	0	0	0	6	0	0	6	0
Jun 17	-	-	-	0	0	0	0	20	0	0	20	0
Jun 24	-	-	-	0	1	0	0	10	0	0	11	0
Jul 1	-	-	-	0	1	0	0	17	0	0	18	0
Jul 8	-	-	-	0	1	0	0	24	0	0	25	0
Jul 15	0	2	0	0	2	0	1	27	3.8	1	31	3.3
Jul 22	0	1	0	0	7	0	0	30	0	0	38	0
Jul 29	0	4	0	0	8	0	1	34	2.9	1	46	2.2
Aug 5	0	5	0	0	13	0	4	43	9.3	4	61	6.6
Aug 12	0	3	0	0	11	0	2	36	5.6	2	50	4.0
Aug 19												
Aug 26												
Sep 2												
Total	**0**	**15**	**0**	**0**	**44**	**0**	**8**	**247**	**3.2**	**8**	**306**	**2.6**

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 species specific pools of up to 50 mosquitoes for WNV testing. Other non-*Culex* species, most notably *Culiseta inornata*, are occasionally placed in pools and tested as well. When more than 50 mosquitoes of the same species are collected from the same trap, additional pools are created for testing. 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 Transition risk area until mid- July.

4. West Nile virus animal cases, 2017

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 West Nile virus positive horses by date and ecological risk area, 2017

Week ending	(1) Boreal Forest	(2) Boreal Transition	(3) Moist Mixed-Grass Prairie	(4) Mixed-Grass Prairie	Weekly totals
Jun 10	0	0	0	0	0
Jun 17	0	0	0	0	0
Jun 24	0	0	0	0	0
Jul 1	0	0	0	0	0
Jul 8	0	0	0	0	0
Jul 15	0	0	0	0	0
Jul 22	0	0	0	0	0
Jul 29	0	0	0	0	0
Aug 5	0	0	0	0	0
Aug 12	0	0	0	0	0
Aug 19					
Aug 26					
Sep 2					
Sep 9					
Total	**0**	**0**	**0**	**0**	**0**

5. West Nile virus human cases, 2017 and 2003-2016

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: West Nile virus surveillance in humans, 2017 (as of week ending August 12, 2017)

Number of WNV Positive Lab Tests*	WNV Neuroinvasive Disease ₸	WNV Deaths
2	0	0

Notes:

* Includes tests done by Saskatchewan Disease Control 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. Includes tests detected through screening of blood donors.

₸ 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 West Nile virus neuroinvasive cases 2003-2016*

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
Total	**157**	**17**

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.