

West Nile Virus Surveillance Report, 2022: September 03

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1. West Nile virus transmission risk (week ending September 03, 2022)

- *Culex* spp. mosquitoes are starting to decline in surveyed communities. As of September 3rd, 2022, all mosquito pools have tested negative for West Nile virus.
- A WNV positive human lab test result (reported last week) indicates that transmission has occurred this season.
- With above normal temperatures forecasted for September, residents are encouraged to continue to take precautions. Possible transmission of WNV may occur until there is a widespread hard frost (i.e. two hours with temperatures below minus 2°C).
- To avoid mosquito bites, use mosquito repellents, cover up, and limit time outside during peak times of mosquito activity (between dusk and dawn).

The risk of West Nile virus (WNV) infection in humans depends on various factors including time of year, number and location of infected *Culex tarsalis*, *Culex restuans*, and *Culex territans* mosquitoes, and number of days with sufficient heat. In Saskatchewan, *Culex tarsalis* is the main transmitter of WNV to humans. It is abundant in the southern areas of the province where it is hotter and drier. *Culex tarsalis* 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* spp. mosquitoes are rare and the weather has not been conducive for virus cycling in mosquitoes and birds, to high when there are high numbers of WNV-infected mosquitoes and the weather and habitat conditions have been optimal for mosquito population growth, biting activity and transmission of the virus to humans.

Risk levels are determined in Saskatchewan through mosquito surveillance indicators such as *Culex* spp. 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 follows: the infection rate X the average *Culex* spp. 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 types of mosquitoes that carry WNV have not been detected in the surveyed communities (Regina, Estevan, and Saskatoon). The accumulated degree day threshold required to observe *Culex* spp. activity (150-200 degree days) has not been met. This does not mean the risk is zero.

Low - The types of mosquitoes that carry WNV have been detected in small numbers but all mosquito pools are negative. The threshold of 150-200 degree days has been met. There is a low probability of being bitten by an infected mosquito.

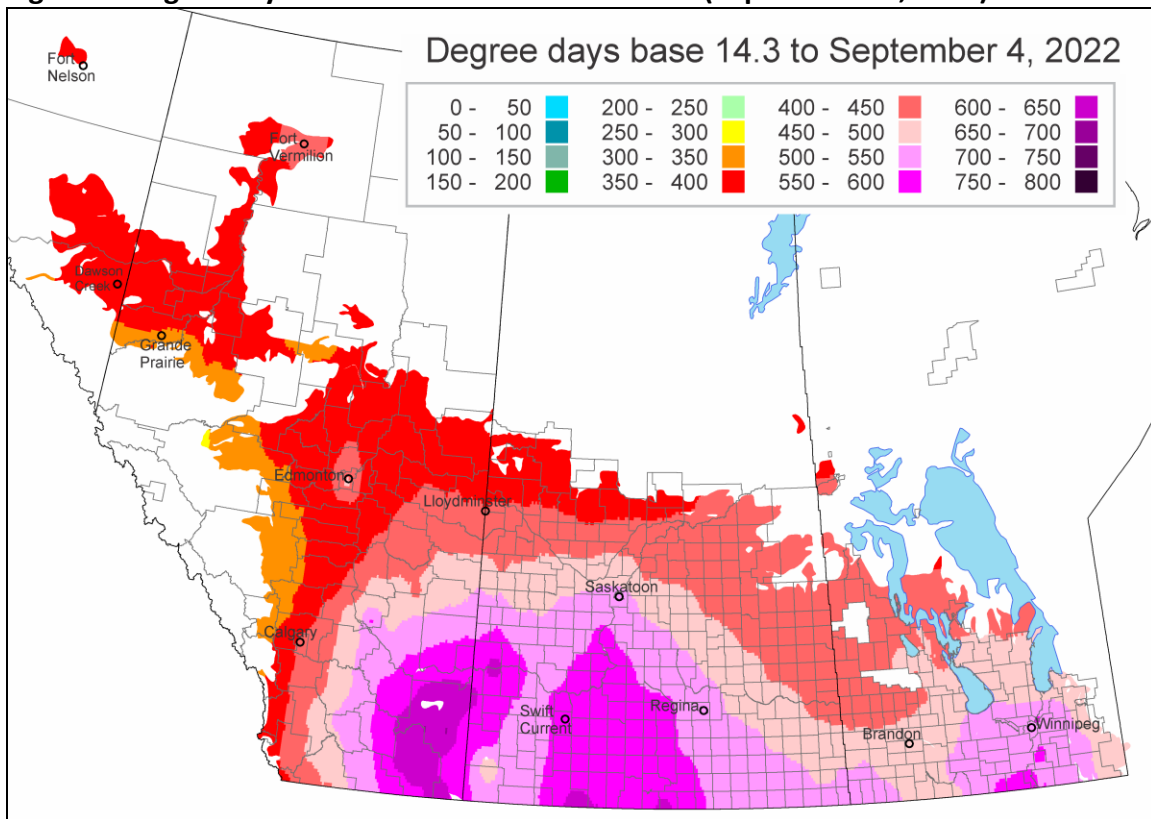
Moderate - WNV positive mosquitoes have been detected in numbers where there is a moderate probability of being bitten by an infected mosquito. 250 to 300 degree days have been accumulated which will support the emergence of the second generation of *Culex* spp. mosquitoes.

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. There is increased *Culex* spp. activity and virus transmission is high.

2. Degree day accumulation

- With record heat waves reported in parts of Saskatchewan over the past week, degree day accumulation is progressing rapidly with southern, central, and western regions of the province accumulating 550-600 degree days. The highest accumulation of degree days this week is 600-650 in localized southern and southwestern areas of the province (Figure 1).
- Daytime temperatures are projected to be above-average as September starts. Warm evenings and nights where the temperatures stay above 15°C are also anticipated.
- *Culex tarsalis* mosquitoes will remain active and biting into early September.

Figure 1: Degree day accumulation Prairie Provinces (September 04, 2022)



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 each day. 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, 2022

- *Culex* spp. mosquitoes have started to decline in surveyed communities. Numbers will continue to decrease over the coming weeks as newly emerged females enter diapause (hibernation). Older females will continue to actively bite on warm afternoons and evenings at temperatures greater than 15°C.
- WNV-infected *Culex* spp. mosquitoes have not been detected this season; however they may be present in small numbers.
- With above normal temperatures forecasted for fall, *Culex tarsalis* mosquitoes will remain active and biting into early September.
- Nuisance mosquito species have sharply declined in all surveyed communities.

Number of *Culex tarsalis* mosquitoes

Table 1: Average number of *Culex tarsalis* mosquitoes captured by date and community, 2022

Surveillance Week ending	Estevan	Regina	Saskatoon
Jun 18	0	0	0
Jun 25	0	0	0
Jul 02	0.1	0.1	0
Jul 09	0.3	0.1	0.1
Jul 16	0.7	0.4	0
Jul 23	1.0	0.7	1.0
Jul 30	4.5	0.8	2.3
Aug 06	6.3	3.7	0.8
Aug 13	7.4	4.8	1.1
Aug 20	11.3	10.4	0.8
Aug 27	4.7	3.8	0.5
Sep 03	4.7	0.2	0
Sep 10			
Average*	3.4	2.1	0.5

Notes:

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

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 community, 2022

Week Ending	Estevan			Regina			Saskatoon			Weekly Totals		
	Positive	Tested	%	Positive	Tested	%	Positive	Tested	%	Positive	Tested	%
Jun 18	0	0	0	0	0	0	0	0	0	0	0	0
Jun 25	0	0	0	0	0	0	0	0	0	0	0	0
Jul 02	0	1	0	0	1	0	0	0	0	0	2	0
Jul 09	0	3	0	0	1	0	0	1	0	0	5	0
Jul 16	0	7	0	0	4	0	0	0	0	0	11	0
Jul 23	0	8	0	0	7	0	0	9	0	0	24	0
Jul 30	0	19	0	0	5	0	0	13	0	0	37	0
Aug 06	0	20	0	0	20	0	0	3	0	0	43	0
Aug 13	0	21	0	0	15	0	0	9	0	0	45	0
Aug 20	0	25	0	0	27	0	0	8	0	0	60	0
Aug 27	0	17	0	0	17	0	0	4	0	0	38	0
Sep 03	0	18	0	0	2	0	0	0	0	0	20	0
Sep 10												
Total	0	139	0	0	99	0	0	47	0	0	285	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:

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

4. West Nile virus animal cases, 2022

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 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 community or rural municipality, August 28, 2022 to the week ending September 03, 2022

Week ending	Number of cases	Community or Rural Municipality
Jun 18	0	-
Jun 25	0	-
Jul 02	0	-
Jul 09	0	-
Jul 16	0	-
Jul 23	0	-
Jul 30	0	-
Aug 06	0	-
Aug 13	0	-
Aug 20	0	-
Aug 27	0	-
Sep 03	0	-
Sep 10		
Total	0	-

5. West Nile virus human cases, 2022 and 2003–2021

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, August 28, 2022 to the week ending September 03, 2022

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

Notes:

*These include tests done by the Roy Romanow Provincial Laboratory (RRPL) and Canadian Blood Services (CBS).

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 2003–2021*

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	1
2018	3	1
2019	0	0
2020	0	0
2021	1	0
Total	162	19

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.