

West Nile Virus Surveillance Report, 2021: September 11 (Final Report)

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1. West Nile virus transmission risk (week ending September 11, 2021)

- *Culex* spp. mosquitoes have not been found in traps for the past two weeks. WNV transmission risk is minimal, but not zero.
- *Culex* spp. mosquito pools tested in the past three weeks have been negative for WNV. In early and mid-August, WNV positive mosquitoes were detected in the moist mixed-grass prairie/aspen parkland ecological risk area.
- Possible transmission of WNV may occur until there is a widespread hard frost (i.e. two hours with temperatures below minus 2°C).
- At this time of year, mosquitoes are most active on warm afternoons and evenings, and at dusk. As days grow shorter, dusk occurs earlier. To avoid being bitten, use mosquito repellents and cover up if your activities take you into areas where mosquitoes may be present.

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 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 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.

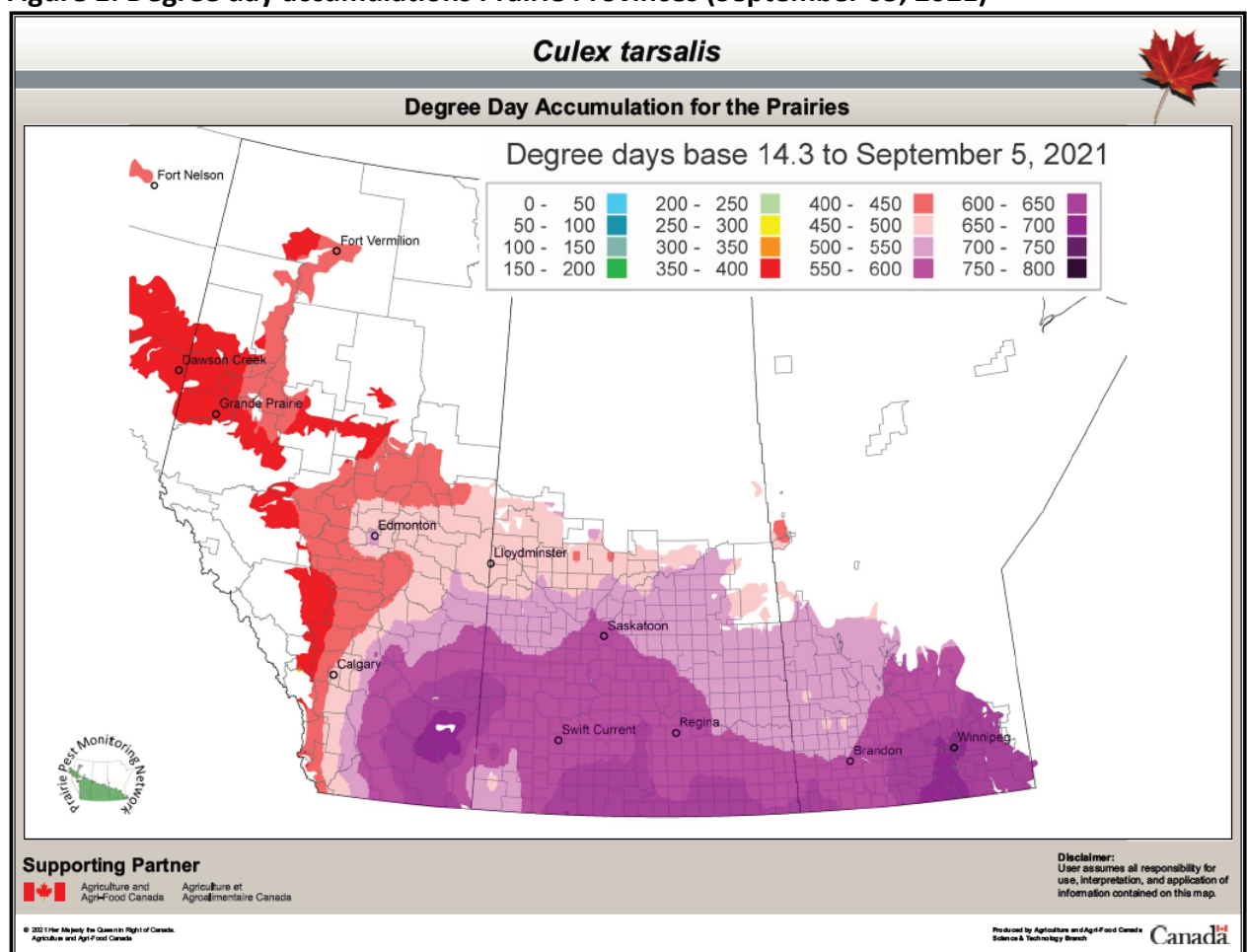
Moderate - WNV positive mosquitoes have been detected in numbers where there is a moderate probability of being bitten by an infected mosquito.

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 accumulation

- Information on degree day accumulation is not available for the week ending on September 11, 2021. Data from the week prior is included below.
- The rate of degree day accumulation is progressing slowly throughout southern and central Saskatchewan.
- Degree day accumulations are greatest in parts of southern and central Saskatchewan with over 600 degree days accumulated (Figure 1).
- As autumn approaches, temperatures are expected to decline. Cooler nighttime temperatures will limit *Culex tarsalis* biting activity and virus transmission to late afternoon and early evening hours.

Figure 1: Degree day accumulations Prairie Provinces (September 05, 2021)



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, 2021

- *Culex tarsalis* mosquitoes have not been detected in traps for the past two weeks. Any newly emerged females will enter diapause (hibernation), but older females may still be present in southern areas of the province.
- A reduced level of risk exists as the weather changes to fall temperatures; however, *Culex tarsalis* remain present and active on warm days when temperatures are greater than 15°C. *Culex tarsalis* mosquitoes will bite earlier in the evening at this time of year.
- There is a small risk of other species such as *Culiseta inornata* becoming infected with WNV at this time. *Culiseta inornata* can be active at temperatures greater than 10°C. However, 24 mosquito pools of *Culiseta inornata*, collected this season, have tested negative for WNV (data not included in tables below).
- Nuisance mosquitoes have increased slightly in areas of the province that received rainfall over the past few weeks.

Number of *Culex tarsalis* mosquitoes

Table 1: Average number of *Culex tarsalis* mosquitoes captured by date and ecological risk area, 2021

Surveillance Week ending	(1) Boreal Forest [‡]	(2) Boreal Transition [§]	(3) Moist Mixed-Grass Prairie – Aspen Parkland	(4) Mixed-Grass Prairie
Jun 12	-	-	0	0
Jun 19	-	-	0	0
Jun 26	-	-	0.03	0
Jul 03	-	-	0.08	0
Jul 10	-	-	0.50	0.23
Jul 17	-	-	1.92	0.23
Jul 24	-	0	1.80	0.68
Jul 31	-	0	1.83	0.95
Aug 07	-	3.00	3.38	0.89
Aug 14	-	0	4.26	1.59
Aug 21	-	0	3.71	0.82
Aug 28	-	0	0.16	0.09
Sep 04	-	0	0	0
Sep 11	-	0	0	0
Average*	-	0.38	1.26	0.39

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* spp. mosquitoes this season, the Boreal Forest ecological risk areas will not be surveyed in 2021.

[§] In 2021, trapping in the Boreal Transition ecological risk areas started in 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, 2021

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 12	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
Jun 19	-	-	-	-	-	-	0	0	0	0	0	0	0	0	0
Jun 26	-	-	-	-	-	-	0	1	0	0	0	0	0	1	0
Jul 03	-	-	-	-	-	-	0	3	0	0	0	0	0	3	0
Jul 10	-	-	-	-	-	-	0	19	0	0	4	0	0	23	0
Jul 17	-	-	-	-	-	-	0	35	0	0	2	0	0	37	0
Jul 24	-	-	-	0	0	0	0	29	0	0	15 [€]	0	0	44 [€]	0
Jul 31	-	-	-	0	0	0	0	52 [‡]	0	0	10	0	0	62 [‡]	0
Aug 07	-	-	-	0	4	0	4	42	9.5	0	14 [€]	0	4	60 [€]	6.7
Aug 14	-	-	-	0	0	0	2	45	4.4	0	14	0	2	59	3.4
Aug 21	-	-	-	0	0	0	3	53 [€]	5.7	0	12	0	3	65 [€]	4.6
Aug 28	-	-	-	0	0	0	0	4	0	0	2	0	0	6	0
Sep 04	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0
Sep 11	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0
Total	-	-	-	0	4	0	9	283	3.2	0	73	0	9	360	2.5

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* spp. mosquitoes this season, the Boreal Forest ecological risk areas will not be surveyed in 2021.

§ In 2021, trapping in the Boreal Transition ecological risk areas started in mid-July.

€ 3 mosquito pools tested this week were trapped the week prior (July 17, 2021)

‡ 14 mosquito pools tested this week were trapped the week prior (July 24, 2021)

£ 4 mosquito pools tested in these weeks were trapped the week prior.

4. West Nile virus animal cases, 2021

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 ecological risk area, June 06 2021 to the week ending September 11 2021

Week ending	(1) Boreal Forest	(2) Boreal Transition	(3) Moist Mixed-Grass Prairie-Aspen Parkland	(4) Mixed-Grass Prairie	Weekly totals
Jun 12	0	0	0	0	0
Jun 19	0	0	0	0	0
Jun 26	0	0	0	0	0
Jul 03	0	0	0	0	0
Jul 10	0	0	0	0	0
Jul 17	0	0	0	0	0
Jul 24	0	0	0	0	0
Jul 31	0	0	0	0	0
Aug 07	0	0	1*	0	1
Aug 14	0	0	1	0	1
Aug 21	0	0	0	0	0
Aug 28	0	0	3**	0	3
Sep 04	0	0	0	0	0
Sep 11	0	0	0	0	0
Total	0	0	5	0	5

*Possibly acquired outside the province.

**1 case had recent history of travel outside the province.

5. West Nile virus human cases, 2021 and 2003–2020

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 06 2021 to the week ending September 11 2021

Number of WNV Positive Lab Tests*	WNV Neuroinvasive Disease ‡	WNV Deaths
1	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 2003–2020*

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
Total	161	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.