

West Nile Virus Surveillance Report, 2024: September 14 (Final Report)

Table of Contents

1. West Nile virus transmission risk	page 2
2. Degree-day accumulations	page 3
3. Mosquito surveillance results	page 5
4. West Nile virus animal cases	page 7
5. West Nile virus human cases	page 8

1. West Nile virus transmission risk (week ending Sept. 14 2024)

- *Culex* spp. mosquitoes have declined to low levels. While mosquitoes infected with West Nile virus (WNV) have not been detected in surveyed communities for the past two weeks, they may be present in small numbers.
- In total, three human WNV neuroinvasive disease cases and five WNV-positive human laboratory test results were detected this season.
- As of September 14th, 7 WNV-positive horses and 64 WNV-positive birds* have been detected. Compared to mosquito surveillance, bird surveillance results are less reliable indicators of spatial and temporal risk for human infection.
- Possible transmission of WNV may occur until there is a widespread hard frost (i.e. two hours with temperatures below -2°C). To avoid being bitten, use mosquito repellents and cover up during peak times of mosquito activity.

The risk of West Nile virus (WNV) infection in humans depends on various factors including time of year, number and location of infected mosquito vectors (*Culex tarsalis*, *Culex restuans*/*Culex pipiens*¹, and *Culex territans*), 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.

¹A small number of *Culex pipiens* mosquitoes were detected in 2023 through the provincial mosquito surveillance program. *Cx. pipiens* are competent vectors of WNV. *Cx. pipiens* and *Cx. restuans* are morphologically similar; genetic analysis is required for species confirmation.

*Information provided by the Western and Northern Region of the Canadian Wildlife Health Cooperative, Western College of Veterinary Medicine.

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. 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.

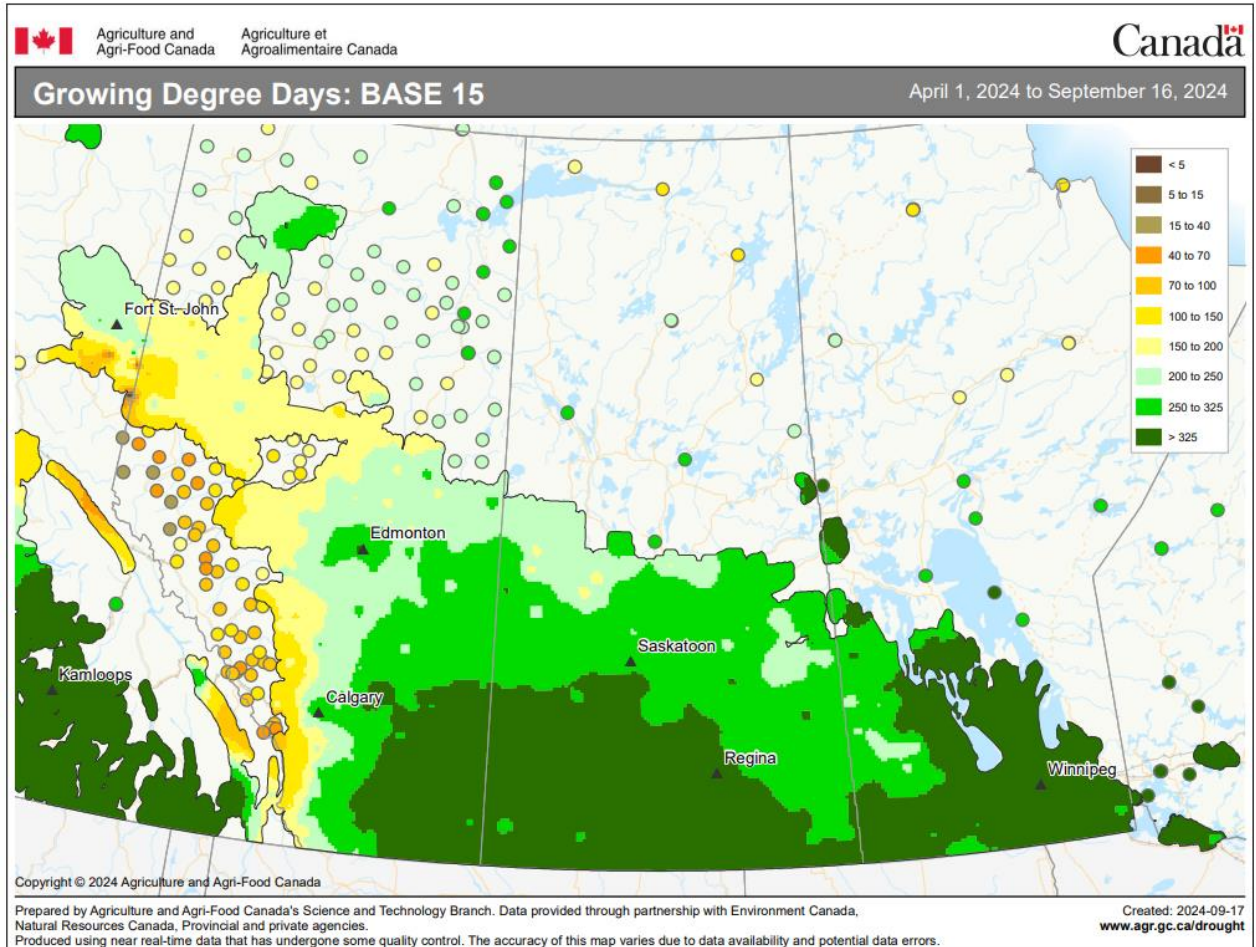
Moderate - WNV positive mosquitoes have been detected in numbers where there is a moderate probability of being bitten by an infected mosquito. 250 to 300 degree days have been accumulated which will support the emergence of the second generation of *Culex* spp. mosquitoes.

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

- The rate of degree day accumulation in Saskatchewan was minimally increased compared to last week as temperatures have cooled (Figure 1).
- Cool nighttime temperatures will limit *Culex tarsalis* biting activity and virus transmission to late afternoon and early evening hours. If temperatures are greater than 15°C, mosquito biting will resume.

Figure 1: Growing degree days for the prairie provinces, Base 15°C (September 16, 2024)²



Note: There is more habitat and higher numbers of *Culex tarsalis* in the southern portion of Saskatchewan. *Culex tarsalis* is rarely found in forested areas.

Map courtesy of Agriculture and Agri-food Canada.

² This map is not specific to *Culex tarsalis*. The accumulated degree days in the map are calculated using base 15°C instead of 14.3°C, resulting in an underestimate of the degree days needed for *Culex tarsalis* development and WNV transmission.

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 the second 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, 2024

- *Culex* spp. mosquitoes have declined in traps as newly emerged female mosquitoes enter diapause (hibernation). However, infected older female mosquitoes may still be present throughout southern areas of the province.
- While WNV-infected mosquitoes were not detected in traps this week, they be present in small numbers.
- A reduced level of risk exists as the weather changes to fall temperatures; however, *Culex tarsalis* will remain active when temperatures are greater than 15°C. *Culex tarsalis* 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.

Number of *Culex* spp. mosquitoes

Table 1: Average* number of *Culex* spp. mosquitoes captured by ecological risk area, community, and date, 2024.

Week ending	(1) Boreal Forest ³	(2) Boreal Transition ³	(3) Moist Mixed Grassland/Aspen Parkland							(4) Mixed Grassland		
			Estevan	Moosomin	Regina	Saskatoon	Rosetown	Weyburn	Yorkton	Assiniboia	Moose Jaw	Swift Current
June 22			0	0	0	0	0	0	0	0	0	0
June 29			0.3	0	0	5.2	0	0	0	0	0	0
July 06			0.7	0	0	0.2	0	0	1.5	0	0.3	0
July 13			3.7	0	0.7	4.1	0	0.5	1.3	0	1.7	0.5
July 20			21.2	3.5	0.8	4.3	8	0	1.5	0	0.3	0.5
July 27			19.3	7	6.4	9.6	0	2.5	3.8	0	3.7	1
Aug 03			22.3	12.5	13	8.1	20.5	0	7.3	1	0.8	0
Aug 10			17.2	16.5	12.1	9.2	38.5	4	0	1.5	0.2	7
Aug 17			6.7	0.5	7.1	8.3	65.5	3.0	5.8	0	2.2	5.3
Aug 24			1.5	6.0	4.7	6.3	28.0	6.0	4.0	8.5	2.8	6.8
Aug 31			-	0	2.0	1.2	2.5	2.0	0	0	1.2	3.8
Sept 07			3.5	0	0.4	1.4	0	-	0	0	1.5	0.5
Sept 14			0.3	1.0	0.3	-	0	1.5	0.8	0	0	0
Average			8.1	3.6	3.9	5.0	12.5	1.6	2.1	0.9	1.1	1.9

Notes:

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

³*Culex* spp. activity is rare in the Boreal Forest and Boreal Transition ecological risk areas. Mosquito surveillance is currently not conducted in these ecoregions; however, if *Culex* spp. activity significantly increases this summer, mosquito traps may be operated in these areas.

- Surveillance data not available.

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, 2024.

Week Ending	(1) Boreal Forest ³	(2) Boreal Transition ³	(3) Moist Mixed Grassland/Aspen Parkland			(4) Mixed Grassland			Weekly Totals		
			Positive	Tested	%	Positive	Tested	%	Positive	Tested	%
June 22			0	0	0	0	0	0	0	0	0
June 29			0	16	0	0	0	0	0	16	0
July 06			0	10	0	0	2	0	0	12	0
July 13			0	40	0	0	7	0	0	47	0
July 20			0	71	0	0	4	0	0	75	0
July 27			0	97	0	0	9	0	0	106	0
Aug 03			0	92	0	0	7	0	0	99	0
Aug 10			0	74	0	0	13	0	0	87	0
Aug 17			1	69	1.4	0	11	0	1	80	1.3
Aug 24			1	64	1.6	1	17	5.9	2	81	2.5
Aug 31			1	22	4.5	0	13	0	1	35	2.9
Sept 07			0	15	0	0	10	0	0	25	0
Sept 14			0	11	0	0	0	0	0	11	0
Total			3	581	0.5	1	93	1.1	4	674	0.6

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/Culex pipiens* 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.

³*Culex* spp. activity is rare in the Boreal Forest and Boreal Transition ecological risk areas. Mosquito surveillance is currently not conducted in these ecoregions; however, if *Culex* spp. activity significantly increases this summer, mosquito traps may be operated in these areas.

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, 2024

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 16 2024 to the week ending September 14 2024

Week ending	(1) Boreal Forest	(2) Boreal Transition	(3) Moist Mixed Grassland/Aspen Parkland	(4) Mixed Grassland	Weekly totals
June 22	0	0	0	0	0
June 29	0	0	0	0	0
July 06	0	0	0	0	0
July 13	0	0	0	0	0
July 20	0	0	0	0	0
July 27	0	0	0	0	0
Aug 03	0	0	0	0	0
Aug 10	0	0	0	0	0
Aug 17	0	0	1	0	1
Aug 24	0	0	1	0	1
Aug 31	0	0	3	0	3
Sept 07	0	1	1	0	2
Sept 14	0	0	0	0	0
Total	0	1	6	0	7

5. West Nile virus human cases, 2024 and 2003–2023

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 timelier indication of risk.

Table 4: WNV surveillance in humans, June 16 2024 to the week ending September 14 2024

Number of WNV Positive Lab Tests*	WNV Neuroinvasive Disease † cases	WNV Deaths
5	3	0

Notes:

*These include tests done by the Roy Romanow Provincial Laboratory (RRPL) and Canadian Blood Services (CBS). A positive laboratory test does not necessarily indicate a current WNV infection. There may be multiple positive tests for one person. A positive WNV laboratory test result may be associated with a WNV Neuroinvasive Disease case.

†The most useful indicator for the burden of disease in the general population is WNV neuroinvasive disease cases. 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: Human WNV neuroinvasive cases and deaths in Saskatchewan 2003–2023

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
2022	0	0
2023	3	0
Total	165	19

Note:

*Deaths are included in WNV neuroinvasive case numbers except for 2003 when two deaths occurred in people with non-neuroinvasive West Nile virus. 2023 numbers are preliminary and subject to change.