

Alberta Health

Tick Surveillance

2016 Summary

June 2017

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Introduction

There are many species of ticks native to Alberta, such as moose ticks and Rocky Mountain wood ticks (*Dermacentor* species). These species are not able to transmit the bacteria that can cause Lyme disease (*Borrelia burgdorferi* sensu stricto) in humans¹. *Ixodes* species ticks, especially *Ixodes scapularis* ticks, are capable of carrying and transmitting *B. burgdorferi* to humans². The range of *Ixodes scapularis* ticks has been expanding into Canada in the last few years and they are now considered endemic in southern Manitoba, southern and eastern Ontario, southern Quebec, and in the Maritimes². Alberta has found *Ixodes* species ticks in small numbers in the province, but so far all evidence suggests that they are an adventitious population carried into Alberta by migratory birds or other animals but not capable of surviving over winter and reproducing.

In 2007 Alberta Agriculture and Forestry, in collaboration with veterinarians, Alberta Health, and Alberta Environment and Parks, began a tick surveillance program to examine types of ticks found on companion animals (e.g. pet dogs). In 2013, the Alberta Arthropod-Borne Diseases Committee, a collaboration of Alberta Health, Alberta Agriculture and Forestry, Alberta Health Services, Health Canada First Nations and Inuit Health Branch, and other stakeholders, expanded the surveillance program to accept submissions of ticks found on humans or in the environment. Alberta Agriculture and Forestry conducts the laboratory analysis on submitted ticks* and manages the companion animal program.

The goal of the Enhanced Tick Surveillance Program is to assess the risk of Lyme disease in Alberta. To do this, the program uses both active and passive surveillance. “Passive surveillance” and “active surveillance” are technical terms that describe how the program acquires the samples. In passive surveillance, members of the public collect and submit ticks that they find on themselves, their pets, or in the environment. Active surveillance can use several techniques to find established tick populations in the environment. Targeted drag-sampling in grassy/bushy areas is the most reliable method to sample emerging populations of ticks, and is used to determine the need for more intensive active surveillance techniques (see Figure 8 for more information). Alberta Health, Alberta Agriculture and Forestry and their partners conduct targeted drag sampling yearly, using the results of passive tick surveillance to choose the best locations.

The enhanced passive surveillance system can detect both established and adventitious *Ixodes* tick populations; the active surveillance component helps differentiate between them. Together these surveillance activities help Alberta determine if there is an emergence and establishment of *Ixodes* ticks in Alberta. This will help determine the level and geographical distribution of risk to Albertans if the ticks establish themselves in the province in the years to come. This report outlines the

* Agriculture and Forestry does not analyze clinical samples submitted by physicians. Such samples are sent to the Provincial Laboratory for Public Health

findings from the fourth season (2016) of the Enhanced Tick Surveillance Program, and compares it to previous years.

Key Findings

- Of 2,781 tick submissions, there were 234 *Ixodes*[†] ticks submitted, 182 of which were likely acquired in Alberta.
- There were three peaks for *Ixodes* submissions: the last week in April, mid-October and late November.
- 35 out of 182 (19 per cent) *Ixodes* ticks acquired in Alberta were positive for *B. burgdorferi*, all of which were found on companion animals.
- While *Ixodes* ticks were found in all health zones through passive surveillance, Edmonton Zone had the highest prevalence at 53 per cent. This is similar to previous years.
- Active surveillance in Edmonton Zone did not find any *Ixodes* ticks.

Results

There were 2,873 submissions to the Enhanced Tick Surveillance Program. The majority of submissions continue to occur through the Companion Animal program (n=1,955) (i.e., ticks submitted to vets). Thirty-two per cent of the submissions were from the Human and the Environment Program; this is similar to 2015 but represents an increase from previous years (Table 1). Six *Dermacentor* tick submissions from the Human and the Environment program could not be linked to travel and location data and were excluded from the rest of the analysis.

The majority of submissions to the program occurred in the late spring/early summer (with 208 submissions at the peak in the last week in May). However, *Ixodes* species submissions by Alberta residents who did not travel outside of Alberta were highest in spring and fall/early winter. Forty per cent of *Ixodes* submissions occurred in the spring, peaking in week 17 (April 24-30, 2016). Fifty-seven per cent of tick submissions occurred in the fall/winter with bimodal peaks in weeks 41 (October 9-15, 2016) and 47 (November 20-26, 2016) (Figure 1). The peaks in 2015 were in week 21 (May 24-30, 2015) and week 44 (November 1-7, 2015) (Figure 2).

The majority (97 per cent) of submissions were identified as a species of tick; 86 submissions were of insects, other types of arachnids or were unable to be identified. Of the 2,781 ticks submitted, 1,100 (40 per cent) were from visitors to Alberta or Alberta residents who travelled outside of Alberta and likely acquired the tick there, and 1,681 (60 per cent) were from Alberta residents who either did not travel or only travelled within Alberta (Table 2). Eight per cent of tick submissions were *Ixodes* ticks; 182 were acquired inside of Alberta, and 52 were likely acquired outside of Alberta. Of those 182 *Ixodes* ticks acquired inside Alberta, 35 were *Ixodes* ticks positive for *B. burgdorferi*. All of the *Ixodes* ticks submitted to the program were adults, with the exception of one where the lifecycle stage was not able to be classified.

[†] *Ixodes* species excluding *Ixodes kingi* and *Ixodes ochtonae*. *I. kingi* and *I. ochtonae* are not considered vectors for *Borrelia burgdorferi*.

To determine the geographic distribution of ticks, a sub-analysis was performed where ticks submitted by visitors to Alberta and by residents who had travelled in the previous two weeks were excluded. One hundred and thirty one *Ixodes* ticks were submitted by Alberta residents who had not travelled. While *Ixodes* ticks were found in all zones, the majority (n=70, 53 per cent) of *Ixodes* ticks were found in Edmonton Zone (Table 3). This is similar to the findings in 2015, 2014 and 2013 (Tables 4 - 6). *B. burgdorferi* positive ticks submitted in 2016 by non-travellers were found in all zones.

Residential postal codes of the humans and animals that submitted *Ixodes* ticks and had not travelled in the past two weeks were mapped to show the geographic distribution (Figures 3 and 4). In hosts that had not travelled or had travelled within Alberta, information regarding the outdoor locations they had visited in the previous two weeks was collected. This information was also plotted on a map (Figures 5 and 6). Potential sites for active surveillance were identified based on visual clustering of residential postal codes and outdoor locations in proximity to an area that could be considered suitable habitat for ticks (i.e. a natural area with mixed forest and grasslands).

Active Surveillance

Based on the passive tick surveillance results from 2015 and early 2016, five sites in Edmonton Zone with suitable tick habitat were selected for targeted drag sampling in a limited geographic area. Drag sampling was performed on two days in April and July of 2016. Teams conducted drag sampling and visually inspected themselves and the drag for ticks at regular intervals (Figure 7). No ticks were found.

Conclusion

While the number of tick submissions continues to rise in Alberta, the number and proportion of *Ixodes* ticks submitted continues to be low. Active surveillance activities have not found *Ixodes* ticks. These results indicate it is likely that the *Ixodes* ticks found in Alberta are adventitious, arriving via migratory birds, and have not yet established a reproducing population capable of overwintering in Alberta. Thus the risk of acquiring Lyme disease in Alberta is very low. Ongoing active and passive surveillance through the enhanced tick surveillance program will help the program identify if a population of *Ixodes* ticks does become established in Alberta.

Acknowledgments

The Enhanced Tick Surveillance Program is a collaborative effort between Alberta Health, Alberta Agriculture and Forestry, Alberta Health Services, Provincial Laboratory of Alberta, and the Alberta Arthropod-Borne Diseases Committee (AABDC). We would also like to acknowledge the City of Edmonton for their invaluable assistance in performing active tick surveillance and the veterinary clinics for their participation and support.

Table 1: Submissions by program and year

	2016		2015		2014		2013	
	N	%	N	%	N	%	N	%
Human and the Environment Program	918	32%	574	31%	405	25%	219	23%
Companion Animal Program	1,955	68%	1,298	69%	1,027	75%	753	77%
Total	2,873		1,872		1,432		972	

Figure 1: 2016 Tick submissions by hosts who had not travelled outside of Alberta, by week and species

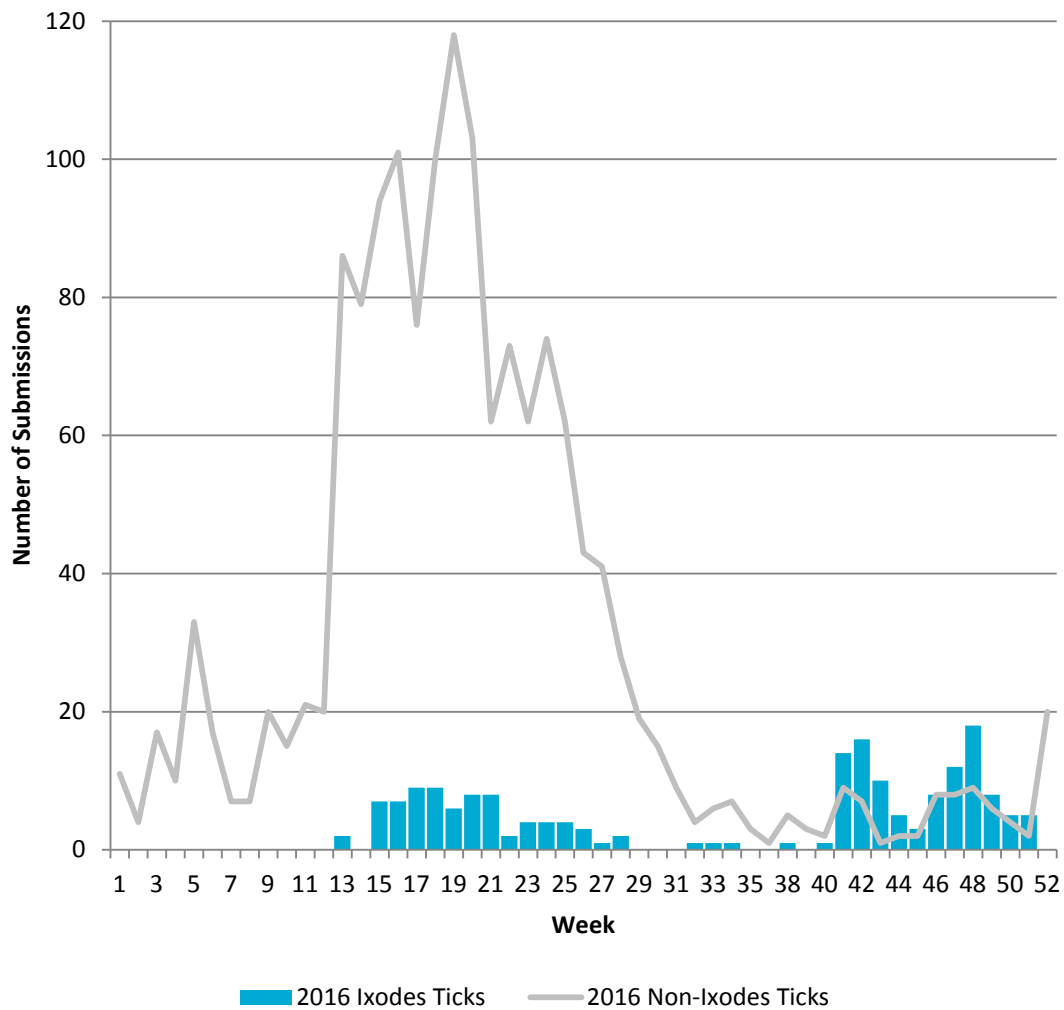


Figure 2. *Ixodes* spp. tick submissions by week and year.

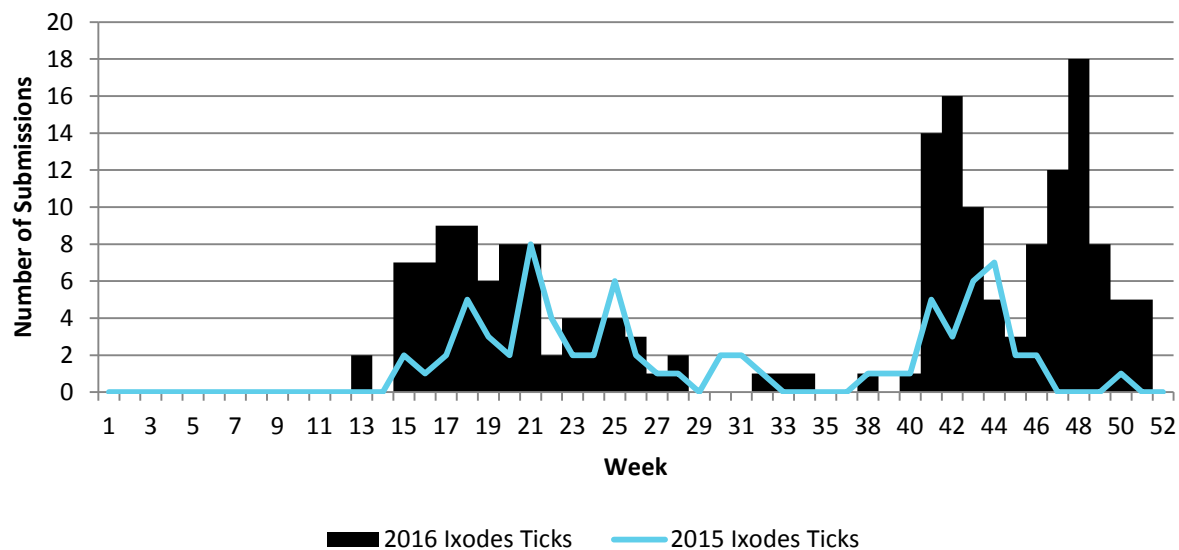


Table 2: Location tick likely acquired in 2016, 2015, and 2014

	2016						2015						2014					
	All Tick Submissions		<i>Ixodes spp</i> Submissions		<i>Ixodes spp B. burgdorferi</i> positive		All Tick Submissions		<i>Ixodes spp</i> Submissions		<i>Ixodes spp B. burgdorferi</i> positive		All Tick Submissions		<i>Ixodes spp</i> Submissions		<i>Ixodes spp B. burgdorferi</i> positive	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
All Tick Submissions*	2,781		234		40		1,814		133		20		1,376		137		15	
Acquired Outside Alberta**	1,100	40%	52	22%	5	13%	757	42%	58	44%	9	45%	614	45%	56	41%	6	40%
Acquired In Alberta [§]	1,681	60%	182	78%	35	87%	1,057	58%	75	56%	11	55%	762	55%	81	59%	9	60%
Travel within Alberta	655		51		14		387		18		2		251		21		6	
No Travel	1,026		131		21		670		57		9		511		60		3	

*In this report each tick is considered one submission. Multiple ticks could be submitted by one host at the same time.

**Includes submissions by individuals who are not Alberta residents and Alberta residents that travelled outside Alberta or where travel status is not known.

Table 3: Ticks submitted from Alberta residents with no history of travel[§] in the previous two weeks, 2016*[‡]

	Both Programs					Companion Animal Program					Human and the Environment Program				
	All Ticks	<i>Ixodes</i>		<i>B. burgdorferi</i> Positive		All Ticks	<i>Ixodes</i>		<i>B. burgdorferi</i> Positive		All Ticks	<i>Ixodes</i>		<i>B. burgdorferi</i> Positive	
		n	%	n	%		n	%	n	%		n	%	n	%
Calgary	346	13	10%	3	14%	158	13	10%	3	14%	188	0	0%	0	.
Central	148	13	10%	5	23%	120	13	10%	5	23%	28	0	0%	0	.
Edmonton	183	70	53%	9	43%	142	64	52%	9	42%	41	6	60%	0	.
North	119	14	10%	3	14%	94	13	10%	3	14%	25	1	10%	0	.
South	220	19	14%	1	4%	114	16	13%	1	4%	106	3	30%	0	.
Unknown	10	2	1%	0	0%	9	2	1%	0	0%	1	0	0%	0	.
Alberta	1,026	131	100%	21	100%	637	121	100%	21	100%	389	10	100%	0	.

Table 4: Ticks submitted from Alberta residents with no history of travel[§] in the previous two weeks, 2015*[‡]

	Both Programs					Companion Animal Program					Human and the Environment Program				
	All Ticks	<i>Ixodes spp</i>		<i>B. burgdorferi</i> Positive		All Ticks	<i>Ixodes spp</i>		<i>B. burgdorferi</i> Positive		All Ticks	<i>Ixodes spp</i>		<i>B. burgdorferi</i> Positive	
		n	%	n	%		n	%	N	%		n	%	n	%
Calgary	261	2	3%	0	0%	116	2	3%	0	0%	145	0	0%	0	0%
Central	94	5	8%	1	11%	73	5	9%	1	50%	21	0	0%	0	0%
Edmonton	107	34	59%	7	77%	91	31	57%	7	50%	16	3	100%	0	0%
North	81	14	24%	1	11%	73	14	25%	1	0%	8	0	20%	0	0%
South	126	1	1%	0	0%	79	1	1%	0	0%	47	0	10%	0	0%
Unknown	1	1	1%	0	0%	1	1	1%	0	0%	0	0	0%	0	0%
Total	670	57		9		433	54		9		237	3		0	

*In this report each tick is considered one submission. Multiple ticks could be submitted by one host at the same time.

[§] Hosts were considered to have travelled if they answered “Yes” to one of the following questions. 2014: Humans: “Did the person travel more than 100km outside their municipality in the 2 weeks prior to finding the tick?” Animals: “Out of Alberta in the last 2 weeks?” or “Out of town, but still in Alberta, in the last 2 weeks?” 2013: Humans: “Did the human travel outside of town in the last two weeks?” Animals: “Out of town in the last 2 weeks?”

[‡] Note: This program is based on a convenience sample of submissions from volunteers. Therefore the number of ticks analyzed per zone does not necessarily correspond to the prevalence of ticks in a zone.

Table 5: Ticks submitted from Alberta residents with no history of travel in the previous two weeks, 2014

	All Ticks	Both Programs				Companion Animal Program				Human and the Environment Program					
		<i>Ixodes spp</i>		<i>B. burgdorferi</i> Positive		<i>Ixodes spp</i>		<i>B. burgdorferi</i> Positive		<i>Ixodes spp</i>		<i>B. burgdorferi</i> Positive			
		n	%	n	%	All Ticks	n	%	n	%	All Ticks	n	%	n	%
Calgary	186	5	8%	0	0%	93	4	8%	0	0%	93	1	10%	0	0%
Central	75	7	11%	1	33%	56	7	14%	1	50%	19	0	0%	0	0%
Edmonton	97	37	61%	2	66%	79	31	62%	1	50%	18	6	60%	1**	100%
North	68	10	16%	0	0%	56	8	16%	0	0%	12	2	20%	0	0%
South	84	1	1%	0	0%	64	0	0%	0	0%	20	1	10%	0	0%
Unknown	1	0	0%	0	0%	1	0	0%	0	0%	0	0	0%	0	0%
Total	511	60		3		349	50		2		162	10		1	

**Note: This *B. burgdorferi*-positive tick was found on a companion animal but submitted through the Human and the Environment Program

Table 6: Ticks submitted from Alberta residents with no history of travel in the previous two weeks, 2013

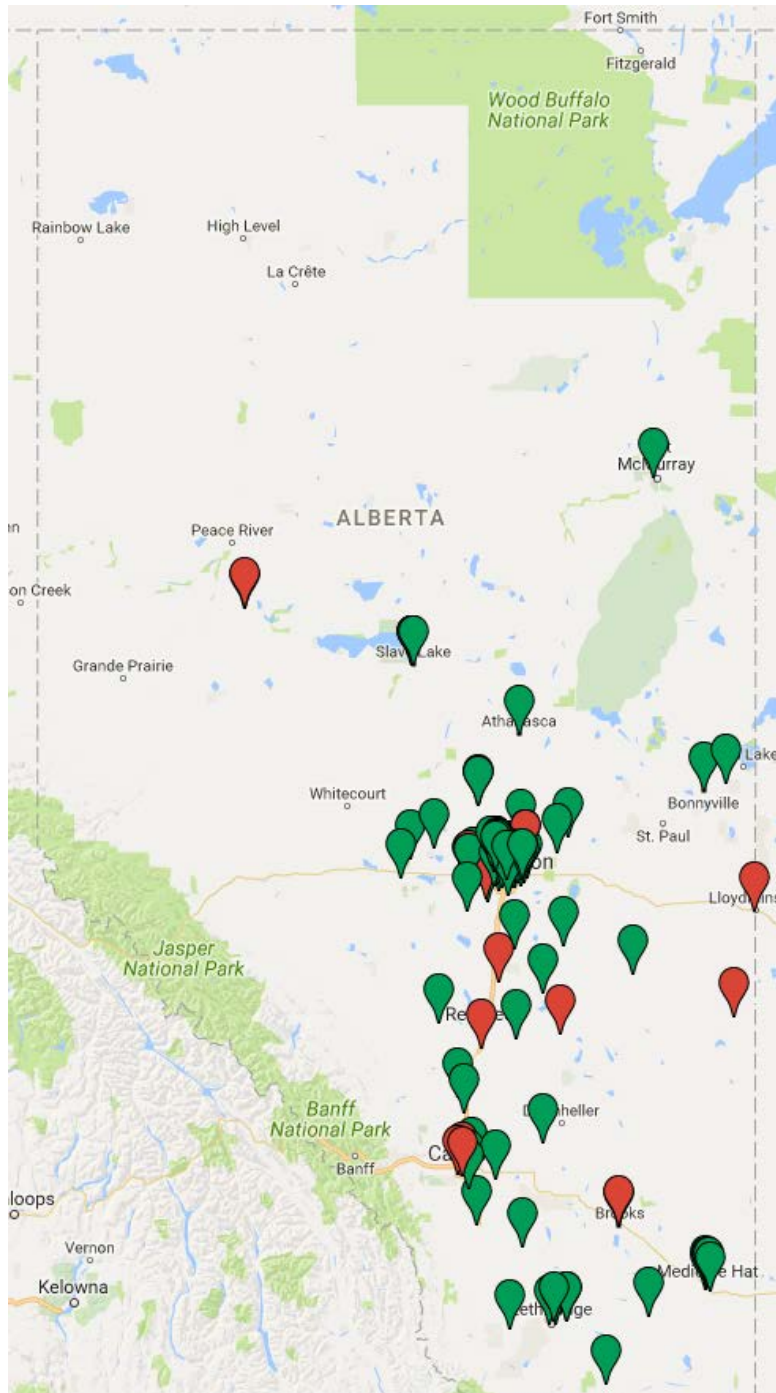
	All Ticks	Both Programs				Companion Animal Program				Human and the Environment Program					
		<i>Ixodes spp</i>		<i>B. burgdorferi</i> Positive		<i>Ixodes spp</i>		<i>B. burgdorferi</i> Positive		<i>Ixodes spp</i>		<i>B. burgdorferi</i> Positive			
		n	%	n	%	All Ticks	n	%	n	%	All Ticks	n	%	n	%
Calgary	89	5	5%	0	0%	55	5	5%	0	0%	34	0	0%	0	0%
Central	47	9	9%	2	10%	39	9	9%	2	10%	8	0	0%	0	0%
Edmonton	133	72	69%	13	62%	126	69	68%	12	60%	7	3	100%	1	100%
North	64	16	15%	4	19%	57	16	16%	4	20%	7	0	0%	0	0%
South	45	3	3%	2	10%	16	3	3%	2	10%	29	0	0%	0	0%
Total	378	105		21		293	102		20		85	3		1	

*In this report each tick is considered one submission. Multiple ticks could be submitted by one host at the same time.

§ Hosts were considered to have travelled if they answered “Yes” to one of the following questions. 2014: Humans: “Did the person travel more than 100km outside their municipality in the 2 weeks prior to finding the tick?” Animals: “Out of Alberta in the last 2 weeks?” or “Out of town, but still in Alberta, in the last 2 weeks?” 2013: Humans: “Did the human travel outside of town in the last two weeks?” Animals: “Out of town in the last 2 weeks?”

§ Note: This program is based on a convenience sample of submissions from volunteers. Therefore the number of ticks analyzed per zone does not necessarily correspond to the prevalence of ticks in a zone.

Figure 3: Residential postal codes of individuals who had not travelled and submitted an *Ixodes* species tick in 2016



Legend:



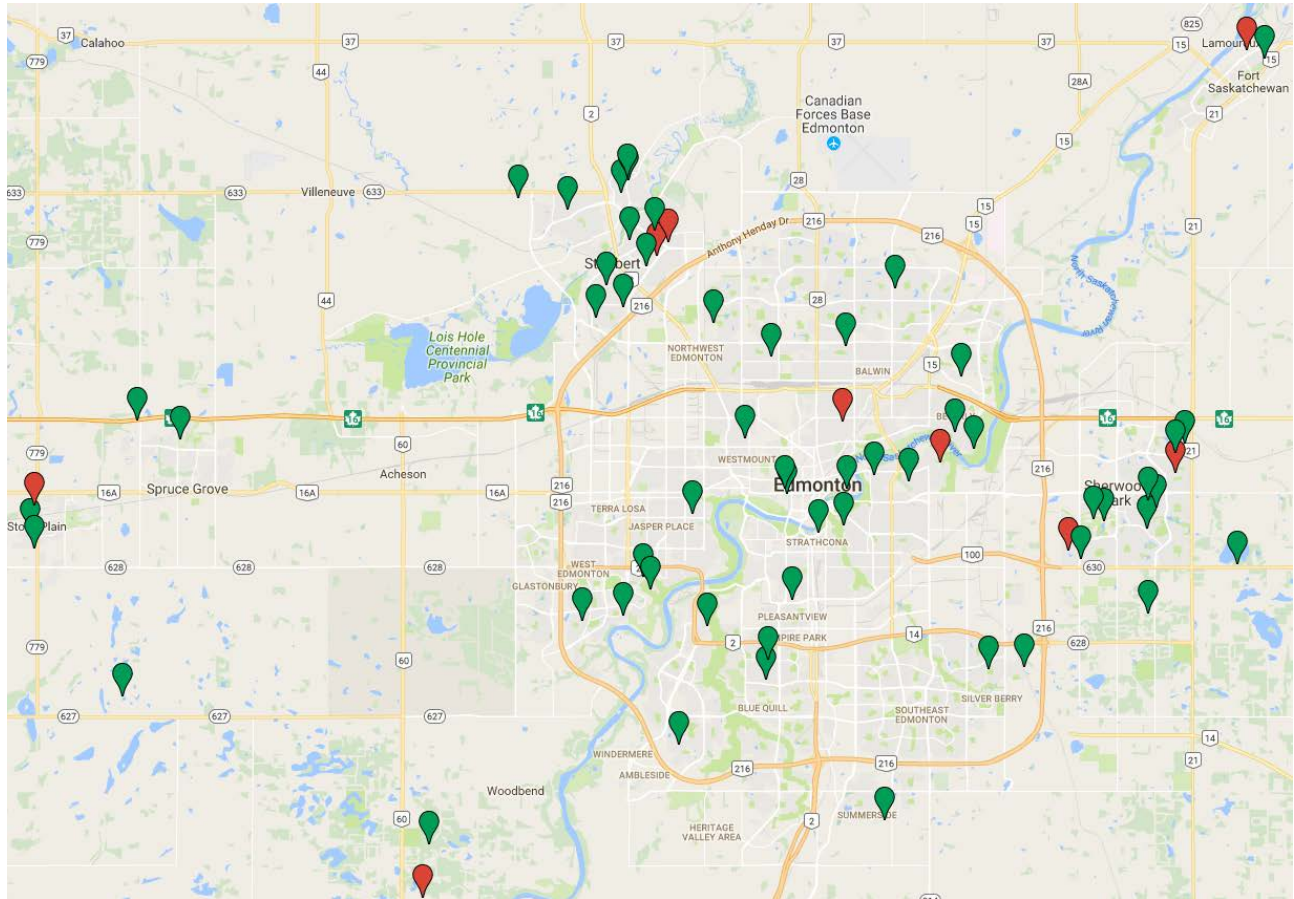
-  2016 *Ixodes*
-  2016 *Borrelia*-positive *Ixodes*

Figure 4: Residential postal codes of individuals who had not travelled and submitted an *Ixodes* species tick in 2016 (Edmonton Zone)



Legend:



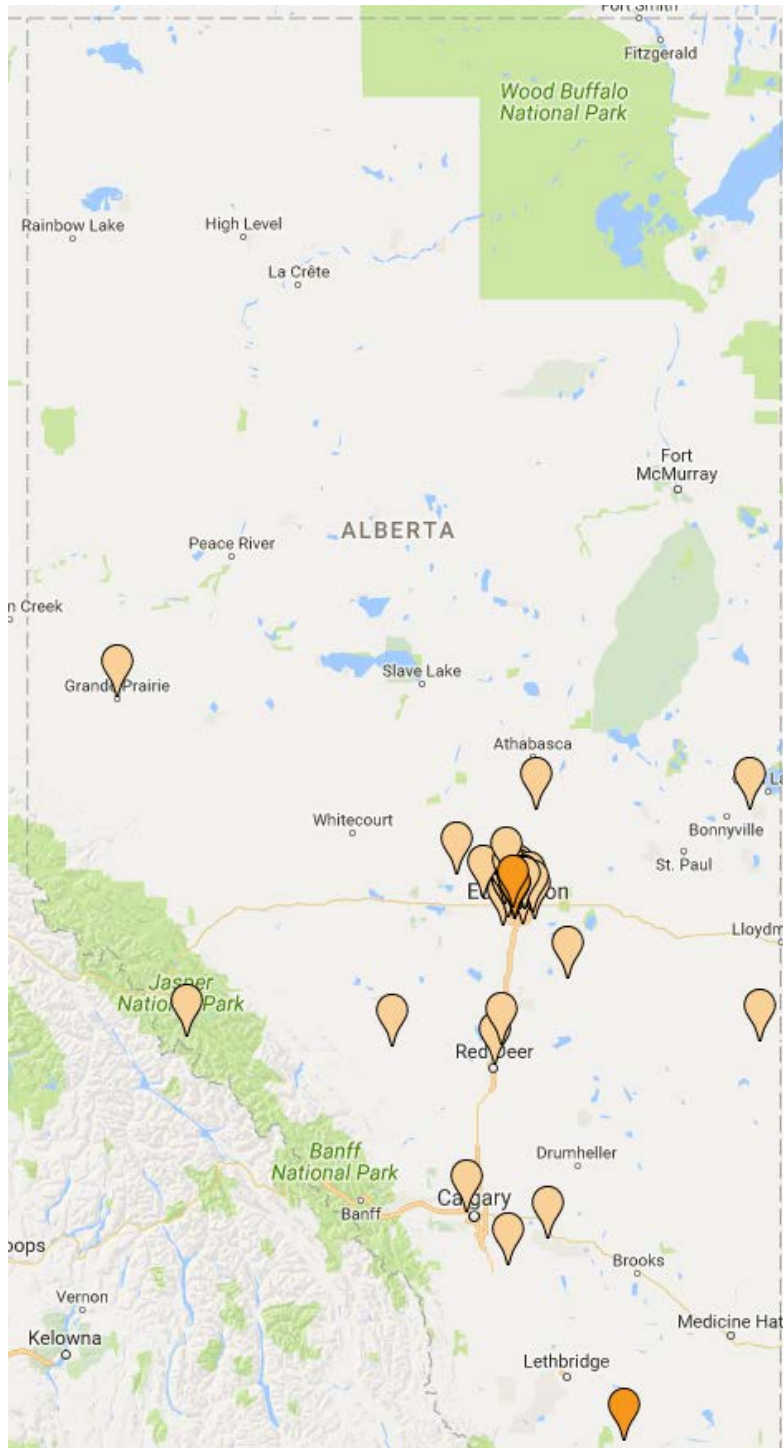
-  2016 *Ixodes*
-  2016 *Borrelia*-positive *Ixodes*

Figure 5: Outdoor locations visited in 2014, 2015 and 2016 by Alberta resident humans and animals from which *Ixodes* species ticks were recovered and who had no history of travel in previous two weeks



Legend



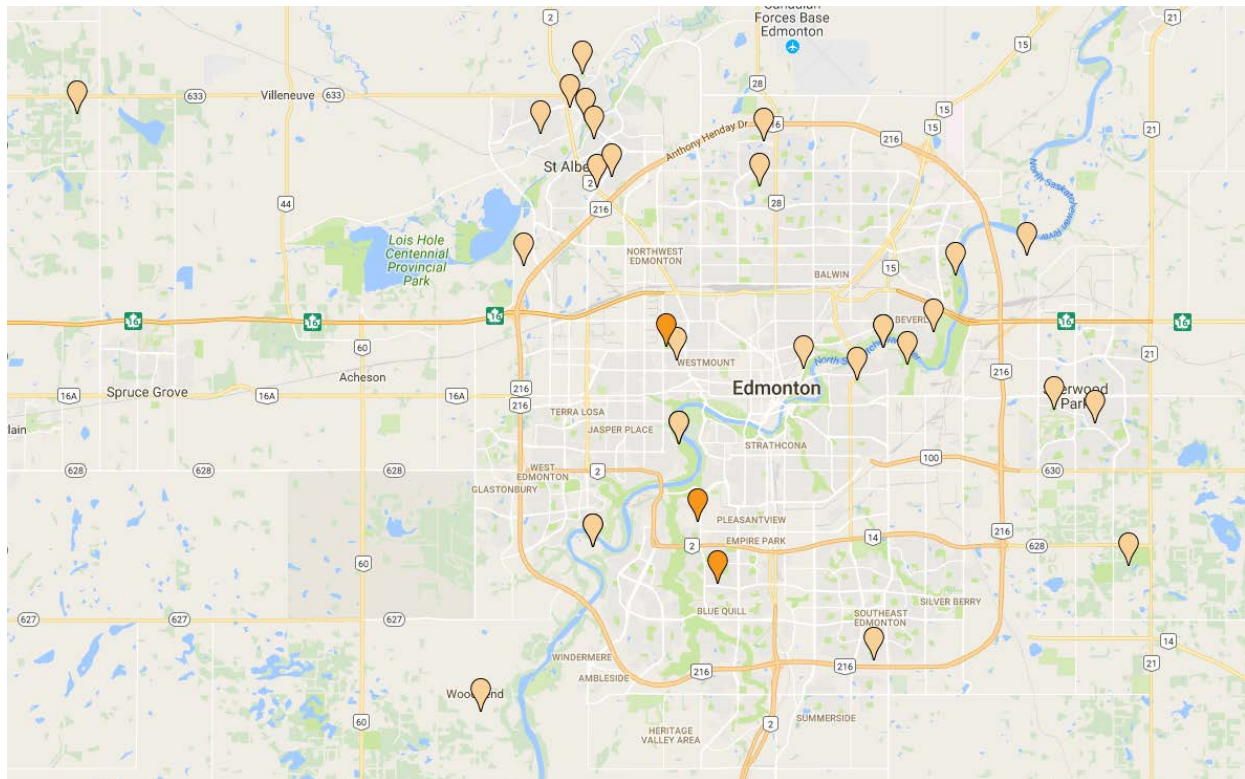
-  2016 Outdoor Locations Visited
-  2014 and 2015 Outdoor Locations Visited

Figure 6: Outdoor locations visited in 2014, 2015 and 2016 by Alberta resident humans and animals from which *Ixodes* species ticks were recovered and who had no history of travel in previous two weeks



Legend



-  2016 Outdoor Locations Visited
-  2014 and 2015 Outdoor Locations Visited

Figure 7: Photographs taken in Spring 2014 and Fall 2016 demonstrating drag sampling (“flagging”). Teams in 2016 wore reflective vests and dragged flannel sheets for a minimum of three person-hours per site visit. They visually inspected themselves and the drags for ticks every 10-20 steps.



Appendix

Table A.1: Submissions in 2016 from Alberta residents who had not travelled within the previous two weeks, by species and zone of residence

	Calgary	Central	Edmonton	North	South	Unknown	Total
AMBLYOMMA AMERICANUM	3	0	2	0	2	0	7
DERMACENTOR ALBIPICTUS	27	36	52	63	26	0	204
DERMACENTOR ANDERSONI	183	14	7	19	98	0	321
DERMACENTOR SPP.	1	0	0	0	0	0	1
DERMACENTOR VARIABILIS	58	74	40	20	32	0	224
HAEMAPHYSALIS LEPORISPALUSTRIS	0	1	7	1	0	0	9
IXODES KINGI	36	6	0	1	41	1	85
IXODES MURIS	0	1	0	0	0	0	1
IXODES OCHOTONAE	0	1	1	1	0	0	3
IXODES SCAPULARIS	11	11	59	11	15	1	108
IXODES SPP.	2	1	11	3	4	1	22
NOT APPLICABLE	28	6	15	2	1	1	53
RHIPICEPHALUS SANGUINEUS	25	3	4	0	2	6	40
UNABLE TO IDENTIFY	0	0	1	0	0	0	1
Total	374	154	199	121	221	10	1079

Table A.2: Submissions in 2016 from Alberta residents who travelled within Alberta, by species and zone of residence*

	Calgary	Central	Edmonton	North	South	Unknown	Total
DERMACENTOR ALBIPICTUS	26	19	19	26	11	1	102
DERMACENTOR ANDERSONI	173	43	46	17	39	0	318
DERMACENTOR SPP.	5	0	0	0	0	0	5
DERMACENTOR VARIABILIS	32	47	21	7	18	0	125
HAEMAPHYSALIS LEPORISPALUSTRIS	0	0	2	0	0	0	2
IXODES KINGI	24	2	0	1	14	0	41
IXODES OCHOTONAE	0	0	1	0	0	0	1
IXODES SCAPULARIS	3	10	20	6	2	2	43
IXODES SPP.	1	0	6	1	0	0	8
NOT APPLICABLE	4	2	5	1	1	0	13
RHIPICEPHALUS SANGUINEUS	7	0	0	0	3	0	10
UNABLE TO IDENTIFY	1	0	1	0	0	0	2
Total	276	123	121	59	88	3	670

*Please note: This table does not indicate in which zone a tick was found, but rather the zone in which the host lives.

Table A.3: Submissions in 2016 from hosts who travelled outside of Alberta or who are not Alberta residents, by species and zone of residence*

	Calgary	Central	Edmonton	North	South	Unknown	Total
AMBLYOMMA AMERICANUM	3	0	0	1	1	0	5
AMBLYOMMA MACULATUM	0	0	1	0	0	0	1
DERMACENTOR ALBIPICTUS	7	0	1	0	0	21	29
DERMACENTOR ANDERSONI	63	6	19	9	5	17	119
DERMACENTOR VARIABILIS	238	107	197	86	50	75	753
HAEMAPHYSALIS LEPORISPALUSTRIS	0	4	0	0	0	0	4
HAEMAPHYSALIS SPP.	0	0	0	0	0	5	5
IXODES KINGI	2	1	0	0	2	1	6
IXODES OCHOTONAE	1	1	0	0	0	0	2
IXODES PACIFICUS	5	1	4	2	0	2	14
IXODES SCAPULARIS	5	2	8	0	0	8	23
IXODES SPP.	4	2	0	0	1	1	8
NOT APPLICABLE	3	0	2	2	0	0	7
RHIPICEPHALUS SANGUINEUS	14	1	12	5	2	5	39
UNABLE TO IDENTIFY	0	1	2	0	1	0	4
Total	345	126	246	105	62	135	1019

*Please note: This table does not indicate in which zone a tick was found, but rather the zone in which the host lives. Visitors to Alberta and Alberta residents where the zone is not known are placed in the "Unknown" category.

References

1. Fitzgerald, D.T. *The species composition and distribution of Ixodidae from companion animals in Alberta, Canada*. Master's Thesis. University of Alberta. Edmonton, Alberta, 2012.
2. Ogden, N.H., J.K. Koffi, Y. Pelcat, and L.R. Lindsay. Environmental risk from Lyme disease in central and eastern Canada: a summary of recent surveillance information. *Can Comm Dis Rep* 2014; 40: 74 – 82