

Local Prevalence of *Borrelia burgdorferi* in Adult Female *Ixodes scapularis*, Spring 2014

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Abstract

The purpose of this study was to conduct a local survey of the female deer tick population harboring *Borrelia burgdorferi*, in Wisconsin, during the spring of 2014. This is a continuation of a larger study began in 2010. *Borrelia burgdorferi*, which is spread through tick bites, is the bacteria responsible for causing Lyme disease. UWEC students collected ticks using sweeping or visual detection methods in local areas. DNA was extracted from individual ticks and a real-time polymerase chain reaction (qPCR) was run to amplify the presence of the bacterial *recA*, gene resulting in a 222 base pair fragment with a melting temperature of 82°C. A total of 34 out of 100 (34%) ticks contained the *Borrelia burgdorferi* bacteria. The addition of last spring's ticks raises the total number of bacteria-containing ticks collected from 2010-2014 to 156 out of 443 (35.2%). Map GPS coordinates of positive ticks around Eau Claire county revealed several areas with a high prevalence, including: Augusta State Wildlife area, 11 out of 17 ticks (64.7%); Fall Creek area, 6 out of 9 ticks (76%); and Colfax area, 4 out of 5 ticks (80%).

Background

Lyme disease is the most common vector borne disease in the United States. In 2013, Wisconsin was one of 14 states where a majority of Lyme disease was found¹. Lyme disease is caused by *Borrelia burgdorferi*, a bacterium that is transmitted through tick bites. In 75% of cases, a bulls-eye shaped rash (*erythema migrans*) develops about 7 days after the tick bite. Fatigue, chills, fever and headache can follow. If left untreated the patient can develop severe joint pain and swelling. The best way to prevent Lyme disease is to avoid contact with ticks².

Recent studies at the University of Wisconsin-Eau Claire found 35% of ticks harbor *B. burgdorferi*³. This is similar to other studies conducted on the East Coast of the United States and in other countries such as Germany and Norway⁴.

Our study used ticks collected in the spring of 2014 as a continuation of a study began in 2010 (fig. 1). Ticks carrying the bacterium were identified by targeting the *recA* gene with real time PCR. This amplified a 222bp fragment of the *recA* gene which was confirmed by an 82°C melting temperature and gel electrophoresis (fig. 2-4).

Materials Methods

DNA Extraction

- Tick homogenization
1. Buffer
2. SDS
3. Proteinase K

DNA Extraction

- A. Phenol
B. Chloroform

Ethanol Precipitation

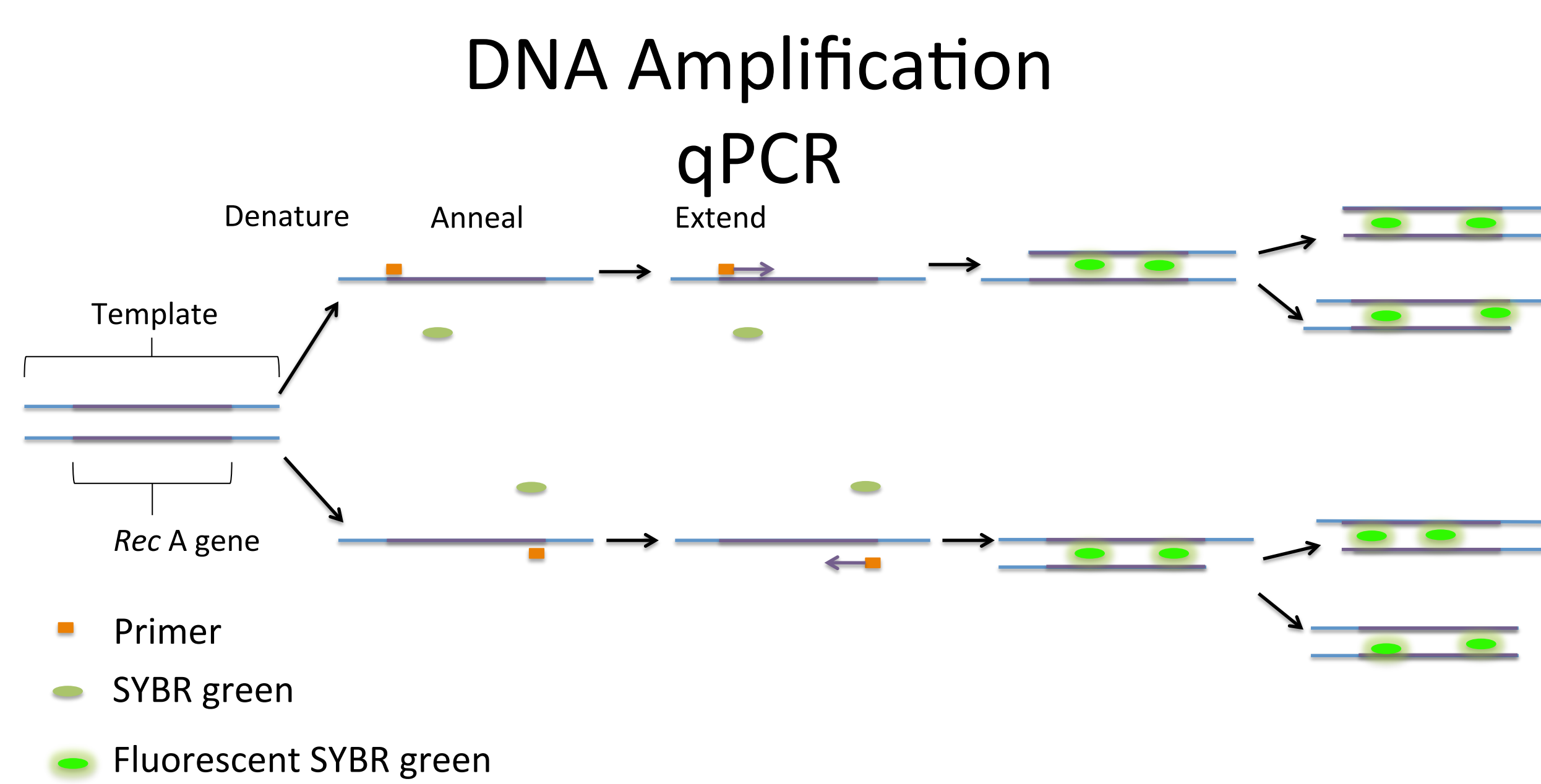


Figure 2. Illustration of SYBR Green assay.

Fluorescence vs. Cycle Number

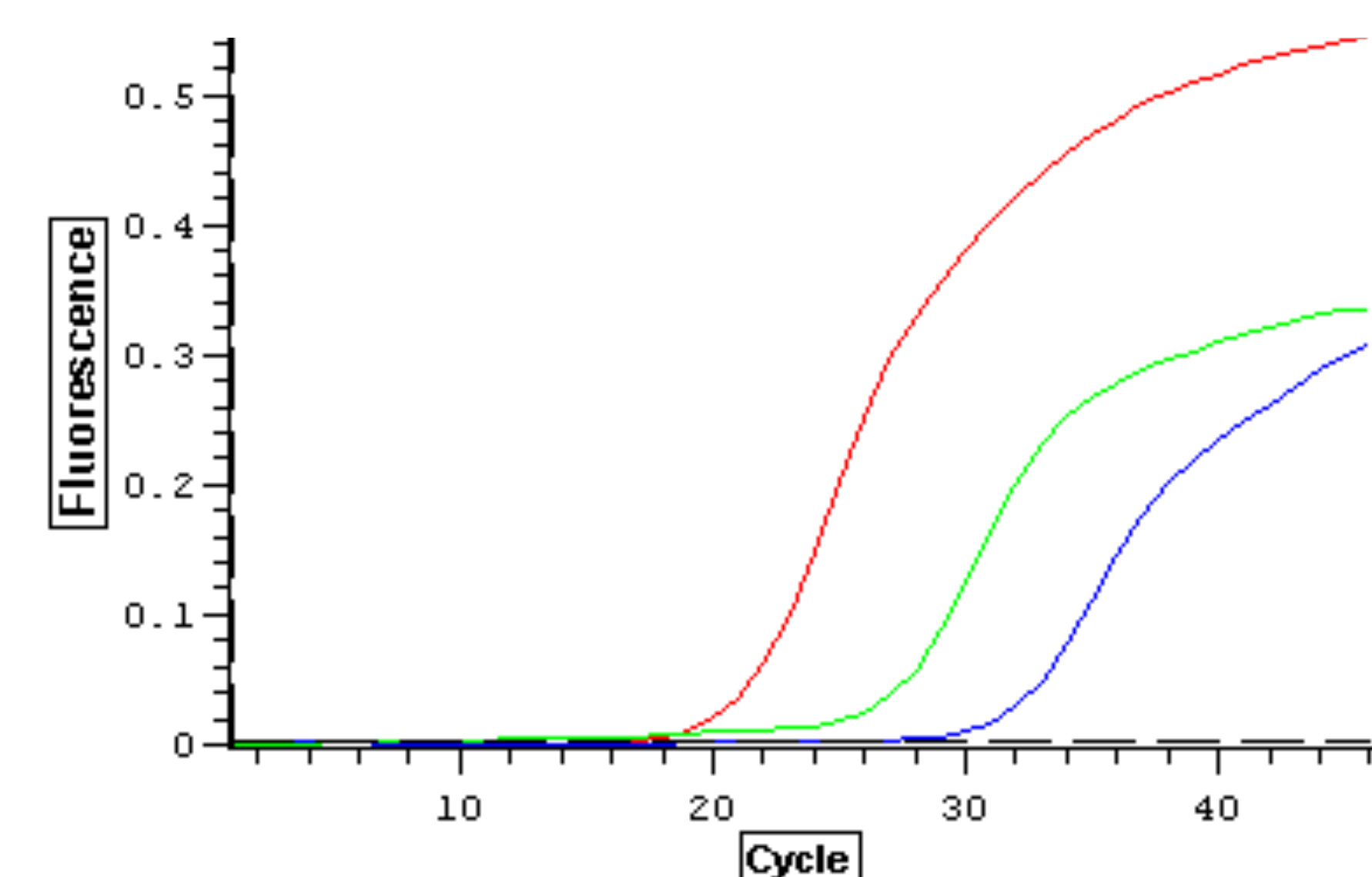


Figure 3. Fluorescence increased as SYBR Green binds to the dsDNA products.

Fluorescence vs. Temperature

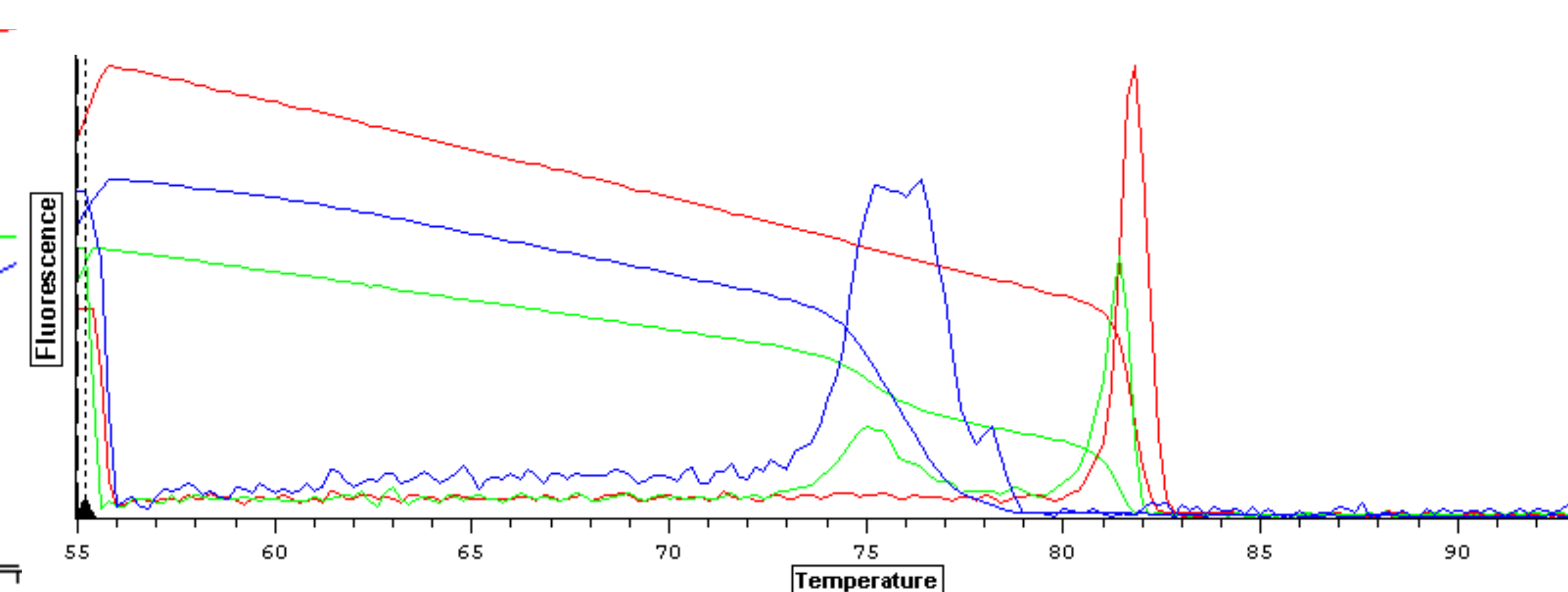


Figure 4. Melting temperature of the replicated product. Melting temperature for *B. burgdorferi* target gene is 82°C. Melting temperature for primer dimer is 76°C.

Results

Prevalence of *Borrelia burgdorferi* in Adult Female Ticks, 2010-2014

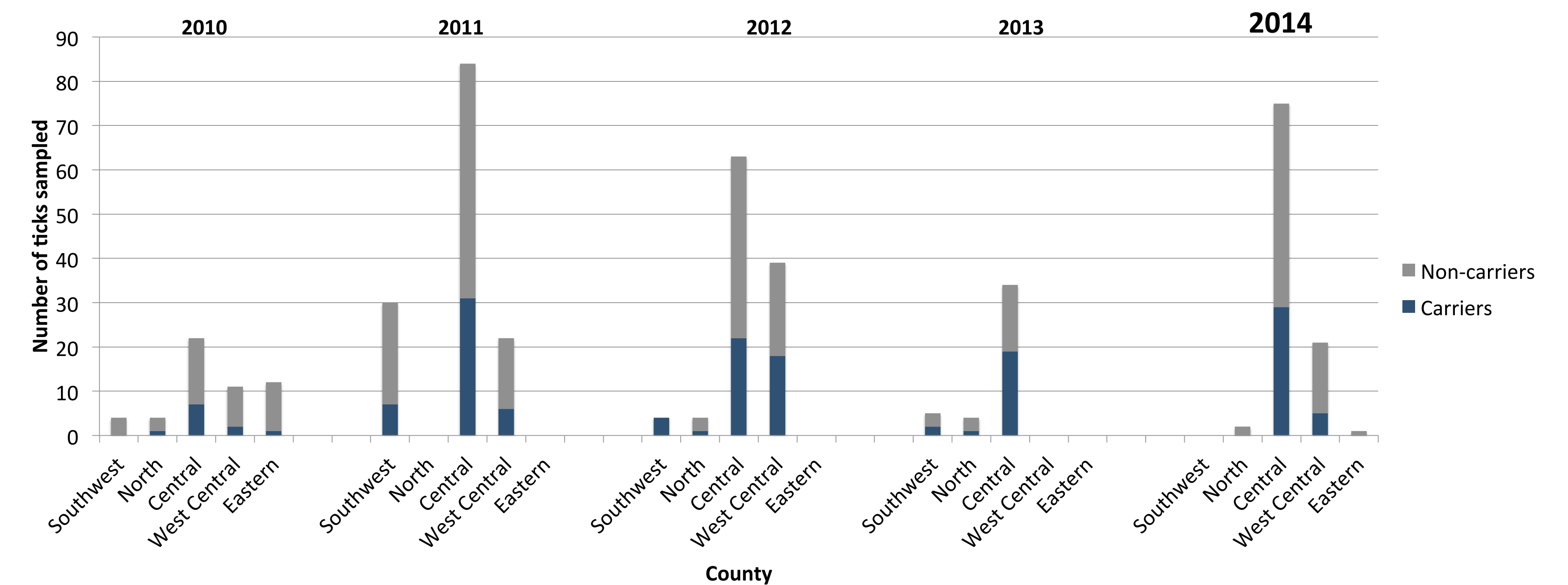


Figure 1. Number of carrier and non-carrier tick in 2010-2014 in Wisconsin. Southwest- Buffalo, Trempealeau, La Crosse, Vernon, Richland. Northern-Bayfield, Sawyer, Washburn, Vilas, Oneida, Rusk. West Central- Polk, Barron, Dunn, St. Croix, Pierce. Eastern- Brown, Manitowoc. Central- Chippewa, Clark, Marathon, Eau Claire.

Eau Claire County Prevalence, 2014

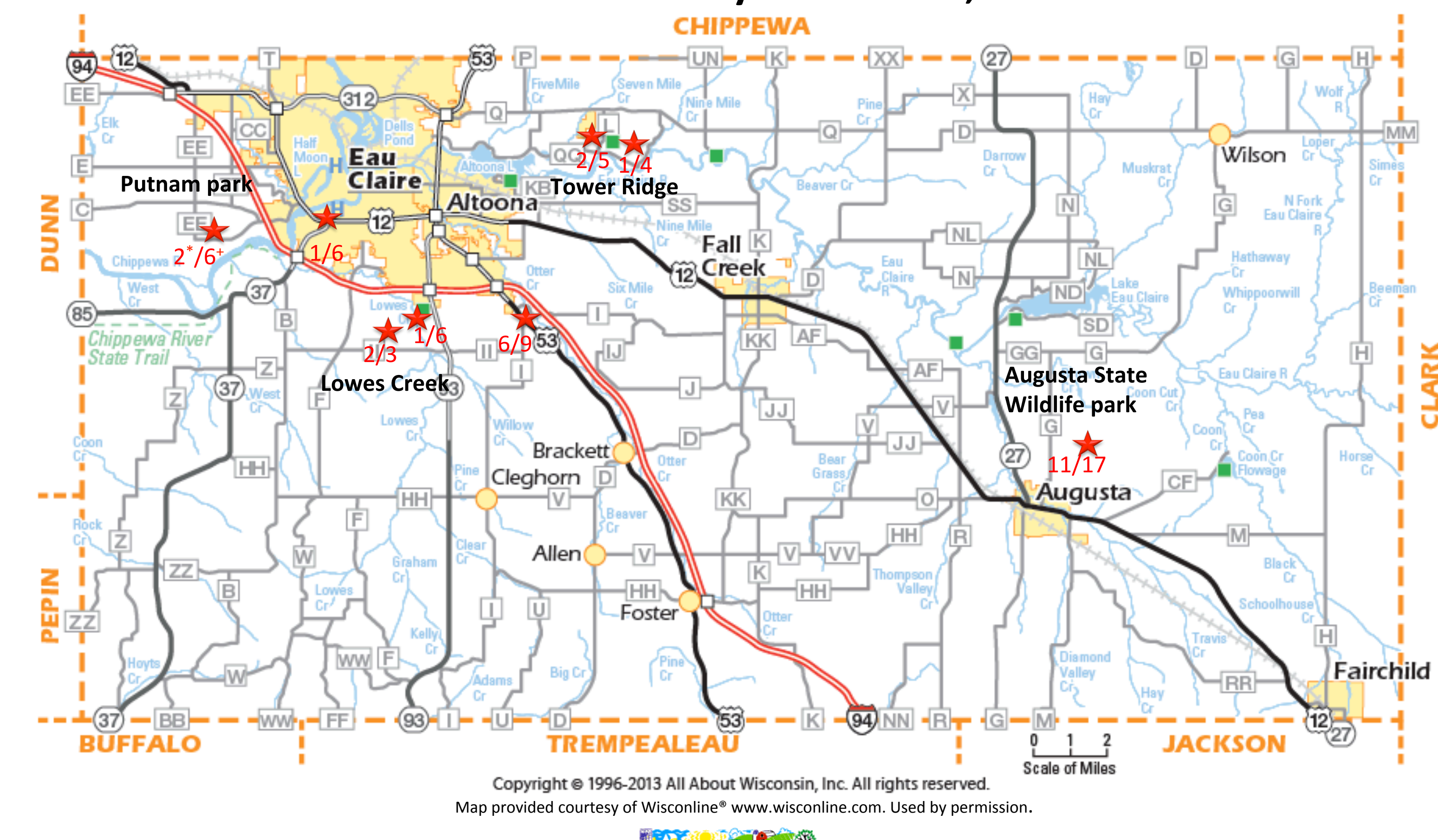


Figure 5. Map of Eau Claire county with prevalence of ticks containing *Borrelia Burgdorferi* in 2014⁵. * Number of ticks containing *B. Burgdorferi* * Total number of ticks sampled

Conclusions

A total of 34 out of 100 (34%) ticks in 2014 contained the *Borrelia burgdorferi* bacteria. The addition of last spring's ticks brings the total number of bacteria-containing ticks collected throughout Wisconsin from 2010-2014 to 156 out of 443 (35.2%). This year alone Eau Claire County had a prevalence of 28 out of 73 (38%) ticks containing *B. burgdorferi* (fig. 1).

Eau Claire County has several areas with high prevalence of *B. burgdorferi*. Colfax area has the highest prevalence with Augusta State Wildlife area and Fall Creek area following closely behind (fig. 5).

It is always important to check for ticks after being in a wooded area, especially after being in areas with high prevalence of positive ticks.

References

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