Lyme Disease Ticks Me Off

A multi-level approach to Lyme Disease Prevention

Eau Claire City-County
Health Department

This grant project was funded by the Wisconsin Department of Health Services—Environmental Public Health Tracking program, Taking Action with Data: Use of the Environmental County Health Profiles to Improve Environmental Health in a Community (Round 3) grant.

Published August 2018

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Executive Summary

Lyme Disease Ticks Me Off! Toolkit

From 2017-2018, the Eau Claire City-County Health Department received funding to address Lyme disease in their community. This toolkit details out how grant activities were completed. Appendices include tools used as part of the grant project. Please read through the grant team experience, think about how it could work in your community, and adapt the resources as needed. The goal in disseminating the results of this project is to help other communities move data to action around Lyme disease.

Grant Project Partners:

Eau Claire City-County Health Department, Beaver Creek Reserve and City of Eau Claire- Parks, Recreation & Forestry Department

Grant Project Goals:

- **Goal 1:** To increase knowledge of prevalence of Lyme disease in deer ticks (ixodes scapularis) in urban Eau Claire city parks by completing tick drags.
    - **Objectives:** Complete weekly tick drags in Phoenix and Carson Parks (urban) and Big Falls and Lowe's Creek Parks (rural) walking and biking trails in the fall, spring and summer months when the air temperature is above 40°F. Analyze prevalence of Lyme disease in deer ticks and report comparing results of urban/city to rural/county parks.

- **Goal 2:** To increase community knowledge about Lyme disease prevention by increasing education.
    - **Objectives:** Develop at least five social media posts, at least one educational sign for parks and toolkit of completed educational materials. Distribute community survey to assess knowledge, attitude and behaviors around Lyme disease prevention & provide education to community members at least three community events, one in Phoenix Park and one in Carson Park.

- **Goal 3:** To strengthen community partnerships by collaborating to provide tick education at targeted facilities.
    - **Objectives:** Collaborate with Beaver Creek Reserve staff to implement at least one strategy that will provide Lyme disease prevention education to their visitors. Collaborate with Parks, Recreation & Forestry Division to post at least one educational material in the parks and participate in at least one Division-sponsored community events.

This toolkit shows the many ways that Eau Claire County is addressing Lyme disease with community partners through all levels of the social ecological model

Individual	Community Survey and Events, Tick Repellent brochure, Tick ID cards
Interpersonal	Social Media posts
Organizational	Education in schools and in youth programming from partners
Community	Posted signage at parks, PSA's
Policy Level	Alternative repellent options available for purchase at Beaver Creek Reserve

Lyme Disease in Eau Claire County

How data drives action

Environmental Public Health Tracking data shows the number of cases of Lyme disease in Eau Claire County is on the rise, almost doubling from 2014 to 2015. In 2014, 24 cases were reported, compared to 45 cases in 2015. In 2016, 54 cases were reported (via WEDSS). Lyme disease has historically been the second most prevalent reportable communicable disease in Eau Claire County. In 2014, the Eau Claire City-County Health Department (ECCCHD) began a tick collection project at two rural county parks to determine the percentage of ticks infected with Lyme disease. Over time, results showed an average infection rate among collected ticks of over 40%! (*See page 5 for data*). This data shows the importance of Lyme disease prevention education in our community. The grant project enhanced our current tick collection project by developing capacity for ECCCHD to collect data from urban parks. One of the factors we were interested in was to see if there is a difference in the number of ticks collected with Lyme disease in our city parks vs. county parks. The two parks in this grant are highly utilized and due to their urban nature, may not seem to harbor a risk to residents of tick bites and Lyme disease.

As we continue to see an upward trend in the number of Lyme disease cases each year, ECCCHD sees a need to enhance our dataset to determine the overall prevalence of Lyme disease and to develop new and innovative strategies at the organizational and community level to increase community knowledge of tick-borne infection and prevention. This grant project allowed us to do so.

Target Audiences

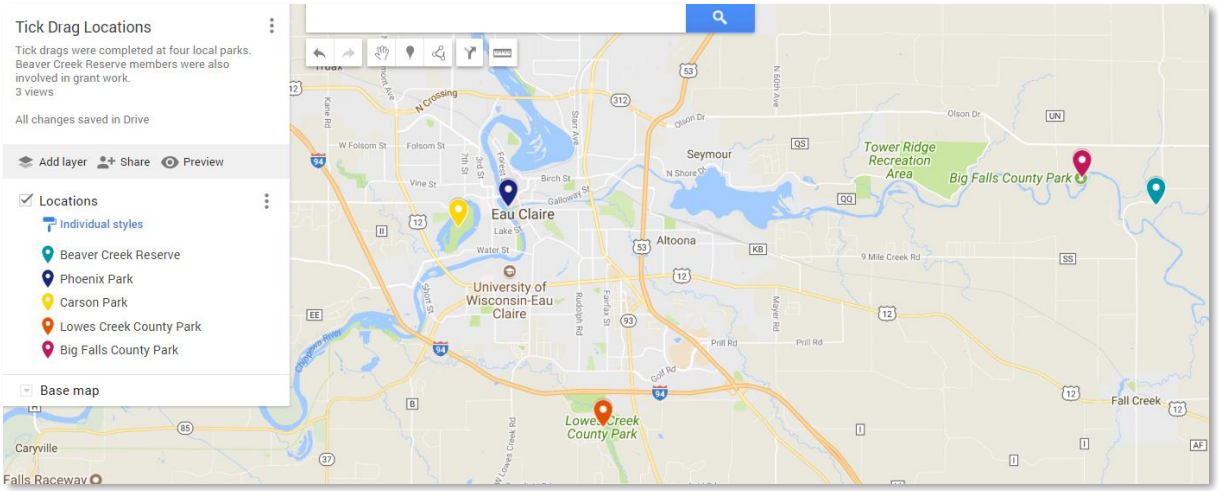
The priority population for this project is residents of Eau Claire County that utilize Carson Park and Phoenix Park---two popular parks located within the city limits of Eau Claire. In the past, ECCCHD has not completed tick drags at any parks located within in the city, and due to their urban nature residents may not consider these parks a risk for harboring ticks. With the high usage of these parks for activities throughout the peak tick season, ECCCHD felt it was important to begin monitoring prevalence of Lyme disease at these locations.

- Carson Park contains three major attractions including the Paul Bunyan Logging Camp, the Chippewa Valley Museum, along with Eau Claire's baseball stadium. Events that happen throughout the summer attract many residents. There are several pavilions, biking/walking trails around the park, playground areas, and places to fish.

- Phoenix Park serves as the trailhead for the Chippewa River State Trail. Phoenix Park offers a walking labyrinth, a natural amphitheater, and is home to Eau Claire's seasonal farmer's market. It is also a popular 'tube launch' location at which tubers enter to float the river. These amenities make Phoenix Park a major gathering spot, especially during the summer months when the park plays hosts summer concerts with weekly attendance of over 2,000 people. There are residential areas across the street as well.

- Both parks are also located in the highest poverty census tracts and are highly utilized by the neighborhood residents. We wanted to ensure that these residents are receiving education about the risk of exposure to ticks and have knowledge of prevention measures, as we know access to healthcare can be limited for this population.

- Although we did not complete tick drags at Beaver Creek Reserve, the grant team also felt this was an important partner to help relay prevention knowledge and techniques to their visitors. Beaver Creek Reserve is well utilized by over 23,000 community members throughout the tick season—for hiking, summer camps, family and youth activities, field trips and more.

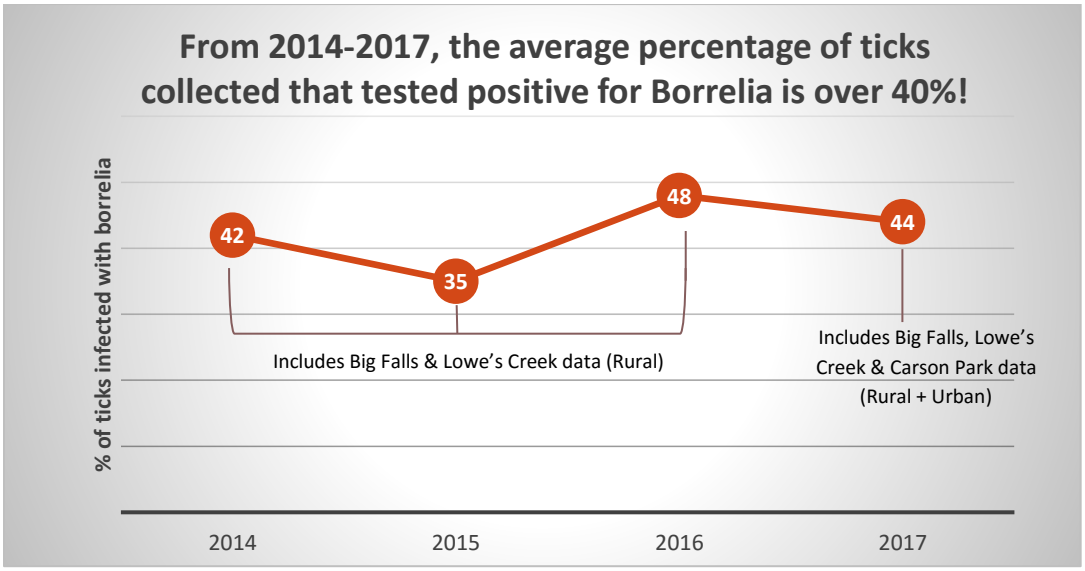


Tick Drag Data

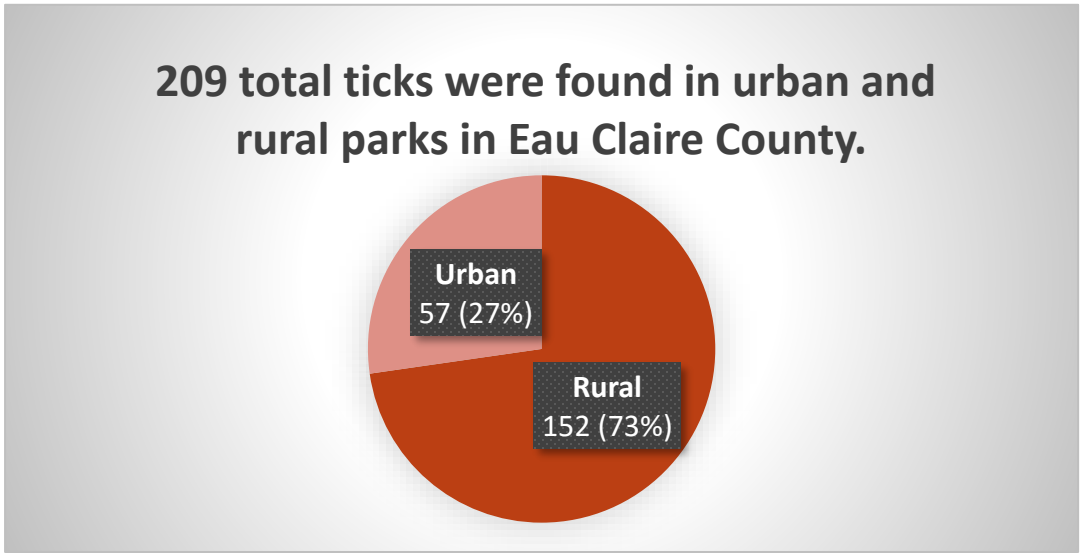
Goal 1: To increase knowledge of prevalence of Lyme disease vectors in urban Eau Claire city parks by completing tick drags.

The Eau Claire City-County Health Department (ECCCHD) has been collecting ticks from two rural parks (Big Falls County Park and Lowe's Creek County Park) since 2014. In 2017, this grant allowed us to expand tick drags to two urban parks (Carson Park and Phoenix Park). We were interested to see if there is a difference in the number of ticks collected with Lyme disease in our urban city parks vs. rural county parks. The two urban parks in this grant are highly utilized and due to their urban nature, may not seem to harbor a risk to residents of tick bites and Lyme disease.

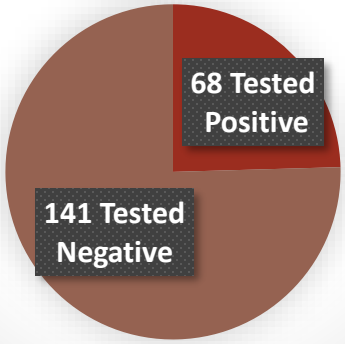
The graph below shows the overall data from our tick drags from 2014-2017.
This grant allowed us to expand tick drags and collect additional data from urban parks in 2017.



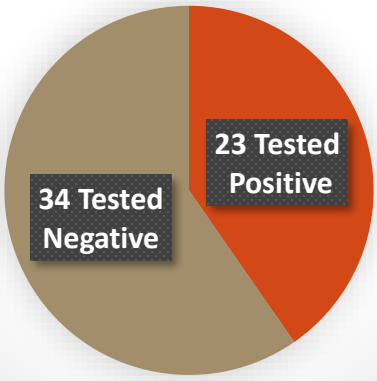
The following four graphs detail out the data collected during the grant year, April 2017- July 2018.



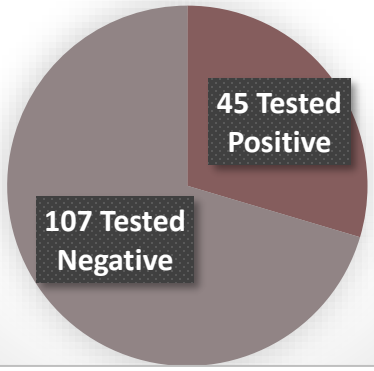
Of the 209 ticks tested, 33% of total ticks tested were positive for Lyme disease.



40% of ticks tested were positive for Lyme disease at Carson Park (Urban).



30% of ticks tested positive for Lyme disease in rural parks (Big Falls and Lowes Creek)



Additional Analysis

- From April 1st to June 30th, we had 22 positive ticks (32% of our samples positive). (Typically, we see fewer ticks in June-August and then it increases.) From Sept. 29th-Oct. 23rd, we had 46 ticks test positive (68% of our samples positive)

-No ticks were found at our Phoenix Park location. This is a highly groomed park, but we had expected to find some ticks.

-More ticks were positive in our urban park (Carson Park- 40%) vs. our rural parks (Big Falls- 25% positive, Lowe's Creek- 35% positive). This shows the need to educate about risk within urban areas.

Outreach Campaign

Goal 2: To increase community knowledge about Lyme disease prevention by increasing education.
Goal 3: To strengthen partnerships by collaborating to provide tick education at targeted facilities.

The grant team used several methods to increase community knowledge about Lyme disease prevention: a community survey, education at outreach events, developing an educational sign, social media posts and incorporating tick curriculum in community partner's programming. The grant team first conducted secondary research to determine best practices for Lyme disease prevention outreach and used this information when developing campaign materials.

Community Survey

Development

The grant team developed a community survey that they could use to assess community perception of Lyme disease risk and prevention in rural and urban areas. Example surveys were collected from other research projects. Questions were extracted from these surveys and some were modified. The grant team received IRB approval to distribute the survey to community members (*See Appendix A for survey questions*). A handout was also created to supplement the survey. This handout had the answers to the true/false questions on the survey and was handed out at outreach events (*See Appendix B*).

Distribution

The surveys were distributed electronically via email and paper copy via community events.

- Survey was emailed to all City of Eau Claire employees and Beaver Creek Reserve members.
- Survey was distributed at four community events: The Amazing Eau Claire Clean Up, Senior American's Day, Music in the Park, and Breakfast in the Valley.
    - Paper surveys went over well at community events as many attendees were willing to take the survey. Over 100 of the 522 total responses came from these four events. Community members were very interested to take the survey and share their experience with Lyme disease. We did have insect repellent to give out at one event and that helped people fill out surveys, however once it was gone people were still interested to talk and take the survey. Staff at events were asked many questions about Lyme disease prevention from community members.

Analysis

Survey responses were reviewed by the grant team and epidemiologists from the Health Department and Environmental Public Health Tracking team. After reviewing survey responses, a few ways to improve the survey were considered. Improvements include: rewriting the double negatives and other questions left for interpretation to be clearer, be more consistent with answer choices, and add a "never" choice in the parks use questions 23-25 (*See Appendix A for questions*). Data from the community survey was used to devise messages in our social media posts and other educational materials.

Community Survey Results

- People know about Lyme disease; however, they don't do protective behaviors regularly.
- We found that community members tend to do more protective behaviors when in the woods compared to their yards. For example- no one that completed the survey said they tuck their pants into their socks in the yard, whereas this was a more common answer when people were answering if they were in the woods.
    - Through this grant work, we assisted UW-Madison researchers with a tick research project in our community. They completed tick drags in residents' yards located nearby parks and found that many yards had a high number of ticks. This also helped us prove that there is a high need to educate of the importance of prevention techniques, even when in your own yard (*See Appendix C*).
- Gardening was one of most common activities reported by respondents. Our grant team discussed that it may be worthwhile to do targeted outreach around gardeners/gardening clubs, since there is still a risk of ticks while gardening in a backyard.
- People seem to take care of their pets regarding Lyme disease prevention. Our grant team discussed that a strategy could be to give educational materials to veterinarians to hand out to owners about how they can prevent Lyme disease for themselves, as well as for their pets.
- DEET was the most commonly used insect/tick repellent. Physical barriers (i.e. long sleeves) was the second most common.
- 87% of respondent had been bitten by a tick before (tick attached to skin).
- Around 75% were worried about getting Lyme disease and felt at risk of getting it.
- From the survey, the grant team discussed importance of educating the public on signs and symptoms of Lyme disease. We know that protective behaviors differ by person and some people choose not to do them, so we need them to know the signs and symptoms, so they can go in and get treated sooner than later.

Educational Sign and Educational Materials

Grant team researched examples of other signs and worked with community partners to develop a sign that included tips on how to prevent Lyme disease. The sign also featured pictures of the different types of ticks found in our area. The sign was printed on metal and posted at trailheads and along the trails in our county and city parks, as well as at Beaver Creek Reserve. They were also laminated and hung up in other community locations. (*See Appendix D for sign*). Additional materials were created based with community partner feedback- a brochure and data sheet that talks through many kinds of tick repellent options (*See Appendix E*). The topic of alternative tick repellents was very popular with

our community members, community partners and the media. We didn't realize going into the grant that was the information our community was craving. We also purchased toilet stall cards and shower cards to place at our local park/campground restrooms and at Beaver Creek Reserve. (*See Appendix F for resources.*)

Social Media

Data from the community survey was used to inform the social media posts. Six posts were developed and shared via the Health Department's Facebook and Twitter accounts. Posts were also shared by community grant partners. Our most popular post featured local data on the number of ticks infected with Lyme disease. (*See Appendix G for social media posts and analytics*).

Tick Curriculum

Through the grant, we purchased multiple sets of the Tick Encounter Learning kit (*See Appendix F for resources*). We purchased a set to give to our partners at Beaver Creek Reserve and City of Eau Claire-Parks, Recreation & Forestry to incorporate into their curriculum. We also had a university student that contacted multiple elementary schools in our community and went to classrooms to teach the curriculum. Over 250 kids in total were taught over the grant year.

Our university student taught at the elementary school and did a short pre-post survey. She found that many, but not all, kids knew what Lyme disease was and some of the symptoms. At the end of the presentation, all kids felt they learned something about Lyme disease. It was very well received in the classroom.

Pre-post Survey used with Elementary school children

-How many kids know what Lyme disease is?

-How many kids know symptoms of Lyme disease?

-How many kids felt they learned something about Lyme disease (post-survey only)?

A few tips on using the tick learning kit in the classroom:

- When teaching 4th graders, it is important to emphasis their role in helping teach their families and other siblings. When asked if they will continue to share this knowledge and information with their families, many were eager to share. The stickers that say "Ask me how to stay tick smart" go over well because the 4th graders want to share their knowledge and show how much they know.
- The poppy seed bagels are always a big hit. It is important to emphasize why we are doing this activity (because the smaller ticks are the ones that carry Lyme disease and smaller ticks can be mistaken as a mole or freckle). A lot of good conversations were happening when these bagels were passed out because kids understood why they were participating.
- Student's personal experiences are important to talk about. Most students raise their hand when asked if they're familiar with Lyme disease. Personal stories help connect the content and they are better able to understand where it comes from and some symptoms associated with it. Lyme Disease Association, Inc. Lyme: Kids & Schools.
- Use PowerPoints and videos

Final Thoughts

Eau Claire County is fortunate to have many assets that help us move this 'data to action' Lyme disease project forward in the community.

- Strong student volunteer base: assisted with research and tick drags.
- Well-connected community and established relationships between community partners.
- Media's strong interest in this topic, driven by community.
- Support and expertise from the Environmental Public Health Tracking Team.

The Eau Claire community has seen many potential impacts due to this grant project.

- Increased community awareness of the prevalence of Lyme disease and the importance of prevention.
- Increased awareness of alternative tick repellents.
- Strengthened partnerships to increase knowledge and awareness of Lyme disease and Lyme disease prevention. This will help propel forward more work in our community.
- Survey data collected from community members about their knowledge, attitude and behaviors related to Lyme disease will help inform future education activities that will occur beyond this grant.
- Increased tick surveillance and data to continue driving "action" around Lyme disease.

Appendix A- Community Survey

The Eau Claire City/County Health Department is working with adjunct faculty from the University of Wisconsin-Milwaukee to measure the public's understanding of Lyme disease (adults 18+). The survey is about five minutes long, is completely voluntary, and all responses are confidential. Information gathered in this survey will be used to plan future outreach on Lyme disease. Risks in taking this survey are no greater than risks encountered in everyday life. By clicking the link, you consent to taking the survey.

If you have any questions about this survey, please contact Marisa Stanley at marisa.stanley@co.eau-claire.wi.us

Thank you!!

Demographics

1. **What is your age?**
   - o 18-24
   - o 25-34
   - o 35-44
   - o 45-54
   - o 55-64
   - o 65-74
   - o 75 or older

2. **To which gender do you most identify?**
   - o Male
   - o Female
   - o Other
   - o Prefer not to answer

3. **Highest level of education completed:**
   - o Less than high school
   - o High school or G.E.D
   - o Associate's degree
   - o Some college
   - o College graduate
   - o Post graduate degree

4. **Where do you live?**
   - o Eau Claire County
   - o Chippewa County
   - o Clark County
   - o Dunn County
   - o Buffalo County
   - o Pepin County
   - o Trempealeau County
   - o Jackson County
   - o Other county in Wisconsin
   - o Not in Wisconsin

Knowledge related to Lyme disease

5. The chance for tick bites is higher when the temperature is above 40 degrees.
   - o Yes
   - o No
   - o Not sure

5. People can get Lyme disease from tick bites only in the summer.
   - o Yes
   - o No
   - o Not sure

6. Using insect repellent does not protect against tick bites.
   - o Yes
   - o No
   - o Not sure

7. Putting clothing in the dryer for at least 10 minutes (or longer if clothes are wet) will kill any remaining ticks.
   - o Yes
   - o No
   - o Not sure

8. People can get Lyme disease after a tick bite.
   - o Yes
   - o No
   - o Not sure

9. A deer/bear tick has a higher chance of giving someone Lyme disease than a dog/wood tick.
   - o Yes
   - o No
   - o Not sure

11. What are the early signs and symptoms of Lyme disease? Check all that apply.
   - o Fever
   - o Chills
   - o Headache
   - o Fatigue
   - o Muscle and joint aches
   - o Swollen lymph nodes
   - o Bullseye rash
   - o All of the above

Preventative behaviors

12.

When participating in outdoor activities **in the yard,** I……	Frequently	Often	Sometimes	Seldom	Never	Not Applicable
wear light-colored clothing						
use insect/tick repellent on skin and/or clothing						
check my body for ticks afterwards						

13.

When participating in outdoor activities **in the woods or brushy areas,** I……	Frequently	Often	Sometimes	Seldom	Never	Not Applicable
wear light-colored clothing						
use insect/tick repellent on skin and/or clothing						
wear long pants						
tuck my pants into my socks						
check my body for ticks afterwards						

14. I have used the following as inspect/tick repellent (check all that apply)

- o DEET (Example: Off!)
- o Permethrin
- o Pre-treated tick repellent clothing
- o Picaridin
- o BioUD
- o IR3535 (Examples: Skinsosoft and Skinsmart)
- o Essential oils
- o Physical barriers (Examples: pants, long sleeve shirts, hat)
- o None
- o Other:

15. If you have pets, do you use insect/tick repellents on them?

- o Yes
- o Sometimes
- o No
- o Not Applicable

Lyme disease exposure

16. On average, I spend the following number of hours in my own or a yard each week during the...

	Number of hours per week					
Spring	Never	1-10 hrs	11-20hrs	21-30 hrs	30+ hours	Not applicable
Summer	Never	1-10 hrs	11-20hrs	21-30 hrs	30+ hours	Not applicable
Fall	Never	1-10 hrs	11-20hrs	21-30 hrs	30+ hours	Not applicable

17. Do you work outdoors?

18. What activities do you like to do outdoors?

19. Have you ever had a tick bite (tick is attached to skin)?

- o Yes
- o No
- o I'm not sure

20. Have you ever had Lyme disease?

- o Yes
  - **If yes—how many times?**
- o No
- o I'm not sure

Perceived risk

21.

	Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree	Not Applicable
I am worried about getting Lyme disease						
I am **NOT** at risk to get Lyme disease						

Park utilization

22. On average, how often do you visit the following locations in spring (March 20th-June 20th)?

	Daily	Weekly	Bi-weekly	Monthly	Once or twice a season
Phoenix park					
Carson park					
Eau Claire County Parks (i.e. Big Falls, Coon Fork, Harstad, Lake Altoona, Lake Eau Claire, L.L. Phillips or Lowes Creek)					
Beaver Creek Reserve					

23. On average, how often do you visit the following locations in summer (June 21st- Sept. 21st)?

	Daily	Weekly	Bi-weekly	Monthly	Once or twice a season
Phoenix park					
Carson park					
Eau Claire County Parks (i.e. Big Falls, Coon Fork, Harstad, Lake Altoona, Lake Eau Claire, L.L. Phillips or Lowes Creek)					
Beaver Creek Reserve					

24. On average, how often do you visit the following locations in fall (Sept 22nd –Dec. 20th)?

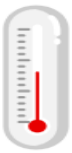
	Daily	Weekly	Bi-weekly	Monthly	Once or twice a season
Phoenix park					
Carson park					
Eau Claire County Parks (i.e. Big Falls, Coon Fork, Harstad, Lake Altoona, Lake Eau Claire, L.L. Phillips or Lowes Creek)					
Beaver Creek Reserve					

Appendix B- Community Survey Supplement

This was handed out after the community member took a survey at our outreach events. It gives correct answers to some of the questions that were on the survey.

Tick Bite Facts

Did you know: You can get Lyme disease from a tick bite

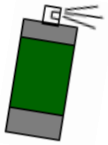


The chance for tick bites is higher when the temperature is above 40 degrees

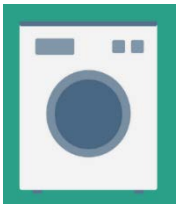
People can get Lyme disease from tick bites in spring, summer, and fall

EC

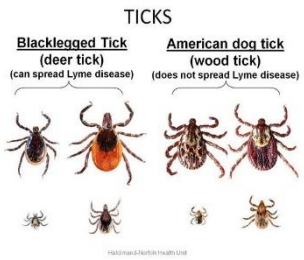
In Eau Claire, we see more of a peak with ticks in spring and fall



Using insect repellent protects against tick bites



Putting clothing in the dryer for at least 10 minutes (or longer if clothes are wet) will kill any remaining ticks



A deer/bear tick has a higher chance of giving someone Lyme disease than a dog/wood tick

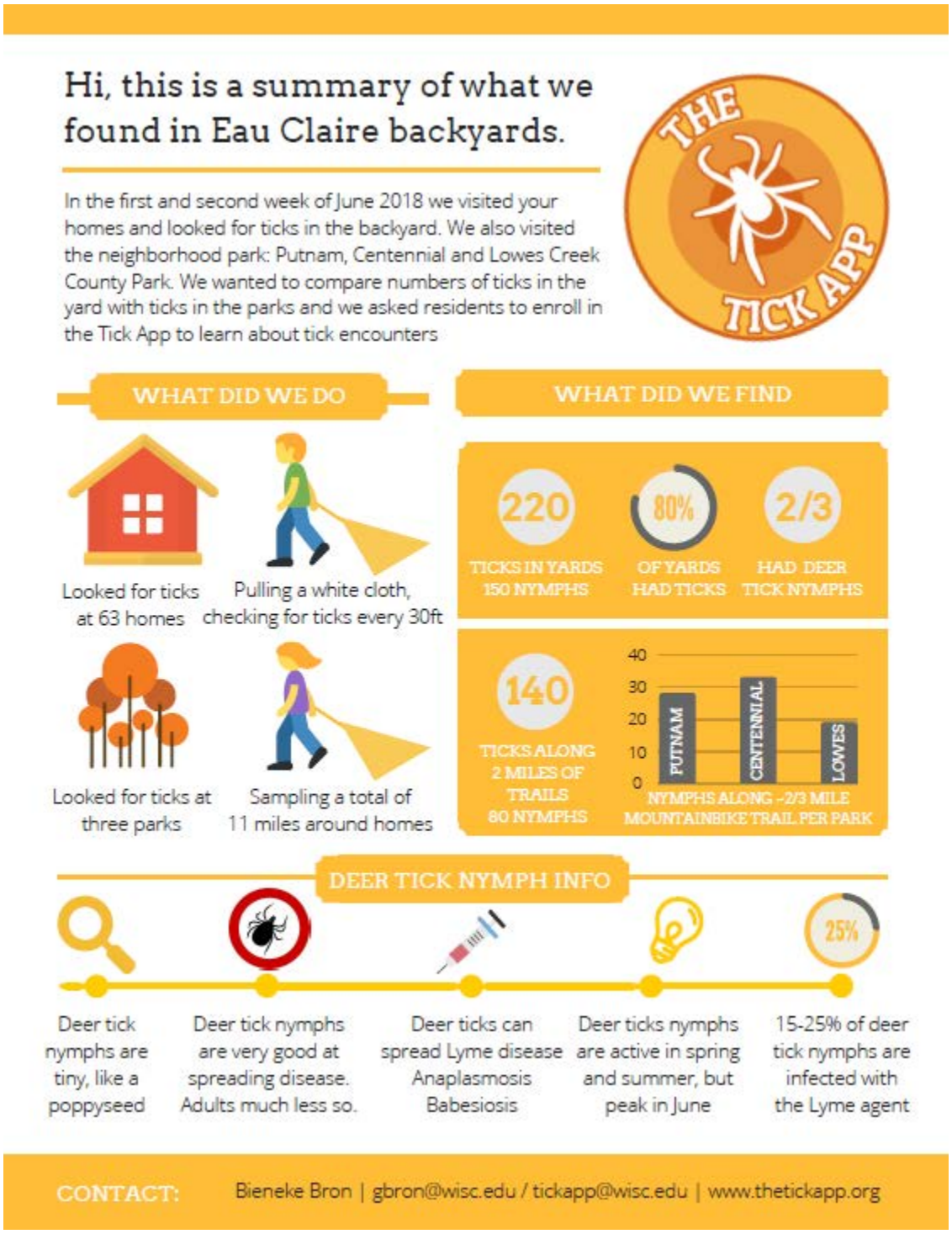
Early signs and symptoms of Lyme Disease include:

- Fever
- Chills
- Headache
- Fatigue
- Muscle and joint aches
- Swollen lymph nodes
- Bullseye rash

Eau Claire City-County Health Department

Appendix C- UW-Madison Research Summary

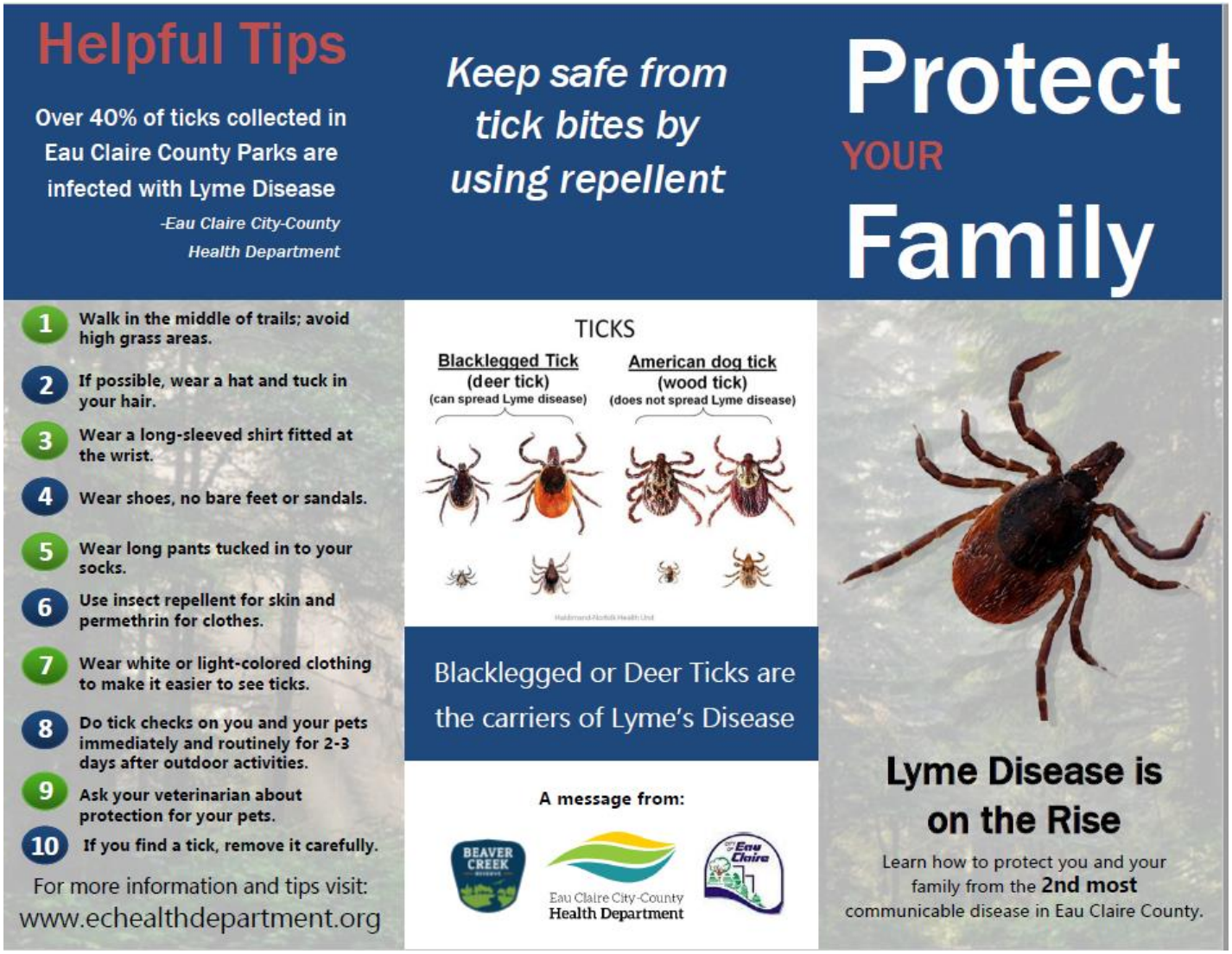
This is a copy of the letter sent to homeowners who participated in the UW-Madison tick drag research that occurred concurrently with our grant project tick drags. The letter shares the results of UW-Madison researchers' tick drags at 63 homes near Putnam, Centennial and Lowe's Creek County Parks, as well as at the three identified parks.



Appendix D- Tick Signage for Parks

Appendix E- Alternative Repellent Brochure

Page 1 of the tri-fold brochure



Page 2 of the tri-fold brochure

Types of Repellent

These repellents are proven to work well and be safe by the Environmental Protection Agency (EPA)

**When used as directed, EPA-registered insect repellents are proven safe and effective, even for pregnant and breastfeeding women.*

	Recommended Concentration	Apply to	Average Effectiveness	Additional Information
Permethrin	0.5%	Clothing ONLY	90%	Only repellent that KILLS ticks
DEET	20-50%	Skin/Clothing (may damage some clothing)	85%	Widely used in U.S. for 70+ years
Picaridin	20% or higher	Skin/Clothing	85%	Odorless
BioUD (2-undecanone)	1-2%	Skin/Clothing	90%+	Derived from wild tomato plant
IR3535 (SkinSoSoft)	20% or higher	Skin/Clothing (may damage some clothing)	85%	Odorless and gentle on skin
Oil of Lemon Eucalyptus (para-methane-diol)	Use a chemically synthesized version of the oil	Skin/Clothing	90%+	Derived from eucalyptus plants

Alternative Choice: Essential Oils

Essential Oils (Rosemary, geraniol, peppermint, thyme, lemongrass, cedar)	Varies based on type, application, and concentration	Skin/Clothing	Varies based on type, application, and concentration	Plant-based, some varieties shown as effective as DEET

Infants and Children

- Always supervise and help children apply repellents according to labeled directions.
- Use as directed in the graphic above. Apply to the hand and then rub onto clothing or skin.
- Repellents should NOT be used on infants under two months of age.

For more information and research about tick repellents, Lyme disease and the Eau Claire City-County Health Department Tick Collection Project, visit:

www.echealthdepartment.org

Tick Repellent Research Information

**Apply each repellent according to directions on the label.*
Note: This is not a full list of all research done around repellents.

DEET

What is DEET?
DEET is the chemical N,N-diethyl-meta-toluamide. DEET is the active ingredient in many repellents used against ticks. DEET is the most widely used and studied insect repellent. Repellents with DEET may come in sprays or mists, lotions and wipes; these are meant to be used on skin. It may damage plastic and some synthetic fabric clothing.

What should I know about how to use DEET safely?

- Make sure to read and follow the directions on the label.
- Avoid applying repellent on wounds or broken skin.
- Avoid breathing in, swallowing, or getting repellent into your eyes (DEET is toxic if swallowed).
    - Swallowing DEET may cause:
        - Nausea
        - Vomiting
        - Low blood pressure
        - Encephalopathy (disease that causes damage to brain)
        - Seizure
        - Coma
        - Ataxia (lack of muscle control during tasks such as walking, talking, and swallowing)

DEET and Children

- An adult should help children less than 10 years old apply repellent. Avoid applying around eyes and mouth of young children. The recommended %DEET for children is 10% to 30%.
    - Research has shown that children absorb more DEET than adults (because of the higher skin to body weight ratio).
    - With excessive exposure of several days to weeks, adults and especially children experienced:
        - Seizures
        - Slow heart rate
        - Nausea
        - Vomiting
        - Blistering
        - Lethargy (lack of energy/enthusiasm)

- Ataxia (lack of muscle control during tasks such as walking, talking, and swallowing)
- Encephalopathy (disease that causes damage to brain)
- Anaphylaxis (extreme allergic reaction)

Can DEET cause problems to my health?

- Negative health effects from limited exposure to a DEET product applied to the skin is rare.
  - Only 10 cases were reported in the 50 years that DEET has been available to the public.
  - None have been reported since 1992.
- One study was done using data from the American Association of Poison Control Centers, they looked 20,764 cases of DEET exposure and the side effects related to each.
  - They found that overall, children experienced more of the less severe outcomes and adults experienced more of the worst outcomes associated with an exposure.

How does DEET effect the environment?

The effect DEET has on the environment and the possible harm it may have is not completely known. Very few studies have been done on this topic, especially the long-term effects. The initial effects DEET has on the environment is better understood. One study found that over 65% of surface water contained a concentration of DEET. In that same study they found that DEET is slightly toxic to birds, fish and is practically nontoxic to small mammals. They found that the concentration in DEET would have to be 75,000 times the highest concentration reported in surface waters to have a significant impact of aquatic life. It is very unlikely that the levels of DEET would reach this naturally.

What should I know about the different concentration percentages (%) in DEET repellents?

- Products meant for the skin can range from 4-100% concentration
- The Centers for Disease Control and Prevention (CDC) recommend a concentration of 20% or higher. Concentrations above 50% give no added protection.

Where can I find more information on DEET?

Centers for Disease Control and Prevention: Agency for Toxic Substances & Disease Registry
https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=201

The insect repellents: A silent environmental chemical toxicant to the health**https://www.sciencedirect.com/science/article/pii/S1382668917300285**
By: Roy, DN; Goswarmi, R; Pal, A. From: The Journal of Environmental Toxicology and Pharmacology; Volume 50; Pages 91-102, Published: March 2017

Insect Precautions - Permethrin, Deet, and Picaridin-Is DEET safe? (Indiana University Bloomington- Health Center, Insect Precautions.)

DEET-based insect repellents: safety implications for children and pregnant and lactating women. Koren et al. http://www.cmaj.ca/content/169/3/209.full

Is there a risk associated with the insect repellent DEET (N,N-diethyl-m-toluamide) commonly found in aquatic environments? https://ac-els-cdn-com.proxy.uwec.edu/S0048969707006316/1-s2.0-S0048969707006316-main.pdf?_tid=87af01af-ebb0-4527-a5b9-2b578b125750&acdnat=1533133580_2f1e63a5b31deb809eb75db67c3a9fc3

The insect repellents: A silent environmental chemical toxicant to the health https://www-sciencedirect-com.proxy.uwec.edu/science/article/pii/S1382668917300285

Permethrin

What is permethrin?
Permethrin repels and kills tick. It is the only repellent that kills them. Permethrin can be found in pretreated clothing or in a spray that can be used on clothing. Could also be used to spray insect nets, sleeping bags, tents, or boots. It should not be applied directly on the skin.

How well does permethrin work?

- The Journal of Medical Entomology, 2011, Vol. 48(2), pp.327-333 research study found the following:
    - People who wore clothes that were treated with permethrin had 3.36 less tick bites than the people who wore clothing not treated with permethrin
    - People wearing permethrin-treated shoes and socks were 73.6% less likely to have tick bites than people who wore shoes and socks not treated by permethrin.
- The number of washes permethrin lasts depends on the product, read the label and follow directions given.

I have never heard of permethrin, is it safe?

- Permethrin is over 2,250 times more harmful to ticks than humans.
- When put directly on skin, usually less than 1% is absorbed into the body.
    - DEET is absorbed at over 20 times that rate.
- Permethrin-treated clothing for toddlers is not a concern of the Environmental Protection Agency (EPA).
- A person who weighs 140 pounds could be exposed to 32 grams of permethrin a day and not experience health effects.
    - An entire permethrin bottle of clothing treatment has less than 1 gram.

Can permethrin cause problems to my health?

- There are possible side effects if permethrin is breathed in, touches skin, or touches eyes. When in contact with skin, it may cause: skin tingling or numbness and mild reddening of skin.
- Possible side effects include:
    - Skin irritation, tingling, burning, or itching
    - Eye redness, pain, or burning
    - Irritation in nose and lungs
    - Difficulty breathing
    - Headaches
    - Dizziness
    - Vomiting

  *Do not use if allergic to Chrysanthemums (a popular plant in the daisy family).

Permethrin and the Environment

Permethrin is highly toxic to aquatic life and cats. Exercise caution and follow label warnings when using permethrin products if you have cats. Avoid using it on dogs who play with or are groomed by family cats. Don't use it around fish tanks or ponds either as it is toxic to fish. Permethrin-treated clothing poses no threat to cats once the product has dried.

Would permethrin be safe for my kids?

No current data was found related to an increased risk of side effects specifically to permethrin.

If I am pregnant or nursing, is it safe for me to wear permethrin treated clothing?

The Environmental Protection Agency (EPA) has found no evidence suggesting this would be a concern.

Where can I find more information on permethrin?

National Pesticide Information Center
http://npic.orst.edu/factsheets/PermGen.html#wildlife

Repellent Treated Clothing
https://www.epa.gov/insect-repellents/repellent-treated-clothing

Permethrin Fact Sheet: Did you know?
http://www.tickencounter.org/prevention/permethrin

BioUD

What is BioUD?
The active ingredient in BioUD is 2-undecanone, which comes from wild tomato plants. In 2007, BioUD was registered by the Environmental Protection Agency (EPA) as a mosquito and tick repellent.

How well does BioUD work?

- BioUD was tested and found to work well against three different groups of ticks in the Ixodes species (deer tick)
- Undiluted and 50% dilutions of BioUD were found to be more repellent against all three tick species when compared to 98.11% DEET.
- BioUD was found to work better than DEET against Lone Star ticks and Black-legged (deer) ticks.
- BioUD was found to work just as well as DEET against American Dog (wood) ticks.
- Further research is needed to see how BioUD and DEET compare in their effectiveness to repel ticks/mosquitos. BioUD needs to be further tested in the field environment. **(**Experimental and Applied Acarology, 2009, Vol. 48(3), pp. 239-250)

Can BioUD cause problems to my health?

- May be harmful if swallowed
- May cause mild eye irritation

Where can I find more information on BioUD?
Experimental and Applied Acarology, 2009, Vol. 48(3), pp. 239-250
https://link.springer.com/article/10.1007/s10493-008-9235-x

*Currently BioUD can only be purchased online. http://www.homs.com/bioud%C2%AE.html

Picaridin

What is picaridin?

Picaridin is an insect repellent that can be used against biting flies, mosquitoes, chiggers, ticks, and fleas. It is a synthetic (man-made) chemical first made in the 1980's. It is available as a lotion, pump spray and wipes. The spray has been found to be more effective than the lotion or wipes. It is odorless and doesn't damage plastics or clothing.

Does Picaridin work well?
Concentrations of 10% and 20% of Picaridin provide very high levels of protection for up to 12 hours against lone start ticks. Picaridin has been found to have better protection against ticks than DEET.

Can Picaridin cause problems to my health?

May cause irritation to the skin and eyes. It is practically non-toxic if inhaled. Less than 6% is absorbed into the skin.

Where can I find more information on picaridin?

Bissinger, B., Roe, R. (2010). Tick repellents: Past, present, and future. Pesticide Biochemistry and Physiology, 96(2), 63-79. https://ac-els-cdn-com.proxy.uwec.edu/S0048357509001412/1-s2.0-S0048357509001412-main.pdf?_tid=65cb0fc7-de59-43d2-8918-9b68b52d9f88&acdnat=1532533077_d151b1a8ba91b9954cd0132ece7674c1

Diaz, J. (2016). Chemical and Plant-Based Insect Repellents: Efficacy, Safety, and Toxicity. Wilderness & Environmental Medicine, 27(1), 153-163. https://www-clinicalkey-com.proxy.uwec.edu/#!/content/playContent/1-s2.0-S1080603215004342?returnurl=null&referrer=null&scrollTo=%23t0005

Gervais, J. A., Wegner, P., Luukinen, B., Buhl, K., Stone, D. (2009). Picaridin General Fact Sheet. National Pesticide Information Center, Oregon State University Extension Services. Retrieved from npic.orst.edu/factsheets/PicaridinGen.html

IR3535

What is IR3535?

IR3535 is a biopesticide that has been used in Europe since the 1970s and became available in the United States in 1999. It is an odorless repellent that is gentle on the skin. Available as an aerosol, lotion, pump spray or wipes. It may damage plastic and clothing.

Does IR3535 work well?

- One study showed IR3535 was more repellent than similar concentrations of DEET against deer tick nymphs.

Can IR3535 cause problems to my health?

- The Environmental Protection Agency (EPA) has no record of adverse effects, including since Europe started using IR3535 in the 1970s.
- IR3535 could cause eye irritation if it enters the eyes.

Where can I find more information about IR3535?

Bissinger, B., Roe, R. (2010). Tick repellents: Past, present, and future. Pesticide Biochemistry and Physiology, 96(2), 63-79. https://ac-els-cdn-com.proxy.uwec.edu/S0048357509001412/1-s2.0-S0048357509001412-main.pdf?_tid=65cb0fc7-de59-43d2-8918-9b68b52d9f88&acdnat=1532533077_d151b1a8ba91b9954cd0132ece7674c1

Diaz, J. (2016). Chemical and Plant-Based Insect Repellents: Efficacy, Safety, and Toxicity. Wilderness & Environmental Medicine, 27(1), 153-163. https://www-clinicalkey-com.proxy.uwec.edu/#!/content/playContent/1-s2.0-S1080603215004342?returnurl=null&referrer=null&scrollTo=%23t0005

IR3535 Fact Sheet- https://www3.epa.gov/pesticides/chem_search/reg_actions/registration/fs_PC-113509_01-Jan-00.pdf

Oil of Lemon Eucalyptus

What is Oil of Lemon Eucalyptus (OLE)?
Oil of Lemon Eucalyptus is made from an essential oil mixed with a chemical called PMD (p-MEnthane-3,diol). The repellent comes in the form of a spray or a lotion. It should not be used with children under the age of 3.

Is Oil of Lemon Eucalyptus oil the same of Lemon Eucalyptus essential oil?

- No. They are different. The lemon eucalyptus essential oil has a trace of PMD (the long acting repellent). This makes the essential oil not as effective because there is such a small amount of PMD in it.
    - In comparison, oil of lemon eucalyptus has between 64-100% PMD (the long acting repellent). Therefore, oil of lemon eucalyptus is much more effective than the lemon eucalyptus essential oil.
    - Oil of lemon eucalyptus is a more natural repellent, however PMD can be synthetic (man-made).

Does Oil of Lemon Eucalyptus work well?
It may offer better protection against ticks than DEET. However you have to reapply more often. Oil of lemon eucalyptus offers about 2 hours of full protection. Doesn't usually have the same lasting power as 20-50% concentrations of DEET, which offers about 5 hours of full protection.

Can Oil of Lemon Eucalyptus cause problems to my health?
Studies show the only adverse effect is eye irritation when the product gets into someone's eyes. When used according to label, an Oil of Lemon Eucalyptus product is not expected to cause health problems, including children (3+ years) and sensitive populations.

Where can I find more information about Oil of Lemon Eucalyptus?
Bissinger, B., Roe, R. (2010). Tick repellents: Past, present, and future. Pesticide Biochemistry and Physiology, 96(2), 63-79. https://ac-els-cdn-com.proxy.uwec.edu/S0048357509001412/1-s2.0-S0048357509001412-main.pdf?_tid=65cb0fc7-de59-43d2-8918-9b68b52d9f88&acdnat=1532533077_d151b1a8ba91b9954cd0132ece7674c1

Diaz, J. (2016). Chemical and Plant-Based Insect Repellents: Efficacy, Safety, and Toxicity. Wilderness & Environmental Medicine, 27(1), 153-163. https://www-clinicalkey-com.proxy.uwec.edu/#!/content/playContent/1-s2.0-S1080603215004342?returnurl=null&referrer=null&scrollTo=%23t0005

Heid, M. (2013, June 18). Is Oil of Lemon Eucalyptus as effective as DEET or Picaridin? Retrieved from https://www.outdoors.org/articles/amc-outdoors/is-oil-of-lemon-eucalyptus-as-effective-as-deet-or-picaridin

Humphries, S. (n,d). Mosquito repellents: 'Lemon Eucalyptus Oil' is not 'Oil of Lemon Eucalyptus'! Retrieved from http://www.hebebotanicals.co.nz/mosquito-repellents/

p-Menthane-3,8-diol (Oil of Lemon Eucalyptus) Fact Sheet https://www3.epa.gov/pesticides/chem_search/reg_actions/registration/fs_PC-011550_01-Apr-00.pdf

Essential Oils

Do essential oils work well as a tick repellent?
Many natural products and essential oils have the potential to work well and be safe for use, however more research needs to be done. Researched oils include: rosemary, geraniol, peppermint, thyme, lemongrass, and cedar. Effectiveness varies based on type, application and concentration.

Where can I find more information on this research?
Ability of Two Natural Products, Nootkatone and Carvacrol, to Suppress *Ixodes scapularis* and *Amblyomma americanum* (Acari: Ixodidae) in a Lyme Disease Endemic Area of New Jersey

http://www.bioone.org/doi/pdf/10.1603/029.102.0638

Repellent Activity of Fractioned Compounds from *Chamaecyparis nootkatensis* Essential Oil Against Nymphal *Ixodes scapularis* (Acari: Ixodidae)

https://academic.oup.com/jme/article-abstract/43/5/957/873494?redirectedFrom=fulltext

Biocidal Activity of Three Wood Essential Oils Against *Ixodes scapularis* (Acari: Ixodidae), *Xenopsylla cheopis* (Siphonaptera: Pulicidae), and *Aedes aegypti* (Diptera: Culicidae)

http://www.bioone.org/doi/pdf/10.1603/0022-0493%282007%29100%5B622%3ABAOTWE%5D2.0.CO%3B2

What would I learn if I read these studies?

These studies show us that many natural products and essential oils have the potential to work well and be safe for use. However, more research must be done. Most of these studies were performed in a lab and not out in the "real world". Research is needed to know if essential oils will work well and be safe when used out in the "real world".

Additional Information

- **Information on Lyme Disease from Centers for Disease Prevention and Control (CDC)**
  https://www.cdc.gov/features/lymedisease/index.html

- Information on Ticks, Research by Dr. Paskewitz from UW-Madison
  - http://mcevbd.wisc.edu/partners/university-of-wisconsin-madison/dr-susan-paskewitz

- **Best repellent for you?**
  - https://www.epa.gov/insect-repellents/find-repellent-right-you

- **At this link you can search to see if your specific repellent is EPA approved:**
  - https://www.epa.gov/insect-repellents/find-repellent-right-you#search tool

Appendix G- Additional Resources

- **Tick Encounter-** We purchased the tick learning kit, toilet stall signs, and shower signs from this company.
    - https://tickencounter.org/ticksmart/products

- **Wisconsin Department of Health Services-** We ordered free Lyme disease prevention and tick removal bookmarks (in English and Spanish), Lyme disease- what you need to know brochures, and tick safety guides (in English and Spanish).
    - https://www.dhs.wisconsin.gov/tickborne/index.htm

- **Wisconsin Department of Health Services tick prevention video-** We shared this on our social media accounts.
    - https://www.youtube.com/watch?v=G0XKzRNSvUc

- **Wisconsin Ticks and Tick-borne diseases- Susan Paskewitz's website.** This is a helpful website that contains much information about ticks in Wisconsin.
    - http://labs.russell.wisc.edu/wisconsin-ticks/
    - http://labs.russell.wisc.edu/wisconsin-ticks/on-people/ - this page specifically shows additional information around tick repellents (including research studies).

- **Centers for Disease Control and Prevention Tick webpage.**
    - https://www.cdc.gov/ticks/index.html

- **BugBeWear- permethrin treated clothing.** We ordered permethrin-treated socks from here. Our community partner signed up for the Sock It To Lyme program to get socks at a discounted rate to put in their store at Beaver Creek Reserve.
    - https://www.bugbewear.com/

- **BioUD repellent.** To purchase BioUD, you must purchase online at their website.
    - http://www.bioud.com/

- **Environmental Protection Agency-** Information about choosing an Insect Repellent
    - https://www.epa.gov/insect-repellents/find-repellent-right-you
    - **At this link you can search to see if your specific repellent is EPA approved:** https://www.epa.gov/insect-repellents/find-repellent-right-you#search tool

***Additional note. We worked with Badger State Industries- Wisconsin's Prison Industry Program to create metal signs with our graphic that were ultimately posted on our trails. Using this program allowed us to buy signs at a much-reduced cost.** http://buybsi.com/

Appendix H- Social Media Posts and Public Service Announcements (PSA's)

Post Details

Eau Claire City-County Health Department
Published by Trish Chmelik [?] · April 26 ·

Did you know that heating your clothing in the dryer on high heat for 10 minutes (longer for wet clothes) can kill ticks? (Or that spring is the beginning of peak tick season?) Watch this short video to learn more tips for preventing Lyme disease--the second most common communicable disease in Eau Claire County! https://www.youtube.com/watch?v=G0XKzRNSvUc
Beaver Creek Reserve Eau Claire Parks, Recreation & Forestry

YOUTUBE.COM
Tips for Preventing Lyme Disease

982 people reached — Boost Unavailable

Trish Chmelik, Donald Sorenson and 3 others — 1 Comment 5 Shares

Like · Comment · Share

Performance for Your Post

982 People Reached

16 Likes, Comments & Shares

10 Likes	**5** On Post	**5** On Shares
1 Comments	**1** On Post	**0** On Shares
5 Shares	**5** On Post	**0** On Shares

54 Post Clicks

0 Photo Views	**12** Link Clicks	**42** Other Clicks

NEGATIVE FEEDBACK

0 Hide Post · **0** Hide All Posts
0 Report as Spam · **0** Unlike Page

Reported stats may be delayed from what appears on posts

Post Details

Eau Claire City-County Health Department
Published by Trish Chmelik [?] · May 3 ·

We need your help!
We are trying to figure out just how much the community knows about Lyme disease (the 2nd most common communicable disease in our community). Click the link below to take our quick survey! Thanks!!
https://www.surveymonkey.com/r/2DCQG2H
Beaver Creek Reserve Eau Claire Parks, Recreation & Forestry

SURVEYMONKEY.COM
Lyme Disease Survey 2018
Web survey powered by SurveyMonkey.com. Create your own online survey now with SurveyMonkey's expert certified FREE templates.

931 people reached — Boost Unavailable

Donald Sorenson — 7 Shares

Like · Comment · Share

Performance for Your Post

931 People Reached

10 Likes, Comments & Shares

2 Likes	**1** On Post	**1** On Shares
1 Comments	**0** On Post	**1** On Shares
7 Shares	**7** On Post	**0** On Shares

71 Post Clicks

1 Photo Views	**25** Link Clicks	**45** Other Clicks

NEGATIVE FEEDBACK

0 Hide Post · **0** Hide All Posts
0 Report as Spam · **0** Unlike Page

Reported stats may be delayed from what appears on posts

Post Details

Eau Claire City-County Health Department
Published by Buffer [?] · May 4 ·

NEWS RELEASE: Over 40% of ticks collected in Eau Claire parks infected with Lyme disease
Take a quick survey: https://www.surveymonkey.com/r/2DCQG2H
bit.ly/ec-newsrelease

Beaver Creek Reserve; Eau Claire Parks, Recreation & Forestry

2,147 people reached — Boost Unavailable

Aaron Fagen, Amanda Peters and 5 others — 14 Shares

Like · Comment · Share

Performance for Your Post

2,147 People Reached

25 Reactions, Comments & Shares

4 Like	2 On Post	2 On Shares
3 Wow	3 On Post	0 On Shares
2 Sad	2 On Post	0 On Shares
1 Comments	0 On Post	1 On Shares
15 Shares	14 On Post	1 On Shares

124 Post Clicks

70 Photo Views	9 Link Clicks	45 Other Clicks

NEGATIVE FEEDBACK

0 Hide Post	0 Hide All Posts
0 Report as Spam	0 Unlike Page

Reported stats may be delayed from what appears on posts

Post Details

Eau Claire City-County Health Department
Published by Trish Chmelik [?] · May 5 ·

Find us at Boyd Park TODAY for the #AmazingEauClaireCleanUp ! 🌳🌷🍀
Besides getting our hands dirty, we'll have a table with information on Lyme disease and an AMAZING prize basket ⬇ you can win! Stop by the Health Dept. table from 10:30am-12pm to sign up to win!
Beaver Creek Reserve Eau Claire Parks, Recreation & Forestry

Eau Claire City-County Health Department
Government Organization

Send Message

373 people reached

Boost Unavailable

ElizaBeth Lucas Draeger, Charlotte Nellessen and 7 others

Like Comment Share

Performance for Your Post

373 People Reached

9 Likes, Comments & Shares

9 Likes	**9** On Post	**0** On Shares
0 Comments	**0** On Post	**0** On Shares
0 Shares	**0** On Post	**0** On Shares

8 Post Clicks

2 Photo Views	**0** Link Clicks	**6** Other Clicks

NEGATIVE FEEDBACK

0 Hide Post **0** Hide All Posts
0 Report as Spam **0** Unlike Page

Reported stats may be delayed from what appears on posts

Post Details

Eau Claire City-County Health Department
Published by Buffer [?] · May 16 ·

Did you know that only deer/bear ticks can transmit Lyme disease? And that over 40% of these ticks collected from our local parks tested positive for Lyme disease? Check out this picture to help you know what they look like...and for tips to avoid their bite! Beaver Creek Reserve Eau Claire Parks, Recreation & Forestry

2,398 people reached — Boost Unavailable

Denise Triplett, Kim Sharp and 5 others — 2 Comments 20 Shares

Like Comment Share

Performance for Your Post

2,398 People Reached

53 Likes, Comments & Shares

28 Likes	7 On Post	21 On Shares
5 Comments	2 On Post	3 On Shares
20 Shares	20 On Post	0 On Shares

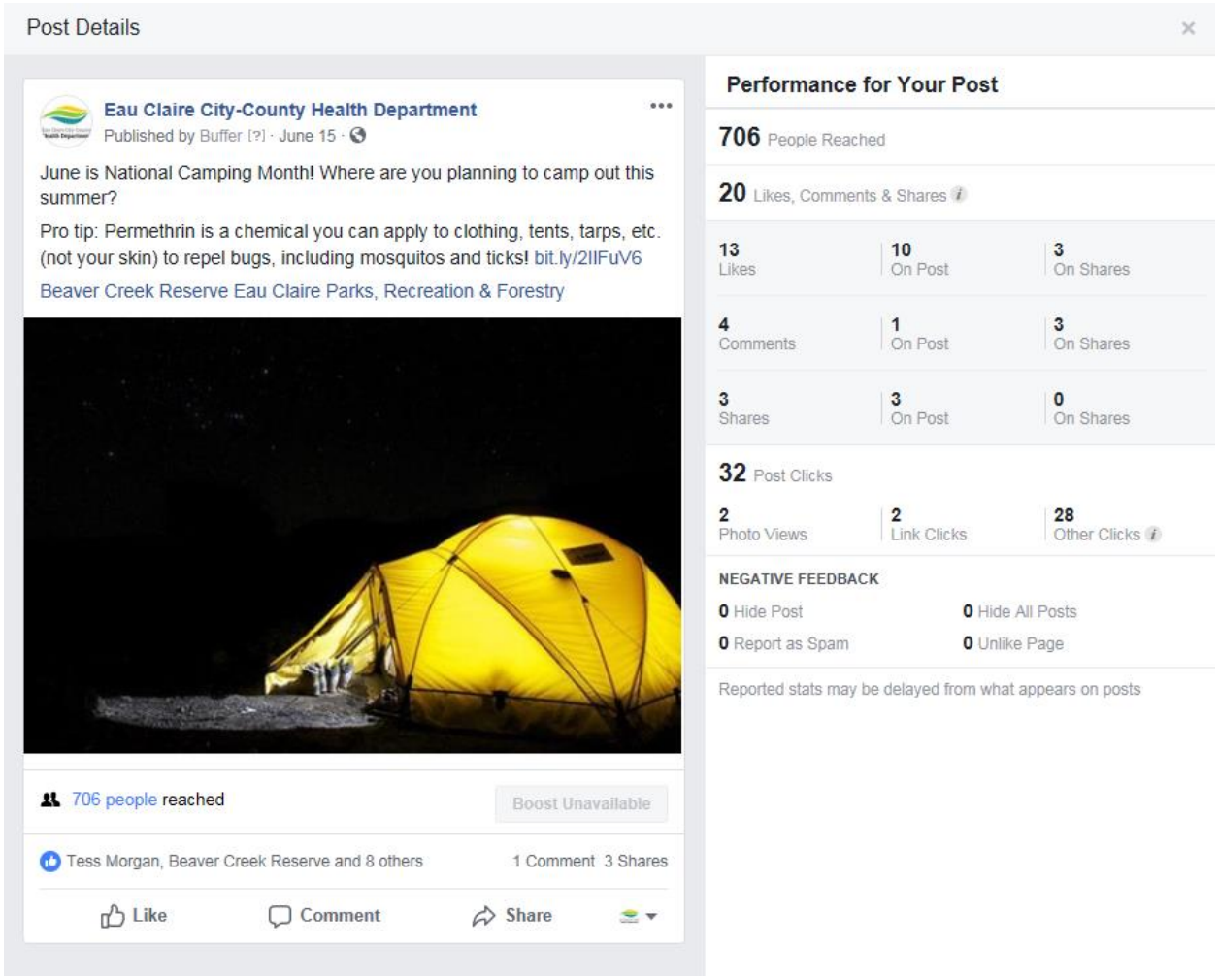
254 Post Clicks

130 Photo Views	0 Link Clicks	124 Other Clicks

NEGATIVE FEEDBACK

1 Hide Post	0 Hide All Posts
0 Report as Spam	0 Unlike Page

Reported stats may be delayed from what appears on posts



Lyme Disease Public Service Announcements PSA's
PSA #1- "The bite from one tiny deer tick can cause big problems. Don't let it happen to you. Early summer is when deer ticks are most active spreading Lyme disease and other diseases. So fight the bite by using insect repellant and check yourself for ticks, after being in wooded or brushy areas. This message brought to you by The Eau Claire City-County Health Department."
PSA #2- "Warmer weather in Wisconsin means deer ticks are now feeding in a wooded area near you. Fight the bite. To avoid Lyme disease and other diseases from deer ticks, use insect repellant. This message is brought to you by the Eau Claire City-County Health Department."