

Understanding and Preventing Tick-Borne Diseases



Susan Rask, M.S., R.S
Concord Public Health Director

Understanding and Preventing Tick-Borne Diseases

Tick Facts and Life Cycle

Tick-borne diseases in our area

- Lyme Disease
- Anaplasmosis
- Babesiosis
- Other emerging diseases

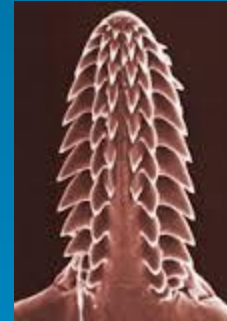
Prevention for Strategies for Humans and Pets

- Tick-borne diseases are preventable—
knowledge is power

What are Ticks?

Ticks are ectoparasites...feeding on the blood of a large group of animals







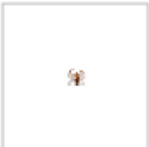






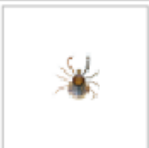
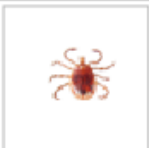
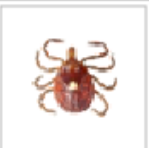



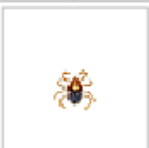
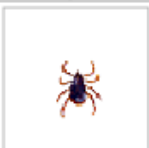
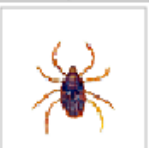
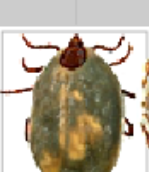

- Mammals
- Birds
- Reptiles
- Amphibians



Unlike mosquitoes that feed quickly, ticks are designed to stay a while.

The barbed hooks on their mouthpart, called a hypostome, are the reason why ticks cannot just be brushed off.

Ticks in New England

Species	Larva	Nymph	Male	Female	Partially Fed Female	Fully Fed Female
Deer Tick <i>Ixodes scapularis</i>						
Dog Tick <i>Dermacentor variabilis</i>						
Lone Star Tick <i>Amblyomma americanum</i>						
Brown Dog Tick <i>Rhipicephalus sanguineus</i>						

Deer ticks

 TickEncounter Resource Center ***Ixodes scapularis* (Blacklegged ticks or Deer ticks)**



Larva



Nymph



Adult Male

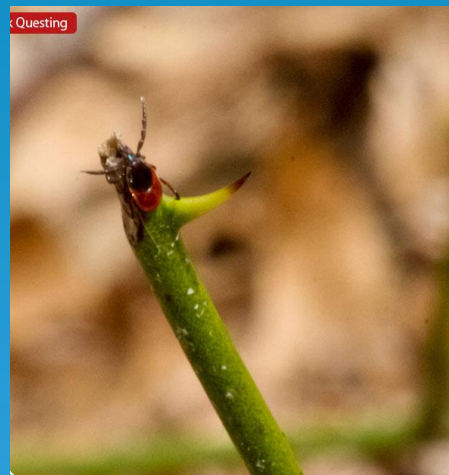


Adult Female

Tick Ambush Behavior – Questing

- Blacklegged ticks search for a host from the tips of low-lying vegetation and shrubs, not from trees.
- Generally, ticks attach to a person or animal near ground level, then climb up.

Designed to latch onto any creature that brushes up against it



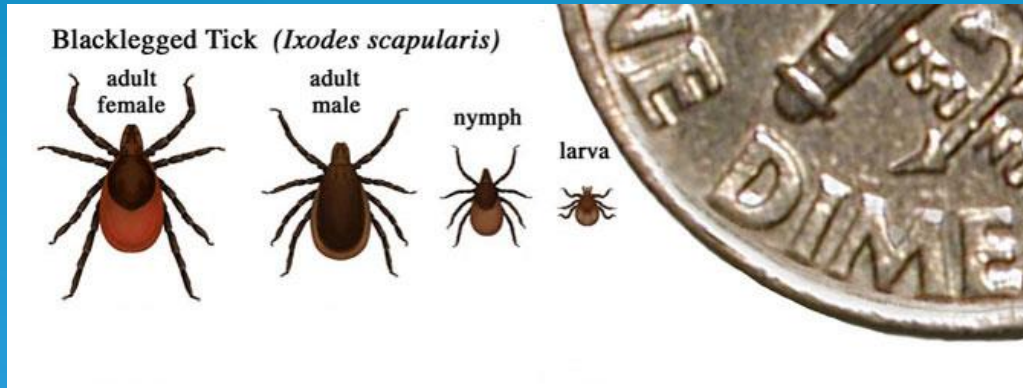
Deer Ticks SIZE WISE ? check your bagels

● Adult – Sesame Seed Sized

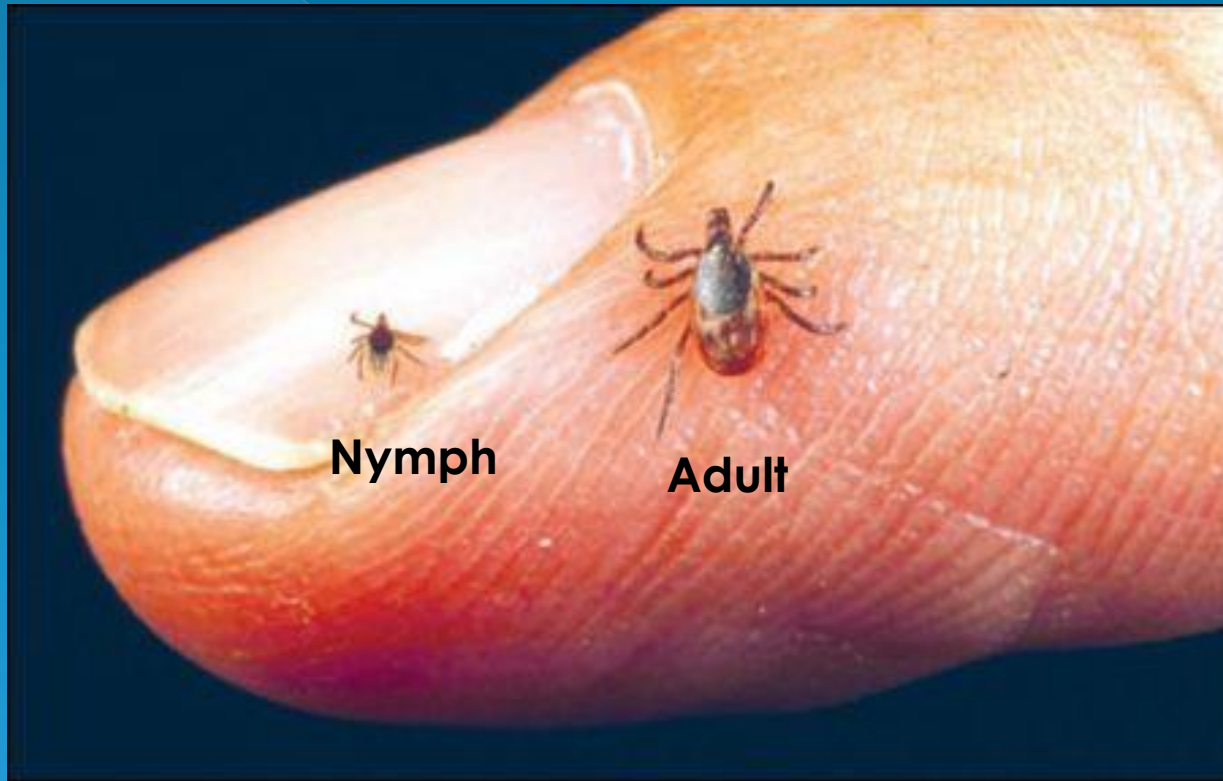
- > Male (Black)
- > Female (Black/Red)



● Nymph – Poppy Seed Sized



Deer Tick Size



Deer Tick Habitat



- Deer ticks live in wooded, brushy areas that provide food and cover for white-footed mice, deer and other mammals.
- This habitat also provides the **humidity** ticks need to survive.
- Exposure to ticks may be greatest in the woods (especially along trails) and the fringe area between the woods and border.
- Our neighborhoods have encroached into deer tick habitat

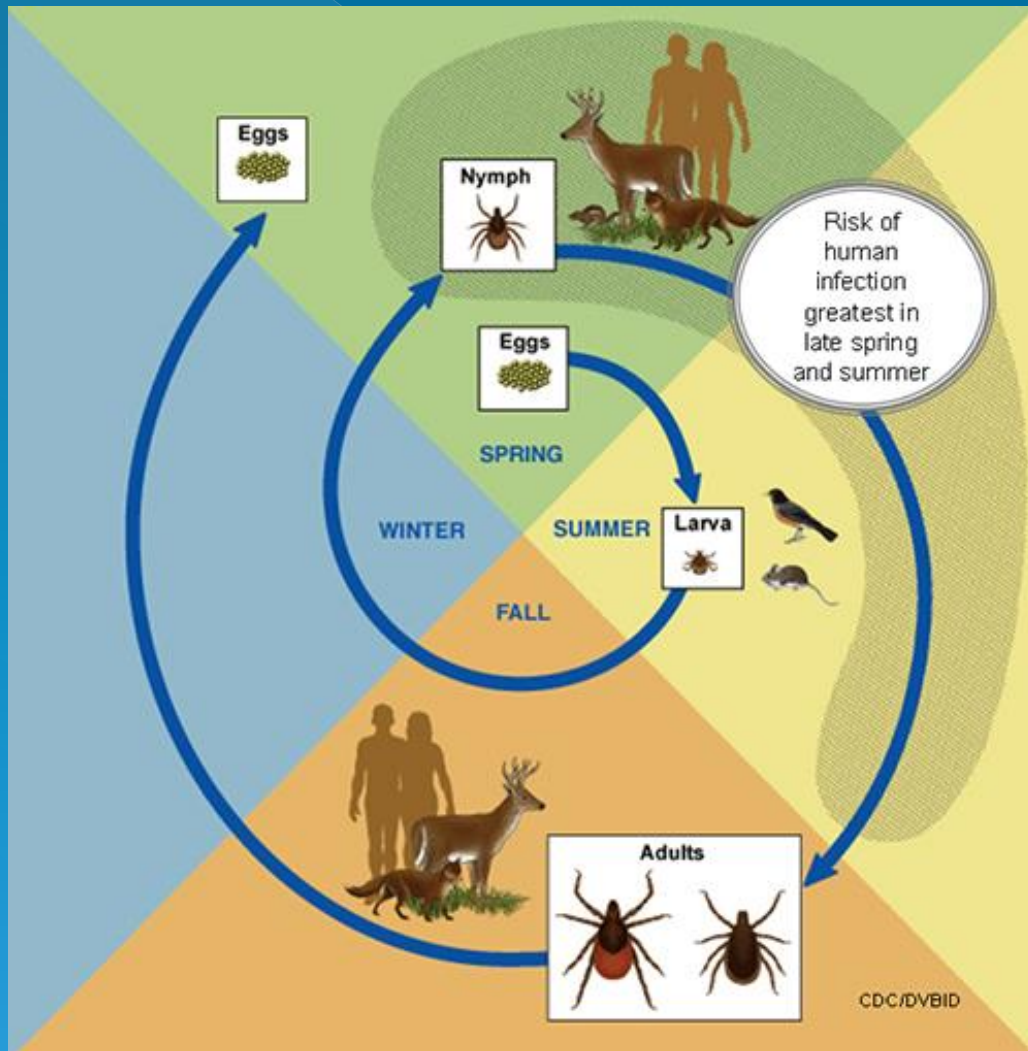


Deer Tick Life Stages

1. **Four Stages – Egg, Larva, Nymph & Adult**
2. **Two year life cycle**
3. **Ticks feed only ONCE as a Larva, Nymph & Adult...3 meals total**



Tick Life cycle



The Lyme Disease Cycle

1. Larval ticks feed and acquire the disease from an infected host such as a mouse or a bird.
2. Nymph ticks retain and transmit the disease back to mice and birds—and HUMANS.
3. Deer and other larger vertebrates (including HUMANS) provide the blood meal for adult female ticks to lay 2,000+ eggs

The greatest risk of infection...

is **NOT** from the deer tick adults

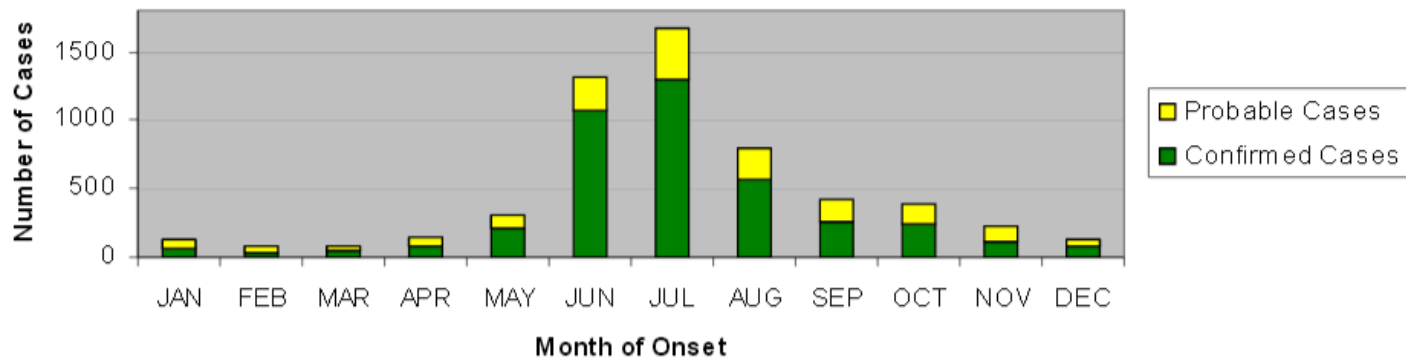
- Most active Fall and Spring
- About 50% carry Lyme
- Attach and feed 6-7 days
- Bite is more likely to be detected

...it's from the nymph stage

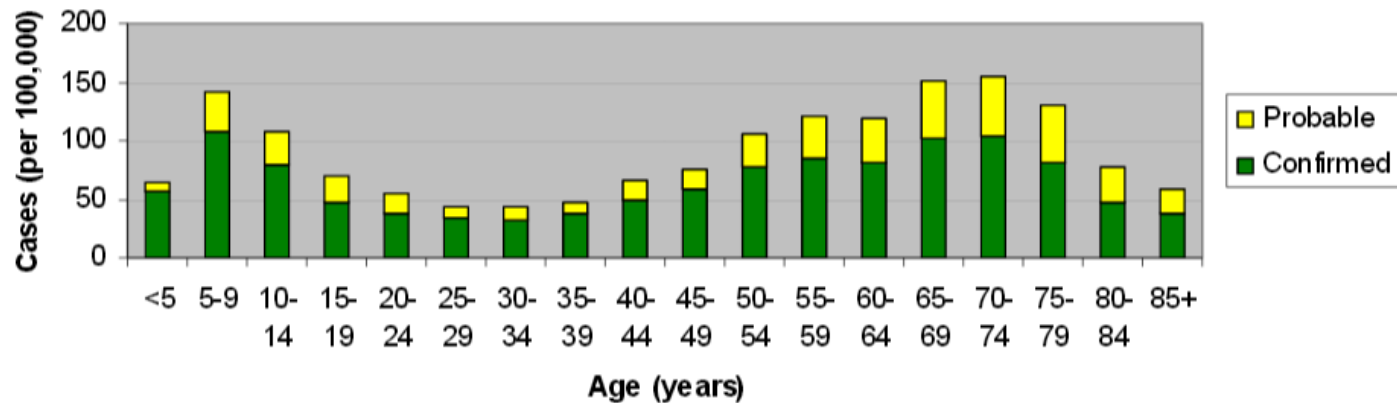
- Late May into August
- About 20% carry Lyme
- Attach and feed 4-5 days
- Bite is difficult to detect



Number of Confirmed and Probable Lyme Disease Cases Reported in Massachusetts by Month of Onset, 2013



Incidence Rates of Confirmed and Probable Lyme Disease Cases in Massachusetts by Age Group, 2013



Tick Borne Diseases in Massachusetts

- Lyme Disease
- Babesiosis
- Anaplasmosis (HGA)

- Powassan Virus
- Borrelia miyamotoi illness
- Tularemia
- Lone Star tick

What are Tick-borne diseases?

Lyme Disease

Lyme disease is a bacterial illness, caused by *Borrelia burgdorferi*, and is transmitted by the bite of an infected deer tick.

Discovered in 1975 in Lyme, Connecticut. It was known as a “condition” since the late 1800’s.

The shape of this bacteria gives it the classification of a Spirochete.



US Centers for Disease Control

Reported Cases of Lyme Disease -- United States, 2001



1 dot placed randomly within county of residence for each reported case

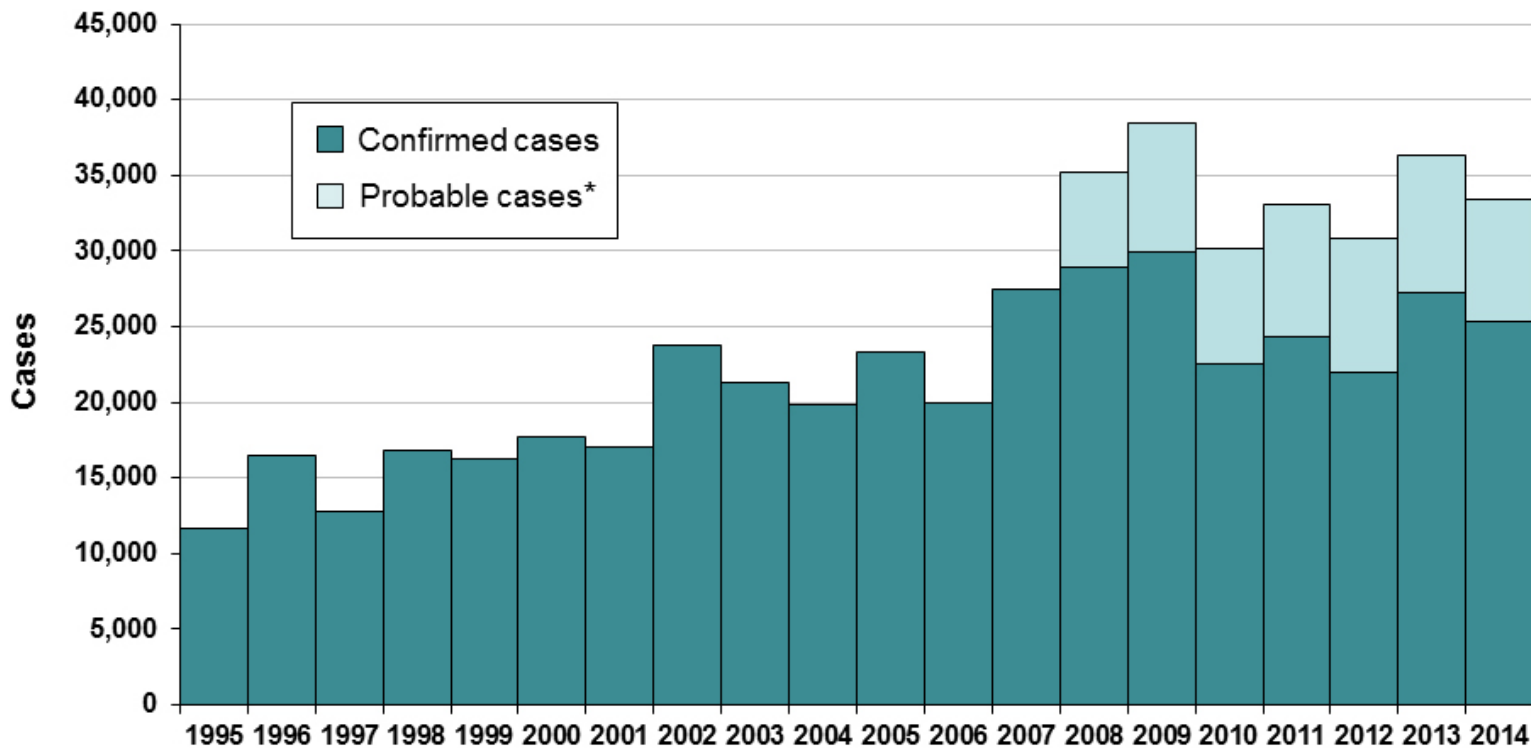
Reported Cases of Lyme Disease -- United States, 2012



1 dot placed randomly within county of residence for each confirmed case

Lyme disease has spread significantly throughout the Northeast and Upper Midwest over the past 15 years

US Centers for Disease Control



Lyme Disease cases nationwide, 1995-2014



Lyme is the second most prevalent infectious disease in MA (only Hepatitis C is higher)

Massachusetts Lyme Disease picture

source: MDPH

County	2013 Confirmed Cases (#)	2013 Probable Cases (#)	Combined Incidence Rate for Confirmed and Probable Cases
Barnstable	186	88	127
Berkshire	84	46	99
Bristol	413	162	105
Dukes	32	38	423
Essex	405	154	75
Franklin	51	20	100
Hampden	167	57	48
Hampshire	112	35	93
* Middlesex	720	267	66
Nantucket	47	16	619
Norfolk	460	150	91
Plymouth	631	233	175
Suffolk	81	49	18
Worcester	480	194	84
Unknown	211	76	-
State Total	4,080	1,585	65.09

Incidence rate =
cases per
100,000
population

Lyme Disease-- Early Signs and Symptoms (3 to 30 days after tick bite)

- Fever, chills, headache, fatigue, muscle and joint aches, and swollen lymph nodes
- Bull's eye rash *possible* but does not always occur

Take Home Message:

If you have any of these symptoms in summer, even if you don't know you've been bitten by a tick—seek medical attention



Centers for Disease Control and Prevention, <http://phil.cdc.gov/phil/>

Lyme Disease-- Early Signs and Symptoms

- Erythema migrans “Bull’s eye” rash:
 - Occurs in approximately 70 to 80 percent of infected persons
 - Begins at the site of a tick bite after a delay of 3 to 30 days (average is about 7 days)
 - Expands gradually over a period of days reaching up to 12 inches or more (30 cm) across
 - May feel warm to the touch but is rarely itchy or painful
 - Sometimes clears as it enlarges, resulting in a target or “bull's-eye” appearance
 - May appear on any area of the body



© Yevgeniy Balagula, Dermatlas: <http://www.dermatlas.org>



© Taryn Holman, Dermatlas: <http://www.dermatlas.org>



© Bernard Cohen, Dermatlas: <http://www.dermatlas.org>

Other Tick-borne Diseases

● Babesiosis

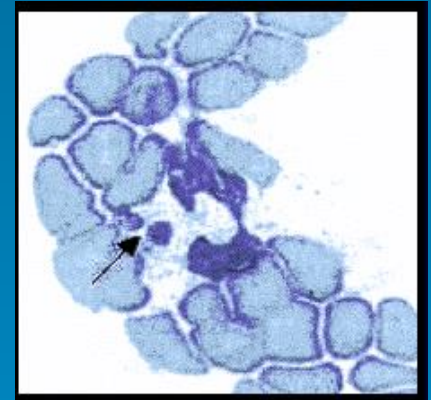
- Protozoan type pathogen
- Invades red blood cells (Malaria-like)

- Nonspecific flu-like symptoms, such as fever, chills, sweats, headache, body aches, loss of appetite, nausea, or fatigue.

- Babesiosis can be a severe, life-threatening disease, particularly in people who:
 - > do not have a spleen;
 - > have a weak immune system for other reasons (such as cancer, lymphoma, or AIDS);
 - > have other serious health conditions (such as liver or kidney disease); or
 - > **are elderly.**

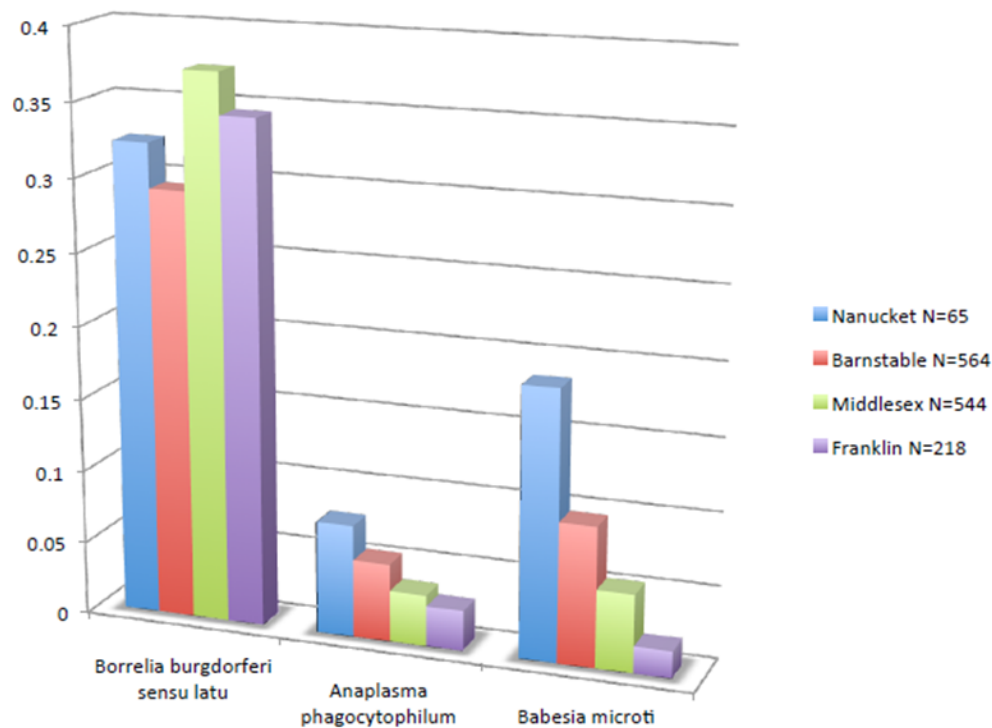
Other Tick-borne Diseases

- Human Granulocytic Anaplasmosis (HGA)
- Rickettsial type pathogen
- Invades white blood cells
- Symptoms include: fever, nausea, malaise-indistinct



2014 Tick Testing results

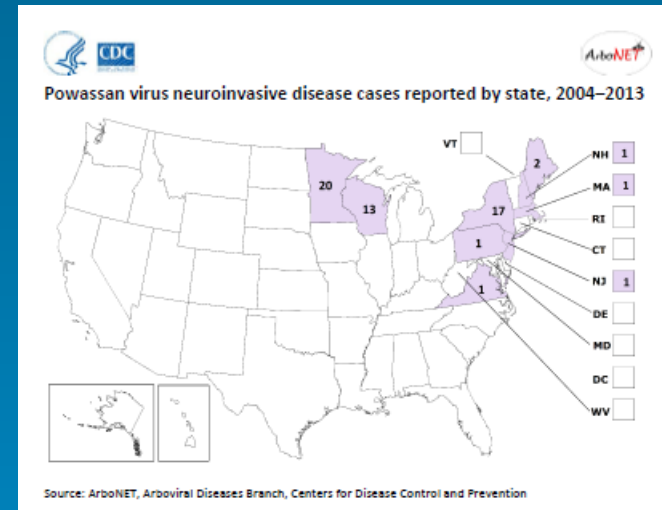
Figure X.3. Rates of infection of *Ixodes scapularis* ticks submitted from CIC participants in 2014. While *B. burgdorferi* infection rates are relatively uniform, there are drastic differences in infection rates with the other pathogens between counties.



Other Tick-borne Diseases

● Powassan virus

- Emerging disease
- Approximately 60 cases of POW virus disease in US over the past 10 years, mostly cases have occurred in the Northeast and Great Lakes region. Recently found in Maine.
- Symptoms include fever, headache, vomiting, weakness, confusion, seizures, and memory loss. Long-term neurologic problems may occur.



Other Tick-borne Diseases

● *Borellia miyamotoi*

- *Borrelia miyamotoi* is a species of spiral-shaped bacteria that is closely related to the bacteria that cause tick-borne relapsing fever (TBRF). It is more distantly related to the bacteria that cause Lyme disease.
- **Emerging disease in Massachusetts**
- Symptoms include fever, chills, and headache. Other common symptoms included body and joint pain and fatigue. Unlike Lyme disease, rash was uncommon, presenting in only 4 out of 51 patients.

Other Tick-borne Diseases

● Tularemia

- Ticks that transmit tularemia to humans include
 - > Dog tick (*Dermacentor variabilis*),
 - Wood tick (*Dermacentor andersoni*),
 - > Lone star tick (*Amblyomma americanum*)
- Cases on Martha's Vineyard and Nantucket
- Symptoms: Swelling of regional lymph glands, usually in the armpit or groin. A skin ulcer may appear at the site of the tick bite.

Other Tick-borne Diseases

● Lone Star Tick

- Southern tick that is now spreading to Massachusetts; definitely on Cape Cod and Islands
- Adult female is distinguished by a white dot or “lone star” on her back.
- A very aggressive tick that bites humans.
- Can cause erlichiosis (similar to HGA), tularemia and STARI (southern tick-associated rash illness)



Tick-borne diseases are preventable!

- Insect repellents for skin
- Permethrin-treated clothing
- Daily tick checks
- Landscaping/backyard interventions
- Awareness of disease symptoms and prompt medical attention



Can Prevent Tick-borne Diseases

Insect Repellents

- Repellents play an integral part in your personal protection strategy.
- Use DEET based products
- DEET comes in 2 strengths:
 - > 7 % effective for mosquitos only
 - > **>20% effective for ticks**
- Botanical/organic repellents—
effectiveness varies— see handout
oil of lemon eucalyptus, picaridin



Insect Repellents

- ⦿ BUT, BE AWARE--Repellents containing DEET are not sufficient to protect against tick bites.
- ⦿ DEET only repels ticks to areas where they could bite and even that little protection does not last long.
- ⦿ The best protection you can achieve is by using a repellent that contains Permethrin on your clothes and one that contains DEET for your skin.

Tick Repellent Clothing

- Clothing treated with permethrin provides long lasting tick bite protection.
- Permethrin kills ticks on contact
- Odorless, invisible
- Lasts through approx. 70 washings



Permethrin Facts—is it safe?

- Permethrin is more than 2500 times more toxic to ticks than humans.
- EPA: Reasonable certainty that permethrin-treated clothing poses no harm to infants or children
- If put directly on skin, absorption is <1%
- A 140-pound person would have no adverse health effects if exposed to 32 grams of permethrin per day. There is less than 1 gram of permethrin in one container of clothing treatment spray.
- Source: www.tickencounter.org at University of Rhode Island

Sources of Tick Repellent Clothing

Did you know you can turn your own favorite clothes into tick repellent clothes?



Professionally treated with an invisible, odorless, EPA registered, tick repellent (permethrin) that remains effective through 70 washes! Service performed by Insect Shield. Click image above for more information.

Insect Shield - Casual Wear

<http://www.insectshield.com/work/Casual-Wear-C18.aspx>

L.L.Bean - Insect-repellent apparel

<http://www.llbean.com>

REI - Outdoor clothing products available on-line

<http://www.rei.com>

Gamehide - "ElimiTick" tick repellent clothing

<http://www.gamehide.com/>

Sawyer - Treat your own

<http://www.sawyer.com/bugs.html>

Tick Block - Treat your own

<http://www.tickblock.com/>

Columbia - Insect Blocker clothing

<http://www.columbia.com/Insect-Blocker>

Go to
www.insectshield.com for
instructions and to order

Tick/Insect Repellent Clothing – Do-it-Yourself Treatment



Permethrin products available retail and on-line

Fabric only...not exposed skin. Active through 6 washings.

Sold under a variety of brand names.

– *Permanone, Repel, Sawyers & Duranon*

Note, Permethrin is an insecticide that repels and kills ticks. Read the Label...

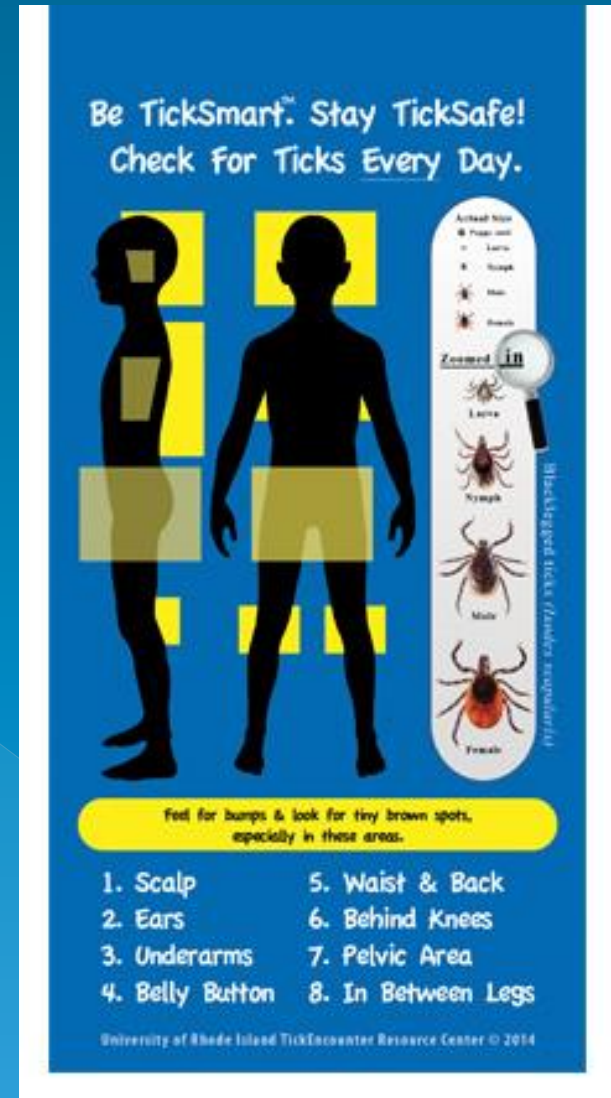
If you don't want to use tick-repellent clothing-----

- Have a set of clothes you use for yard work or trail walking
- DRY CLOTHES FIRST - THEN WASH
- Most ticks are VERY sensitive to dryness. After working in the yard strip clothing off and throw it in a **hot dryer for 15 min.** after wearing
- Washing clothes does not always kill ticks 😞
- Clothing just left in the hamper or on the floor may put the next person to touch it at risk.



Daily Tick Checks

- Ticks need to be attached >24 hrs. to transmit disease.
- The simplest way to protect yourself is to remove a tick before it has a chance to transmit disease-causing pathogens.
- Ticks can attach anywhere, in particular, they will find spots like: the back of your knee, around waistbands, under armpits or any other constricted place.
- Anytime after you have been in tick habitat you should thoroughly check your entire body and remove attached ticks immediately.
- Once attached, ticks DO NOT wash off in the shower



Deer Tick Habitat



- Deer ticks live in wooded, brushy areas that provide food and cover for white-footed mice, deer and other mammals.
- This habitat also provides the humidity ticks need to survive.
- Exposure to ticks may be greatest in the woods (especially along trails) and the **fringe area between the woods and border.**
- Our neighborhoods have encroached into deer tick habitat



Deer Tick Habitat Prevention Strategies

- Landscaping controls—Reduce Tick Habitat
- Perimeter Sprays and Granules
- Mouse Targeted Devices--Tick tubes
- Do not attract Wildlife

Reduce Tick Habitat in Your Yard

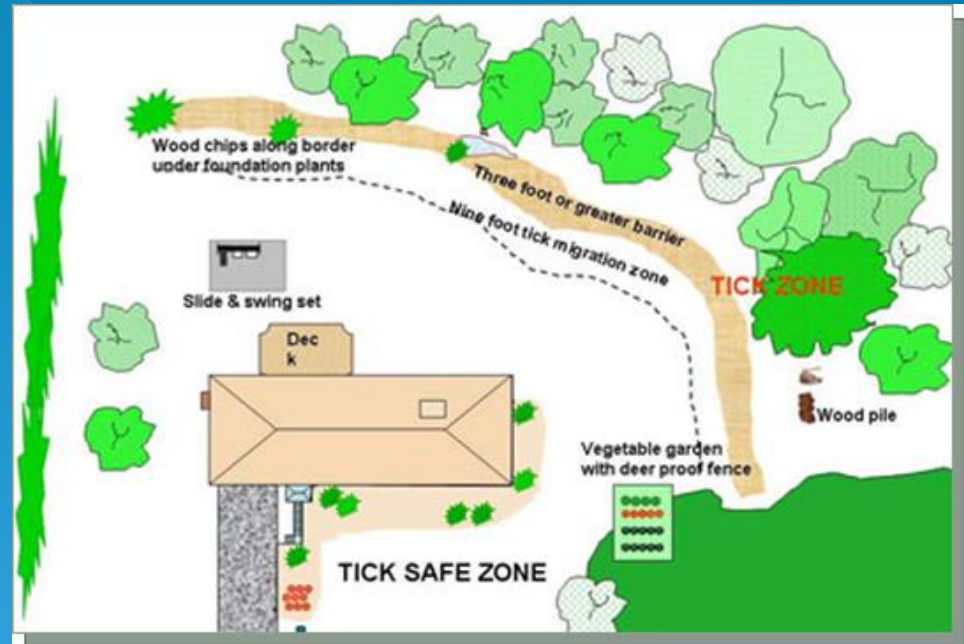
Deer tick nymphs require exceptionally high humidity, and are usually only found in shady, leaf-covered areas

Deer ticks are not out in the middle of your lawn, they live where yards border wooded areas, ornamental plantings and gardens, or anywhere it is shaded and there are leaves with high humidity.



Reduce Tick Habitat in Your Yard

- By raking leaves, trimming shrubs and low branches you can make certain areas where ticks cannot survive.
- Pay special attention to frequented border areas, woodpiles, stonewalls and sheds.
- Creating borders of wood chips stone or any other landscaping material helps to serve as a reminder between tick-safe and Tick-danger zones.



Protect Your Yard



Perimeter Sprays and Granules:

The single most effective way to reduce blacklegged (deer) ticks in your yard is by insecticide applications that are applied mainly to the yard perimeter , shady perennial beds , or along trails and paths in woods . In most situations, TREATMENT IS NOT NEEDED ON OPEN OR SUNNY LAWNS

Perimeter treatments can be either liquid or granular applications. Products with bifenthrin or permethrin as the active ingredients work well. Spray treatments should be applied using high-pressure sprayers. To best accomplish this, **TERC highly recommends hiring a licensed Professional Pest Control Applicator trained to kill ticks in the environment.**

Protect Your Yard



Perimeter Sprays and Granules:

Perimeter spray treatments are eco-friendly by limiting the amount of pesticide being applied, and targeting the areas where people most frequently come into contact with deer ticks.

The chemicals used today for tick control are much less toxic than in the past, and are used in very low concentrations.

Additionally, Bifenthrin and permethrin do not leach through soil; these chemicals are degraded by soil microorganisms within the top 4 cm of the soil surface.

Note: Pyrethroid products should not be applied around fish-containing ponds or streams.

Protect Your Yard

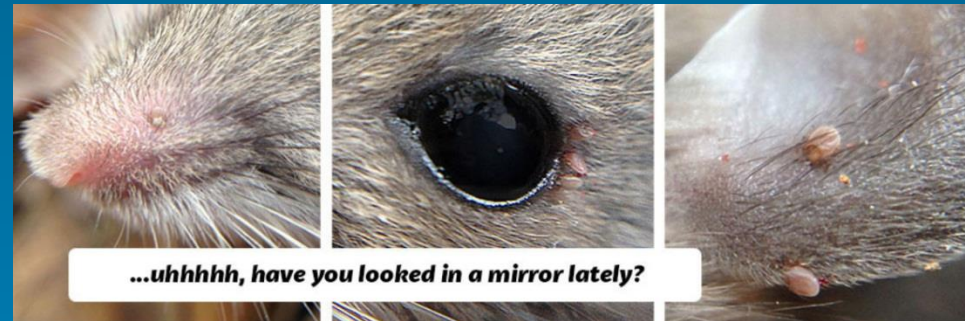


Perimeter Sprays and Granules:

Helpful hint #1: Ask your professional where they will be applying the product. If they say over the entire yard, then they don't really know that blacklegged tick nymphs require exceptionally high humidity only found in shady, leaf-covered areas.

Helpful hint #2: Two applications usually work best, and should be done in mid-May and again in mid-June throughout the northeast and upper mid-western portions of the United States. It may be helpful to add one fall application -- timed after the emergence of adult-stage ticks - typically in mid-October.

Mice



- When larval blacklegged ticks hatch from eggs, they generally are pathogen-free
- Ticks become infected with disease-causing pathogens when they feed on reservoir animals.
- Most studies support the notion that white-footed mice (*Peromyscus leucopus*) are the main reservoir host for Lyme disease spirochetes, Babesia protozoa, and Anaplasma bacteria.
- **In most settings, mice are the primary culprits for producing infected ticks.** These mice are common and often quite abundant in rural, suburban, and semi-urban settings across much of the eastern United States.

Make Your Backyard Mouse Unfriendly

- Mice like to live in stonewalls, around sheds, woodpiles or any enclosed area they can get into.
- Clean up brush, keep stonewalls clear of leaves, move woodpiles away from daily activity.
- Birdfeeders also attract rodents that may drop ticks off right where you are standing.



Mouse -Targeted Devices

Tick Tubes



- Tick Tubes are stuffed with cotton nesting material impregnated with permethrin.
- If mice are present, they typically are very attracted by this nesting material.
- If tubes are placed in areas harboring mice, the mice will steal the treated nesting material and place it in their nests, where it kills ticks.

Mouse -Targeted Devices

Tick Tubes



- Once mice have treated nests, they almost never are infested by ticks.
- With complete coverage in a yard, in time nearly all of the mice will have treated nests.
- Targeting the ticks that feed on mice can greatly reduce the number of infected ticks in your yard.

Mouse -Targeted Devices Tick Tubes



- **It's best to apply Tick Tubes in late July/August when larvae are active, and again before next-year's nymphs emerge in May.**
- A typical 1 acre yard will require applying about 24 tubes at each application.
- Check the tubes for the presence of remaining cotton---when re-applying, if there is still cotton in a tube, then don't put the next tube at exactly the same location. You will learn where the mice feel most comfortable stealing cotton but be sure to distribute Tick Tubes in all "mouse habitat" around the area to be protected.
- Tick Tubes are extremely eco-friendly; cardboard Tick Tubes completely biodegrade, and the permethrin is tightly bound to the cotton fibers. There is minimal risk for environmental contamination, and a toddler would need to consume more than a pound of treated cotton before there would be any chance for toxicity.

Do NOT Attract Wildlife

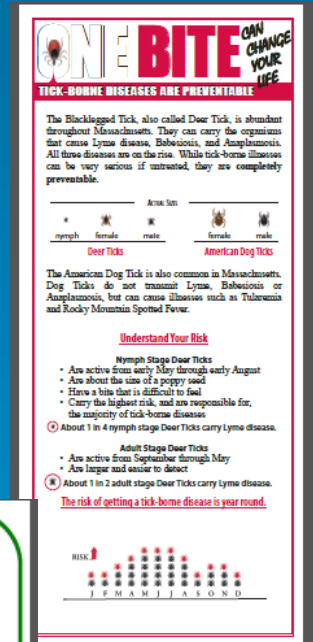
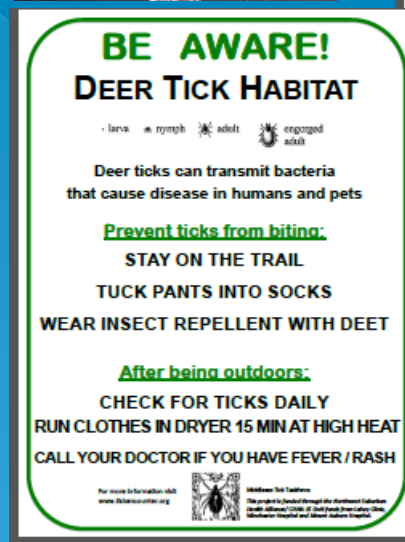
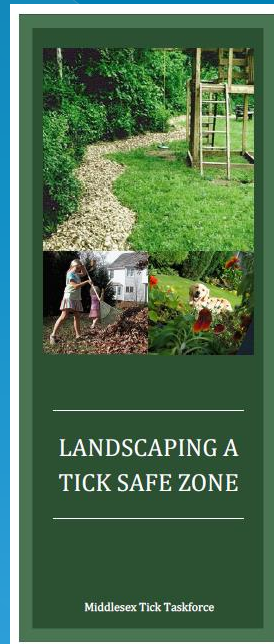


- Ticks are brought to your yard by deer and become infected mainly by feeding on mice.
- Keep deer out by planting deer resistant plants, installing a deer fence, or by applying deer repellents.



What is Concord doing to prevent tick-borne diseases?

- Info packet sent home with all campers at summer camps
- More info available at Health Division office and town website



Tick Testing

- Ticks can be tested to see if they are carrying the pathogens that cause a number of diseases
 - > But remember, that although the tick carries a pathogen, the pathogen may not have been transmitted to you. during the tick bite.
- Available through a number of labs
- Least expensive is Laboratory of Medical Zoology at UMass: \$50
- www.tickreport.com

Take Home messages



- If you feel unwell in summer, don't ignore it—seek medical attention
- Use permethrin-treated clothing and wear repellents when outside in wooded areas
- Daily tick check for people and pets
- Reduce tick habitat in your yard and use additional strategies as appropriate

Tick-Borne Disease Resources— Best sources of information

Information on Tick biology, identification
and prevention

University of Rhode Island

www.tickencounter.org

Information on tick-borne diseases

Centers for Disease Control and Prevention

www.cdc.gov

Questions?

