NH DIVISION OF
Public Health Services
Department of Health and Human Services

STATE OF NEW HAMPSHIRE

TICKBORNE DISEASE CURRICULUM KIT

TEACHER'S GUIDE

June 2019

New Hampshire Department of Health and Human Services

Division of Public Health Services

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I. INTRODUCTION

A. Purpose

The New Hampshire Tickborne Disease Curriculum Kit Teacher's Guide is intended to provide in-depth background information on topics covered within the New Hampshire Tickborne Disease Prevention Curriculum Kits for grade K-1, 2-3, and 4-5. Educators should use the Teacher's Guide in preparation for teaching lessons and educating students on tickborne disease prevention. Additional resources have been outlined in Appendix A of this document.

B. Contact Information

For questions about this document, please contact:
Bureau of Infectious Disease Control
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Phone: (603) 271-4496
Website: http://www.dhhs.nh.gov/dphs/cdcs/lyme/index.htm

II. TICK SPECIES

There are several different tick species that have been found around the world; however, only seven hard bodied ticks have been identified to cause human disease in the United States. These include: American dog tick, (*Dermacentor variabilis*), blacklegged tick (*Ixodes scapularis*) and formerly known as the deer tick, brown dog tick (*Rhipicephalus sanguineus*), Gulf Coast tick (*Amblyomma maculatum*), Lone star tick (*Amblyomma americanum*), Rocky Mountain wood tick (*Dermacentor andersoni*), and Western blacklegged tick (*Ixodes pacificus*).

A. American Dog Tick

The American dog tick is the most commonly found tick species in NH. Its distribution range includes the northeast, southeast, Midwest, eastern portions of the southwest and western California. The American dog tick is responsible for transmitting diseases including tularemia and Rocky Mountain spotted fever, however, to date, local transmission of these diseases has not occurred in NH.

B. Blacklegged Tick

The blacklegged is the second most commonly found tick species in NH. Its distribution range includes the northeast, southeast, upper Midwest, and eastern portions of the southwest. The blacklegged tick is responsible for transmitting five diseases in NH. These are Lyme disease, anaplasmosis, babesiosis, Powassan virus, and *Borrelia miyamotoi*. Lyme disease, anaplasmosis, babesiosis, and Powassan virus have been detected in NH, with Lyme disease being the most common.

C. Brown Dog Tick

The brown dog tick is widespread throughout the world. In certain portions of the U.S. including the southwestern portion of the country, it is responsible for transmitting Rocky Mountain spotted fever. While capable of biting humans and other animals, dogs are the host preference for this tick.

D. Gulf Coast Tick

The Gulf Coast tick is named based on its distribution in the U.S., which includes coastal and southern regions in southeastern states, and areas as far north as southern Kansas and southern Missouri. The Gulf Coast tick is responsible for transmitting rickettsiosis spotted fever.

E. Lone Star Tick

The Lone Star tick has been detected in the northeastern, southeastern, lower Midwestern, and eastern portions of the southwestern states. It is thought that this tick may be as far north as

Maine, however, has yet to be detected in NH. The Lone Star tick is an aggressive tick that is responsible for transmitting ehrlichiosis, tularemia, and southern tick-associated rash illness (STARI).

F. Rocky Mountain Wood Tick

The Rocky Mountain wood tick is found in the western region of the U.S. It is responsible for transmitting three tickborne diseases including Rocky Mountain spotted fever, Colorado tick fever, and tularemia.

G. Western Blacklegged Tick

The Western blacklegged tick is found in a small portion of the U.S., particularly in California and coastal regions of Oregon and Washington. There have been some detections of this tick in southern Nevada, Utah, and eastern Arizona. The Western blacklegged tick is responsible for transmitting Lyme disease and anaplasmosis.

II. TICKBORNE DISEASES IN NEW HAMPSHIRE

A. Lyme Disease

Lyme disease is caused by an extracellular spirochete (a type of bacteria) known as *Borrelia burgdorferi* and was first recognized as a disease in the mid 1970's in Lyme, Connecticut[1] and is now known to have a global distribution. In the United States, about 80% of persons infected with Lyme disease will have an expanding bull's eye rash known as erythema migrans. Other symptoms can include headache, flu-like illnesses, muscle pain, joint pain and swelling, neurological deficits and cardiologic dysfunction.

Between the years 2000 and 2008 Lyme disease incidence increased dramatically in NH, and across the nation. This could be due to a true increase in incidence reflecting spread of the vector (tick) and pathogen, increased use of NH's natural areas by NH residents without appropriate personal protective measures, increased awareness among providers, changes in laboratory testing availability and practices, and changes in surveillance methods or increased reporting to the state. Since 2008, incidence has remained high in NH. For the years 2008 and 2012, NH had the highest incidence rate of Lyme disease in the US. Since 2012, NH has remained in the top five states for incidence. Lyme disease remains the most common vectorborne disease in the US. It is predominantly seen in the northeast and upper Midwest but cases have been reported across the country. Additional information about Lyme disease in NH, including data and maps that are updated annually, may be found here:
http://www.dhhs.nh.gov/dphs/cdcs/lyme/index.htm

B. Anaplasmosis

Anaplasma phagocytophilum is the rickettsial organism (intracellular bacteria) that causes anaplasmosis and infects the white blood cells of its host. Anaplasmosis was first recognized in the US in the mid-1990's. Since that time, similar to Lyme disease, there has been a significant increase in cases reported nationally and in NH. A rash is a rare symptom for anaplasmosis and may be indicative of a co-infection with Lyme disease. Symptoms are nonspecific and can include a flu-like syndrome with fever, chills and muscle aches, fever, headache, nausea, fatigue, abdominal pain, cough and confusion. The geographical distribution is similar to that of Lyme disease.

C. Babesiosis

Babesiosis is caused by an infection of red blood cells by protozoan parasites in the genus *Babesia*. The most common parasite causing disease in the US is *Babesia microti*, but there are other species that have been identified in human cases of babesiosis. Babesiosis, first recognized as a public health concern in the US in the 1960's, remains a rare disease, although recent years have seen an increase in incidence in NH and other areas where *Babesia* is endemic. The geographic distribution of this disease is similar to that of Lyme disease and anaplasmosis. While

Babesia is predominantly transmitted by the blacklegged tick, blood transfusions are another documented source of babesiosis.

It is possible to be infected with *Babesia* organisms and not have any symptoms of illness; however severe disease is also possible. When symptoms are present, they can include fever, extreme fatigue, dehydration, mental confusion, hemolytic anemia and jaundice.

D. Powassan Virus Infection

Powassan virus is an arbovirus (**ar**thropod-**bo**rne virus) of the *Flavivirus* genus, the same genus as West Nile virus (WNV). It was first identified in Canada in the late 1950's and since then has been identified in United States New England and the upper Midwest but remains rare. Like WNV, Powassan virus infects the central nervous system and can cause inflammation of the brain (encephalitis) and the membranes surrounding the brain and spinal cord (meningitis). Some of those infected may experience mild or no symptoms. For those that do have symptoms, they usually begin with acute onset of fever and may include headache, muscle weakness, nausea, vomiting, stiff neck, fatigue, confusion, paralysis, speech difficulties, and memory loss. It is possible that neurological deficits will persist after the resolution of acute symptoms.

III. LIFE CYCLE OF A TICK

Identifying and understanding the tick life cycle, the pathogens, and reservoir hosts is critical to understanding the retention and transmission of tickborne diseases in NH. Most ticks have a two year life cycle involving multiple reservoir hosts.

A reservoir host is an animal that is capable of sustaining a large enough population of a pathogen in its blood, without displaying significant negative effect, to allow a vector to become infected when it feeds to take a blood meal. Should the animal become ill from the pathogen and either die or be eaten by a predator, it would reduce its ability to function as a host as it would reduce its availability to questing ticks. Similarly, if the pathogen does not reach high enough levels in the host's body, then transmission of the pathogen from the reservoir to the vector will not occur. Understanding the roles that are played by different hosts is an important component in identifying appropriate control methods. The main, and shared, reservoir host for the five tickborne diseases known to be transmitted in NH is the white footed mouse. Chipmunks, shrews, voles and birds, including the American Robin, have also been identified as reservoirs for Lyme disease, although are of lesser importance. Wild rodents have been identified as possible reservoirs for anaplasmosis and babesiosis; woodchucks, squirrels and the white footed mouse are the three known reservoirs for Powassan virus.

Blacklegged ticks hatch from their eggs as larvae in the summer and quest for a host for their first blood meal at that time. This is the usually first opportunity for the tick to become infected with one or more pathogens. Interestingly, *Borrelia miyamotoi* shows some ability to be passed from the female ticks to her eggs, unlike the other tickborne disease pathogens in New Hampshire. Usually the hosts selected are small mammals or birds, many of which are competent, or suitable, reservoir hosts. After engorging on blood and dropping off, the tick will molt into a nymph and quest for a second blood meal in the late spring to summer. Hosts for this stage of the tick are also small mammals and birds, however humans are possible hosts. The nymph stage of most ticks is exceedingly small, about the size of a sesame seed, and is easy to miss during routine tick checks. As a result, this is the stage of the tick that is most likely to transmit a pathogen to a human. Should an infected nymph feed on a competent, but naïve (uninfected) reservoir host, disease transmission and the perpetuation of the pathogen in the reservoir host population will occur, and occur just prior to the emergence of the next crop of larval ticks allowing for the infection of a new generation of ticks. Once the nymph has fed, it molts into an adult tick to quest for the next blood meal in the fall or the following spring. See Figure 1.

Adults do not hibernate and will be active and questing for a host during the winter months when the ground is not covered with snow and the temperature is above 41 degrees Fahrenheit. The preferred reproductive host (host which allows them to feed enough to lay eggs) is the white-tailed deer, but other medium and large mammals may also serve as reproductive hosts. Reproductive hosts for the blacklegged tick are generally not competent reservoirs. Infection rates of adult ticks are higher than those of nymphs since they have had two opportunities to

become infected through prior feeding events, however, since nymphs are more likely to go undetected, the nymphs are responsible for more disease transmission and, subsequently, illness.

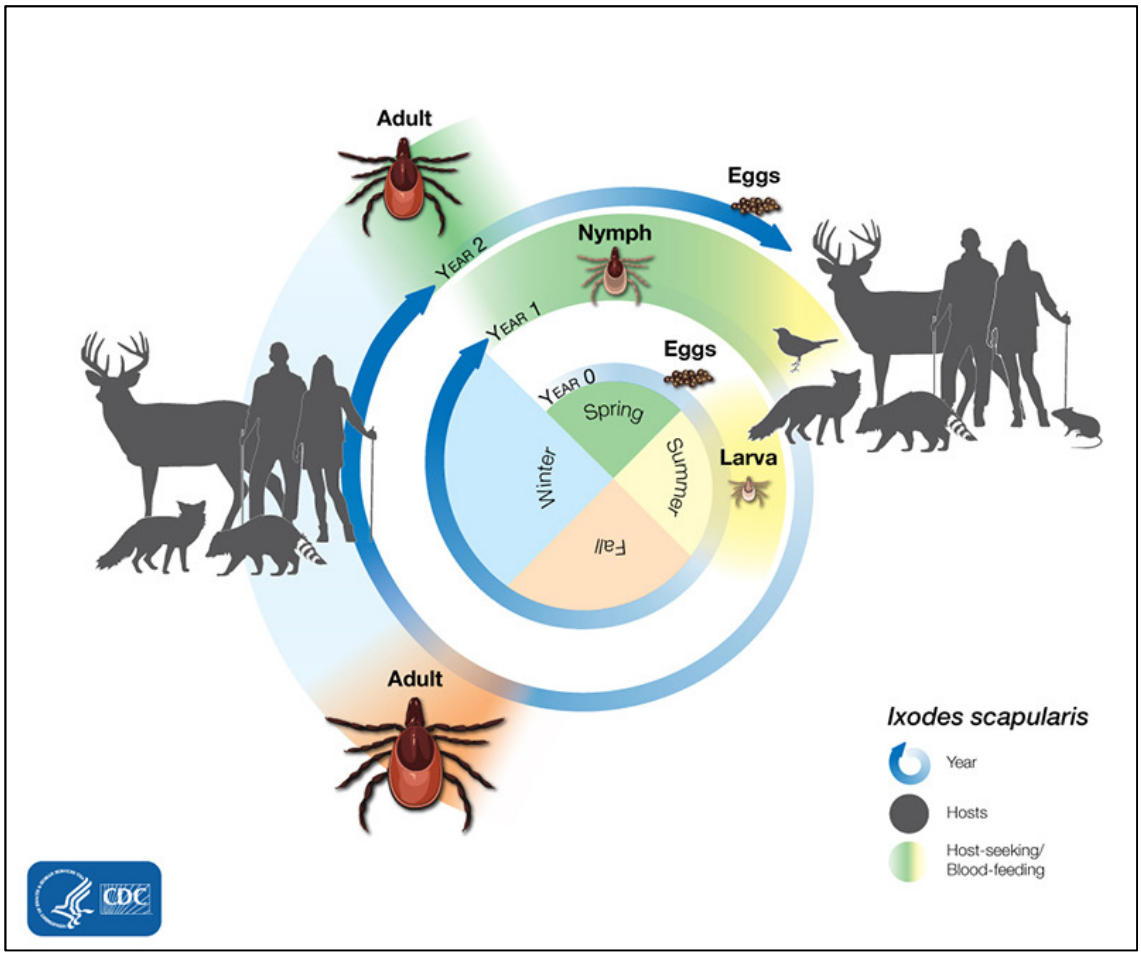


Figure 1. The blacklegged tick life cycle. https://www.cdc.gov/ticks/life_cycle_and_hosts.html

IV. TICKBORNE DISEASE PREVENTION

The most effective way to prevent illness due to a tickborne disease is to prevent tick bites from happening. NH has a wealth of outdoor recreational areas and a rich natural beauty that should continue to be enjoyed by NH residents and visitors. It is important to be aware of, and utilize, the available prevention methods appropriately and consistently. Personal protection measures are critical in preventing tick bites[2]. Environmental management also has a significant role to play in prevention of tickborne disease.

Important websites for prevention information:
NH DHHS: http://www.dhhs.nh.gov/dphs/cdcs/lyme/index.htm
CDC: http://www.cdc.gov/ticks/

A. Tick Checks

The importance of daily, or more frequent, tick checks cannot be over emphasized as part of what an individual can do to reduce their risk of contracting a tickborne disease. If a tick is identified and removed immediately, either before it attaches or after it attaches but before it is able to transmit pathogens (within 24-36 hours after attachment for *Borrelia burgdorferi*), risk of illness from that tick encounter is absent. The nymph stage of the blacklegged tick is the stage most likely to transmit a tickborne disease simply because it is easy to miss during a routine tick check. It is helpful to use a mirror or have another person help you check the hard-to-see portions of your body. Child caregivers should always check their children when returning from outdoors as children are not able to perform this task reliably. Adults should always be the ones to perform tick removal for children. Children should be encouraged to go to an adult for this purpose should they find a tick on themselves. After a bite is noted, monitoring for signs of a rash or other symptoms should be done.

A tick can attach to any portion of the body, and the entire body should be checked, however it is wise to spend extra time checking some of the more tick-prone areas:

a. Groin
b. Armpits
c. Hairline/hair
d. Between toes
e. Behind ears
f. Elbows
g. Back of knees
h. Areas of constriction (i.e. waistbands, collar lines)

Action to be taken: Every person that was exposed to potential tick habitat should perform a tick check at least once daily as described above. For children who are not able to perform this activity on their own, parents or guardians should do this for them.

B. Tick Removal

Attached ticks should be removed immediately. The head of the tick should be grasped using fine nosed tweezers as close to the skin as possible and removed using a slow, steady retraction motion in the same plane as the tick is attached to minimize the chances of leaving the head behind. Under no circumstances should a tick be burned, submerged in kerosene or other solvents/chemicals or be smothered in a petroleum jelly product or nail polish in an effort to kill it prior to removal. These methods actually may increase the likelihood of disease transmission by potentially causing the tick to regurgitate.[3] The feeding apparatus (mouth parts) of ticks, the hypostome, is barbed to ensure that they are able to stay attached to their host to feed to repletion. Because of this, and the cement that they secrete into their host, they cannot detach rapidly. It is important that anyone removing a tick do so carefully and follow guidelines for successful removal. The bite area should be cleaned with soap and water or rubbing alcohol. For later identification purposes, the removed tick may be placed in a crush proof container that has a tight seal to prevent escape. It is also a good idea to mark on a calendar the day and location of any tick bite for later reference should you become ill. If the tick has been attached long enough to feed, it will no longer have the flat body shape of a questing tick. Because of the high proportion of ticks infected with *B. burgdorferi* in NH, people who have had a tick attached for at least 36 hours should consult their healthcare provider for possible prophylaxis to prevent the development of Lyme disease. Prophylaxis (a single dose of the antibiotic doxycycline) can only be given to people 8 years of age and older and must be given within 72 hours of tick removal. One study found that if this was done, the prophylactic treatment was 87% effective in preventing early Lyme disease.[4] If any concerns of illness arise after a tick bite, whether or not prophylactic treatment was administered, a healthcare provider should be contacted to discuss whether testing or treatment is needed.

More information about tick bites and removal:
NH DHHS: http://www.dhhs.nh.gov/dphs/cdcs/lyme/documents/tickbites.pdf
CDC: http://www.cdc.gov/ticks/removing_a_tick.html

Action to be taken: All attached ticks should be removed immediately and either kept for identification purposes or disposed of by submersing it in alcohol, placing it in a sealed bag, wrapping it between two pieces of tape, or flushing it down the toilet. For any person not able to remove a tick on his or her own, assistance should be sought. A responsible adult should do this for children. Any non-attached ticks should be disposed of to prevent attachment.

C. Repellents

While the State of NH does not endorse any one particular brand of repellent, DEET, which can be found in many repellent products, has been shown to be the most effective tick repellent on the market. DEET should only be applied to exposed skin (not applied to skin and then covered up). A concentration of 20-30% DEET is sufficient to last a few hours and duration of efficacy will be printed on the label of the chosen product. Permethrin, used only on clothing, has also been

proven to be extremely effective in decreasing the likelihood of tick attachment and can be used in combination with DEET products applied to skin to great effect. Permethrin infused clothes may be purchased or the permethrin may be applied to clothes you use regularly when outside. Additionally, clothing items may be shipped to companies that specialize in permethrin applications. Depending on the preparation, the repellency effects of permethrin may last up to 6 weeks. Label information will give details about washability of products and longevity of formulations.

DEET is safe for use on children over two months of age according to the American Academy of Pediatrics. Their guidelines for repellent use in children are found here: http://www.healthychildren.org/English/safety-prevention/at-play/Pages/Insect-Repellents.aspx.

Products that contain both sunscreen and repellent are available for use on children, however they are not recommended as the product will need to be applied more frequently for sun protection than for repellency, which could lead to adverse reactions. Children should never apply repellents; a responsible adult should do this for them. Repellents should also never be applied or sprayed directly onto the face. To apply repellent to the face, or other sensitive areas, first apply the repellent to your hands or a cloth and then to the face and/or other sensitive areas. Do not apply repellents on broken or irritated skin, or on wounds. In accordance with federal law, repellents should always be used by following the instructions on the label.

There are a number of repellent options available that are registered with the Environmental Protection Agency. A web-based tool is available to help with the selection of the appropriate product for the desired purpose, length of time and arthropod (insect or tick) to be repelled. That tool can be found here: http://cfpub.epa.gov/oppref/insect/.

UNH Cooperative Extension has also developed a repellent guide that is specific for NH. It can be found here: http://extension.unh.edu/resources/files/Resource000963_Rep1073.pdf

A factsheet developed by the Department of Defense for military personnel is also available and includes information on repellent use and answers to frequently asked questions for their DEET and permethrin system. This factsheet can be found here: http://www.afpmb.org/sites/default/files/pubs/techguides/TG26/files/DODInsectRepellentSystemJustheFacts-June2007.pdf

Action to be taken: All persons above two months of age should either apply or, in the case of children or persons otherwise in need of assistance, have it applied for them in accordance with the product's label as outlined above. Determination of which product or combination of products is appropriate is a personal decision; however a healthcare provider may be able to provide assistance in product selection.

D. Pets

People cannot become infected with a tickborne disease from their pet; however, pets can bring ticks into the home and are therefore sources of tick and tickborne disease exposure. Because of this, it is important to check your pets each time they come in from outside and to talk with your veterinarian about tick preventatives for your pet. Similar to humans, ticks may attach anywhere on your pet's body, however some of the more common sites are between the toes, the head and neck, behind ears, the axilla (arm pits) and groin area. There is a very effective canine vaccine available for use and you should discuss with your veterinarian if this would be a good option for your dog in combination with a commercial tick preventative medication.

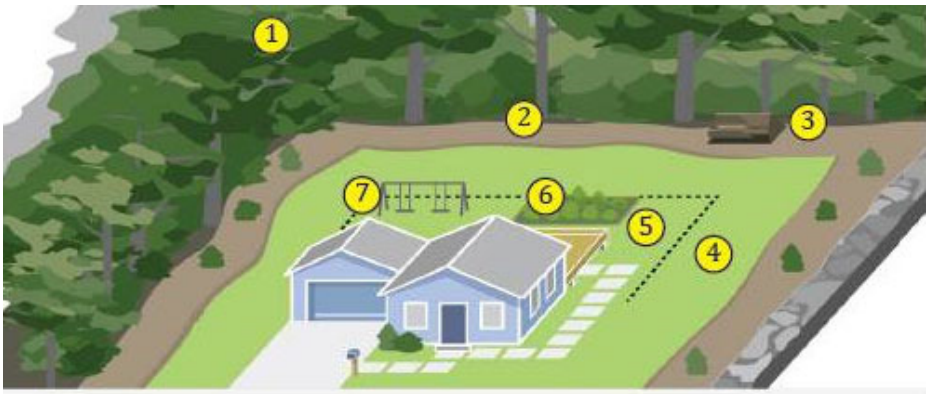
Action to be taken: Pet owners should consult with a veterinarian about the correct tick prevention regime for their pets. A veterinarian will also be able to discuss tick checks for pets and how to remove any attached ticks.

E. Environmental Control:

1. Home and property owners have some ability to modify their landscape to minimize tick migration and survivorship.
    a. Creating a three foot wide boundary of mulch or pea gravel between edge or forest habitat and open yard will help prevent ticks migrating into the areas of the yard that see the highest human activity. Ticks are adverse to traveling across such terrain, preferring to crawl upward on vegetation to quest. Creating a boundary will not prevent hosts from traveling between habitats and depositing ticks that could pose a health risk.
    b. Since ticks do not tolerate dry conditions, maintaining a mowed yard with sun exposure will aid in keeping ticks from infesting yards and shared or communal areas. Similarly, placing play equipment in sunny areas of the yard or property that are free from brush and debris or in areas that are mulch covered will help minimize tick exposure to children using the equipment.
    c. When performing beautification of properties, owners should be aware of the types of plants and landscape arrangements that they use. Many non-native and invasive plants are more likely to provide ideal tick and host habitat. These plants should not be used, and if present should be removed. Garden and extension specialists are good resources for developing appealing landscaping using native plants that are deer browse resistant.
    d. Eliminating hosts and host habitat can reduce the number of ticks encountered. Mice and other rodents can invade homes, woodpiles, stone walls, garages and sheds. By controlling both the population of these hosts and the habitat available to them, tick populations will also be controlled. Bird feeders are another food source for rodents that serve as reservoirs and hosts for ticks. While these feeders do not need to necessarily be eliminated, they should be kept away from the house. Consider discontinuing their use during the months of May through August when nymphs are

most active and other food sources for birds are plentiful. Keeping woodpiles away from human dwellings and stacking them to minimize rodent friendly habitat will reduce the risk these structures pose. Sealing stonewalls where feasible will also reduce rodent habitat. Excluding hosts from human dwellings or lethal control of rodents will decrease the risk these animals pose for vectorborne and other infectious diseases. Products are available that kill ticks attached to host animals (fipronil bait boxes) or that fall off of the animal hosts into their nests (Damminix tick tubes). Whether the use of these products is appropriate is dependent on the home or property owner.

Action to be taken: All private home or property owners should consider modification to their landscape or property as discussed above to the best of their ability to reduce the risk of being exposed to ticks while enjoying the outdoors.



1	**Tick zone**	Avoid areas with forest and brush where deer, rodents, and ticks are common.
2	**Wood chip barrier**	Use a 3 ft. barrier of wood chips or rock to separate the "tick zone" and rock walls from the lawn.
3	**Wood pile**	Keep wood piles on the wood chip barrier, away from the home.
4	**Tick migration zone**	Maintain a 9 ft. barrier of lawn between the wood chips and areas such as patios, gardens, and play sets.
5	**Tick safe zone**	Enjoy daily living activities such as gardening and outdoor play inside this perimeter.
6	**Gardens**	Plant deer resistant crops. If desired, an 8-ft. fence can keep deer out of the yard.
7	**Play sets**	Keep play sets in the "tick safe zone" in sunny areas where ticks have difficulty surviving.

Based on a diagram by K. Stafford, Connecticut Agricultural Experiment Station

Figure 2. Tick-safe zone through landscaping.
Image from: http://www.cdc.gov/lyme/prev/in_the_yard.html.

Additionally, municipalities should consider landscaping of parks, playgrounds, schools and developments to minimize the risk of tickborne disease. Edge habitat (the shrubby area at the edge of a wooden area that is commonly associated with forest fragmentation and urban development) is becoming increasingly common and increases the available habitat for hosts and vectors. Subsequently, this leads to an increase in the prevalence of infected ticks. Measures should be taken by municipalities, commercial or large residential property owners (i.e. housing developments, nursing homes, apartment buildings, residential placement facilities etc.) and city planners to minimize this type of habitat. Many of the same methods as mentioned for residential properties could be applied to these properties as well, in addition to larger scale landscape alterations to reduce edge and host friendly habitat. Municipalities and other entities responsible for public lands should consider posting signs at trails and entrances to their properties that ticks are present as a reminder that vigilance is required. The CDC has created trail signs for this purpose: http://www.cdc.gov/lyme/toolkit/

Action to be taken: All persons or organizations that own or are responsible for the maintenance of community or shared outdoor space that could be a source of exposure to ticks have a responsibility to ensure that those using these spaces do so safely and should modify the landscaping of these spaces accordingly.

F. Other important personal protection measures include:

a. Showering when you return inside. This activity will help wash away any crawling or unattached ticks and will help you find ones that have attached.
b. Removing and immediately washing and drying the clothes you wore outside in tick endemic areas. Because ticks are prone to desiccation and dehydration, which are their major mortality risk, they will not be able to survive in a dryer on high heat. Even if clothes are not washed immediately, placing them in the dryer for 10 minutes will kill any remaining ticks on clothing. If clothes are wet, they will need to be in the dryer on high heat for an hour.
c. Wear light colored clothing. This will aid in the identification of any ticks that you pick up on the trail or in other tick-prone environments. It is best to wear lightweight long pants and long-sleeved shirts to help in identifying ticks that you have picked up and prevent them from gaining immediate access to your skin.
d. Tuck pants into socks and shirts into pants. This will prevent ticks from being able to find an easy entry point to attach. It is also an option to wear gaiters over shoes and socks. These can also be treated with permethrin to increase their efficacy in repelling ticks.
e. Wearing high rubber boots (16 inch high rubber boots). This will prevent ticks from being able to grab onto legs since the rubber will be too smooth for them to grasp effectively.
f. Review the informative video on tick prevention measures produced by Dr. Alan T. Eaton, a University of New Hampshire extension specialist. It is available here: http://extension.unh.edu/Integrated-Pest-Management/Public-Health-IPM

Action to be taken: Persons exposed to tick habitat should consider making the prevention measures listed above a routine part of their daily routine to further reduce the likelihood of tick attachment and transmission of tickborne disease.

APPENDIX A: Resources

References

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5. Nelson CA, Hayes CM, Markowitz MA, Flynn JJ, Graham AC, Delorey MJ, Mead PS, Dolan MC. The heat is on: Killing blacklegged ticks in residential washers and dryers to prevent tickborne diseases. Ticks Tick Borne Dis. 2016 Jul;7(5):958-963. doi: 10.1016/j.ttbdis.2016.04.016. Epub 2016 Apr 28.

University of New Hampshire Cooperative Extension

1. Biology and Management of Ticks in New Hampshire: http://extension.unh.edu/resources/files/Resource000528_Rep1451.pdf
2. Public Health and Integrated Pest Management: http://extension.unh.edu/Integrated-Pest-Management/Public-Health-IPM
3. Map of Blacklegged Tick Records in New Hampshire: http://extension.unh.edu/Blacklegged-Ticks-New-Hampshire

Centers for Disease Control and Prevention

1. Lyme disease toolkit: http://www.cdc.gov/lyme/toolkit/index.html
2. Publication ordering information: http://wwwn.cdc.gov/pubs/CDCInfoOnDemand.aspx?ProgramID=148
3. Tickborne Disease: http://www.cdc.gov/ticks/index.html

New Hampshire Department of Health and Human Services

1. Lyme and Other Tickborne Diseases: http://www.dhhs.nh.gov/dphs/cdcs/lyme/index.htm
    a. State of New Hampshire Tickborne Disease Prevention Plan: http://www.dhhs.nh.gov/dphs/cdcs/lyme/documents/tbdpreventionplan.pdf
2. Walk ST, Xu G, Stull JW, Rich SM. Correlation between tick density and pathogen endemicity, New Hampshire. Emerg Infect Dis. 2009 Apr;15(4):585-7.

Tick Identification Resources

1. State Entomologist (No fee associate with this service): http://agriculture.nh.gov/publications-forms/documents/tick-submission-form.pdf
2. UNH Cooperative Extension Arthropod Identification Center (There is a $5 fee per specimen.): http://extension.unh.edu/Problem-Diagnosis-and-Testing-Services/Insect-Identification-Service

Tick Removal Videos

1. New York State Department of Health tick removal video: https://www.youtube.com/watch?v=1Vj-qhxCJbA
2. University of Maine and Maine Medical Center tick removal videos: http://www.ticksinmaine.com/prevention/tick-removal and https://extension.umaine.edu/ticks/removal/
3. Maine Centers for Disease Control tick check video: https://www.youtube.com/watch?v=4ORIWFgVyMc

Connecticut Agricultural Experimental Station

1. CAES Tick Management Handbook: http://www.ct.gov/caes/lib/caes/documents/publications/bulletins/b1010.pdf
2. Managing Exposure to Ticks on your Property: http://www.ct.gov/caes/lib/caes/documents/publications/fact_sheets/entomology/tick_control_fs.pdf
3. Tick Related Information: http://www.ct.gov/caes/cwp/view.asp?Q=378212&A=2837
4. An Integrated and Individual Tick Management Program to Reduce Risk of Lyme Disease in a Residential Endemic Area: http://www.ct.gov/caes/lib/caes/documents/publications/ticks/an_integrated_and_individual_tick_management_program_redding_ct.pdf

Integrated Pest Management

1. United States Environmental Protection Agency. Managing Pests in Schools. https://www.epa.gov/managing-pests-schools
2. Cornell University: http://idl.entomology.cornell.edu/files/2013/11/Deer-Tick-1q9srf1.pdf

Studies Performed, or Resources from, Neighboring States

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2. Maine Medical Center Research Institute's Vector-borne Disease Laboratory. Deer Control: A Basic Element in the Integrated Management of Ticks That Carry Lyme Disease. A Community Guide. October 2012.
3. University of Rhode Island. http://www.tickencounter.org/

Local Health Department Resources

1. Nashua Health Department's Lyme Disease Toolkit: http://www.nashuanh.gov/DocumentCenter/View/2707

Additional Prevention and Tickborne Disease Articles of Interest

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