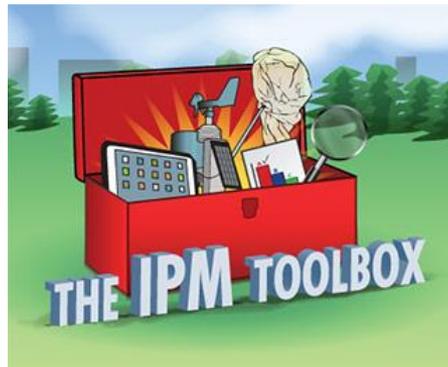


# How IPM Can Help Keep Children Safe from Lyme Disease at Schools and in Suburban Communities



Northeastern  
**IPM**  
Center



United States  
Department of  
Agriculture

National Institute  
of Food and  
Agriculture



# Webinar Details

- Welcome
- A recording of this webinar will be available within a week at

<http://www.neipmc.org/go/ipmtoolbox>

# We Welcome Your Questions

- Please submit a question **at any time** using the Q&A feature to your right at any time
- If you'd like to ask a question anonymously, please indicate that at the beginning of your query.

# Webinar Presenters



**Kathy Murray, Ph.D.**  
Maine Department of  
Agriculture, Conservation  
and Forestry, Augusta, ME  
[www.maine.gov/IPM](http://www.maine.gov/IPM) |  
[www.maine.gov/schoolipm](http://www.maine.gov/schoolipm)



**Andrew Li, Ph.D.**  
USDA

# Outline

- Scope of the tick/Lyme disease problem
- IPM Resources for Schools

# SOME QUESTIONS FOR YOU



United States  
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# The Scope of the Tick/Lyme Problem



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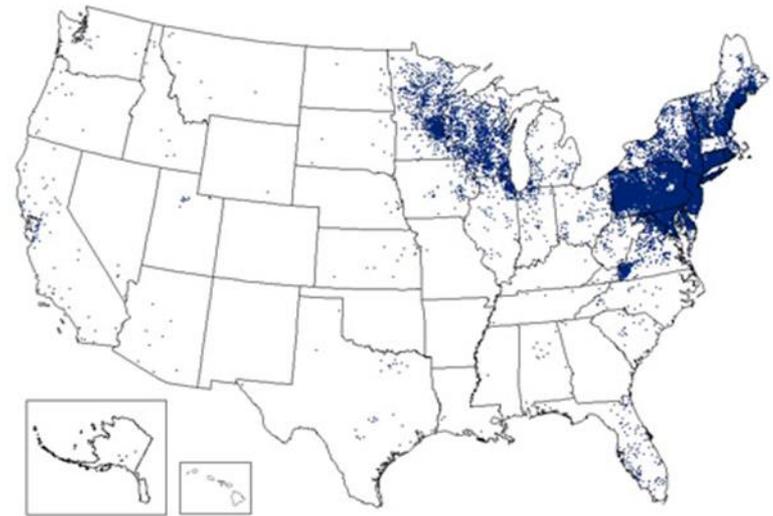
<b>Tick species</b> common name	<b>Distribution</b>	<b>Diseases transmitted</b>
<b><i>Ixodes scapularis</i></b> Blacklegged tick	Wide distribution in Eastern half of the U.S.	Lyme disease, anaplasmosis, babesiosis, and Powassan disease
<b><i>Ixodes pacificus</i></b> Western blacklegged tick	Along the Pacific coast of the U.S., particularly northern California	Anaplasmosis and Lyme disease
<b><i>Amblyomma americanum</i></b> Lone star tick	Widely distributed in the southeastern and eastern United States.	Causative agents of human ehrlichiosis, tularemia, and southern tick-associated rash illness.
<b><i>Amblyomma maculatum</i></b> Gulf coast tick	Coastal areas of the U.S. along the Atlantic coast and the Gulf of Mexico	Rickettsia parkeri rickettsiosis, a form of spotted fever.
<b><i>Dermacentor variabilis</i></b> American dog tick	Widely distributed east of the Rocky Mountains. Also occurs in limited areas on the Pacific Coast	Tularemia and Rocky Mountain spotted fever.
<b><i>Dermacentor andersoni</i></b> Rocky Mountain wood tick	Rocky Mountain states and southwestern Canada from elevations of 4,000 to 10,500 feet.	Rocky Mountain spotted fever, Colorado tick fever, and tularemia.
<b><i>Rhipicephalus sanguineus</i></b> Brown dog tick	Throughout the U.S.	Rocky Mountain spotted fever (in the southwestern U.S. and along the U.S.-Mexico border)
<b><i>Ixodes cookei</i></b> Woodchuck tick	Throughout the eastern half of the U.S. and Canada	Powassan disease
<b><i>Ornithodoros spp.</i></b> soft ticks	Throughout the western half of the U.S. and southwestern Canada	Tick-borne relapsing fever ( <i>Borrelia hermsii</i> , <i>B. parkerii</i> , or <i>B. turicatae</i> )

# The Blacklegged Tick

the vector of  
**Lyme disease**



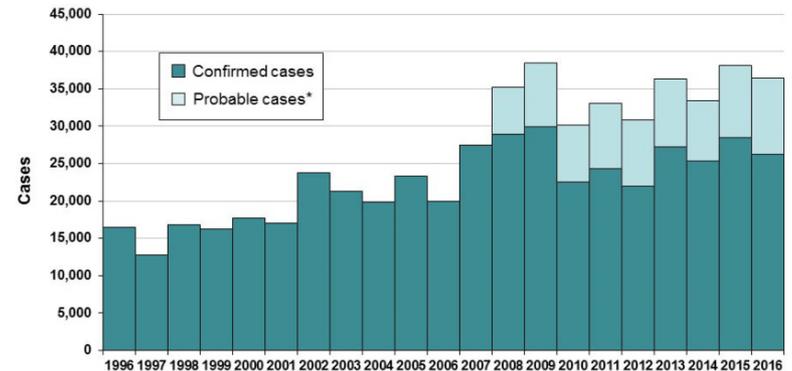
- ✓ *Erythema migrans* (EM) or "bull's-eye" rash
- ✓ Facial or Bell's
- ✓ Severe headaches and neck stiffness
- ✓ Arthritis <pain and swelling in the large joints>
- ✓ Lyme carditis



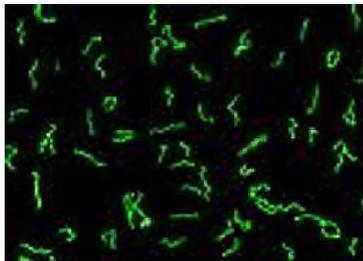
1 dot placed randomly within county of residence for each confirmed case

**~ 300,000 cases / year**

Reported Cases of Lyme Disease by Year, United States, 1996-2016



\*National Surveillance case definition revised in 2008 to include probable cases; details at [http://www.cdc.gov/ncepi/diss/nndss/casedef/lyme\\_disease\\_2008.htm](http://www.cdc.gov/ncepi/diss/nndss/casedef/lyme_disease_2008.htm)



*Borrelia burgdorferi*



The **burden** of tick-borne illness, in terms of cost to both individuals and society, is astronomical and **only getting worse.**

# Annual Cost of Lyme disease in the United States

**Annual Cases of Lyme Disease** The CDC raised case estimates based on national survey data by a factor of 10X in 2013

300,000

\* **Lyme Disease Cost Per Case**  
Direct Medical Costs, Indirect Medical Costs, Lost Income, Lost Taxes, and Related Lyme Disease Costs Per Case and adjusted for 2014 dollars

X \$10,769

**Total Annual Cost Burden**

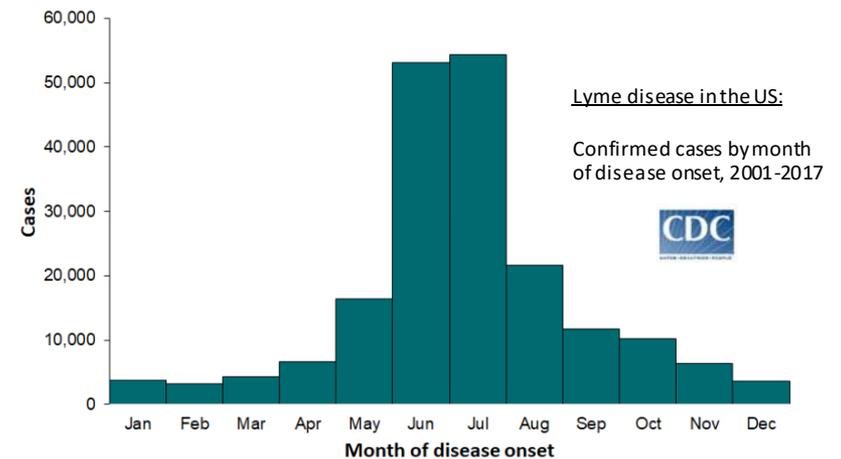
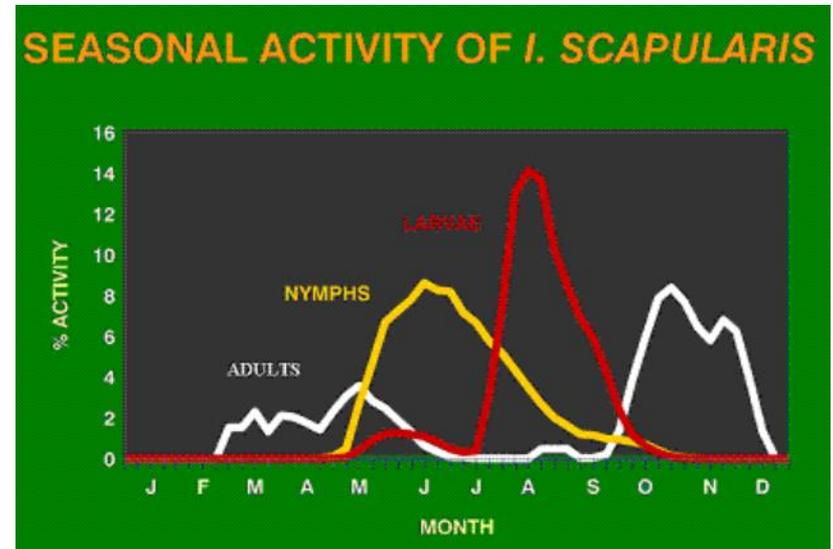
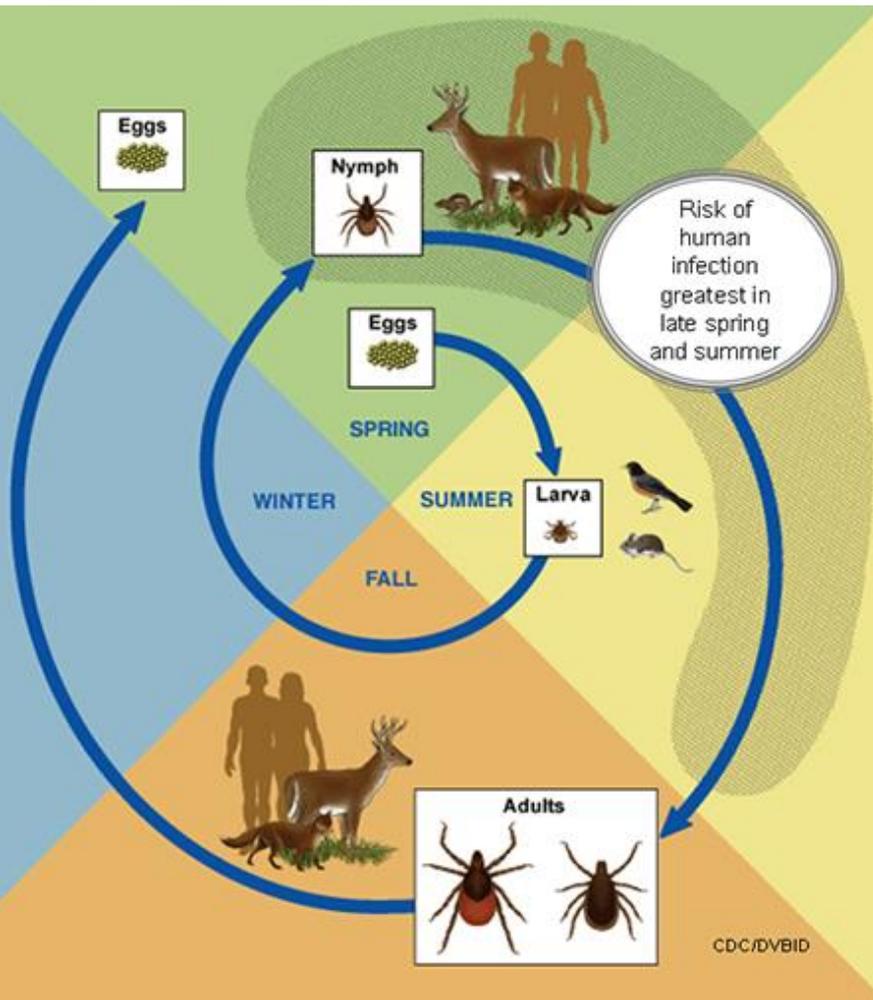
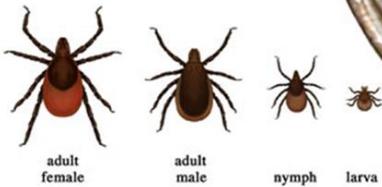
\$3,230,700,000

\*Source: Zhang, X., Meltzer, M.I., Pena, C.A., Hopkins, A.B., Wroth, L., and Fix, A.D. (2006) Economic Impact of Lyme Disease, Emerging Infectious Diseases, 12(4), 653 – 660. Adj. for inflation 2006 - 13)

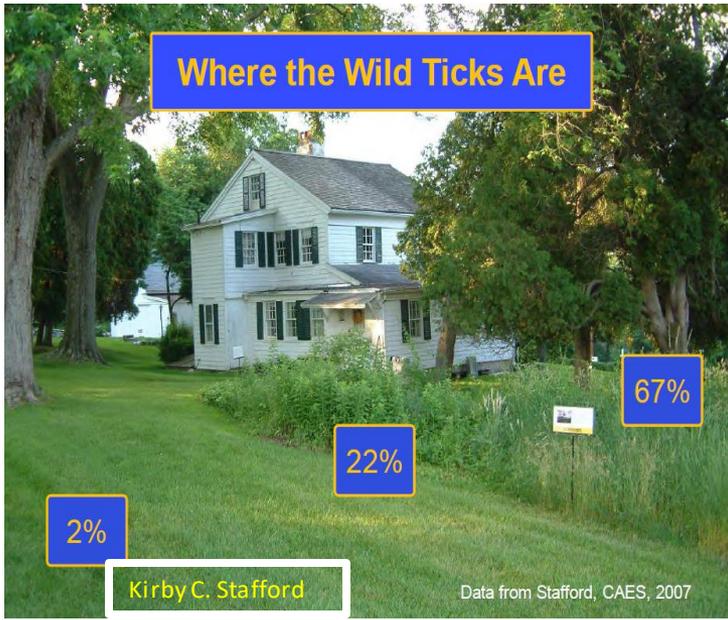
Jill Auerbach  
Chairperson, Hudson Valley Lyme Disease Association  
Coordinator, Tick Research to Eliminate Diseases: Scientist Coalition

# Life cycle of the blacklegged tick

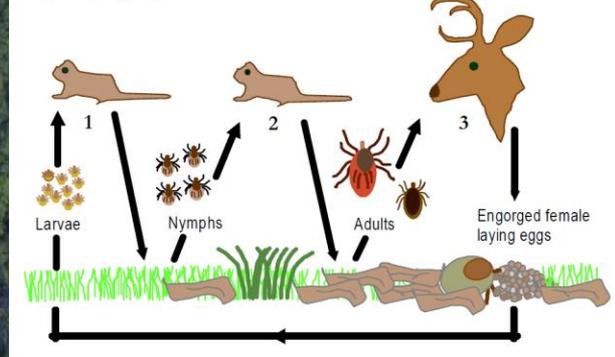
Blacklegged Tick (*Ixodes scapularis*)



## Where the Wild Ticks Are



### 3-host tick life cycle

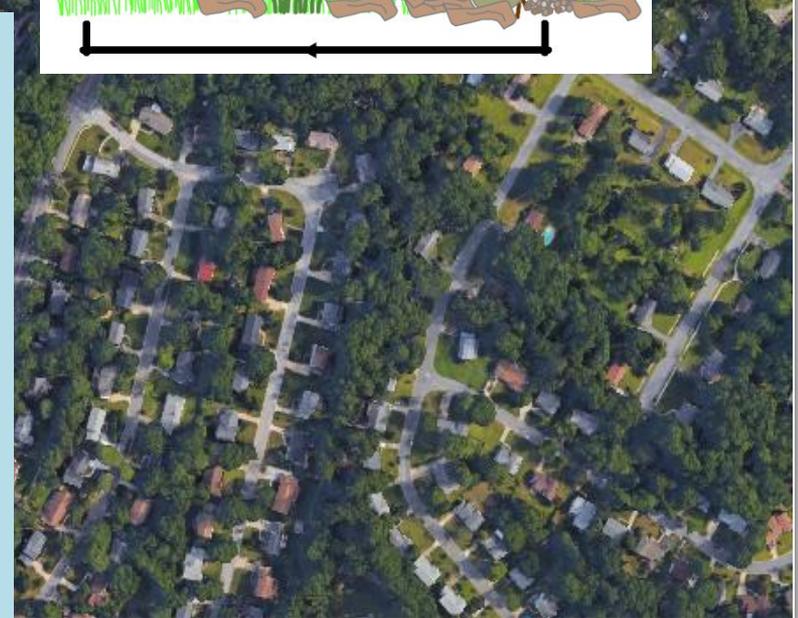


### Distribution of *I. scapularis* ticks:

- 67.3% woods, 21.6% ecotone, 2% on the lawn
- 82% nymphs are within 3-m of the lawn edge with woods, stone walls, ecotone, etc.

Estimated 75% ticks are picked up outdoors at home.

Maupin et al. 1991; Stafford & Magnarelli 1993; Carroll et al. 1992.



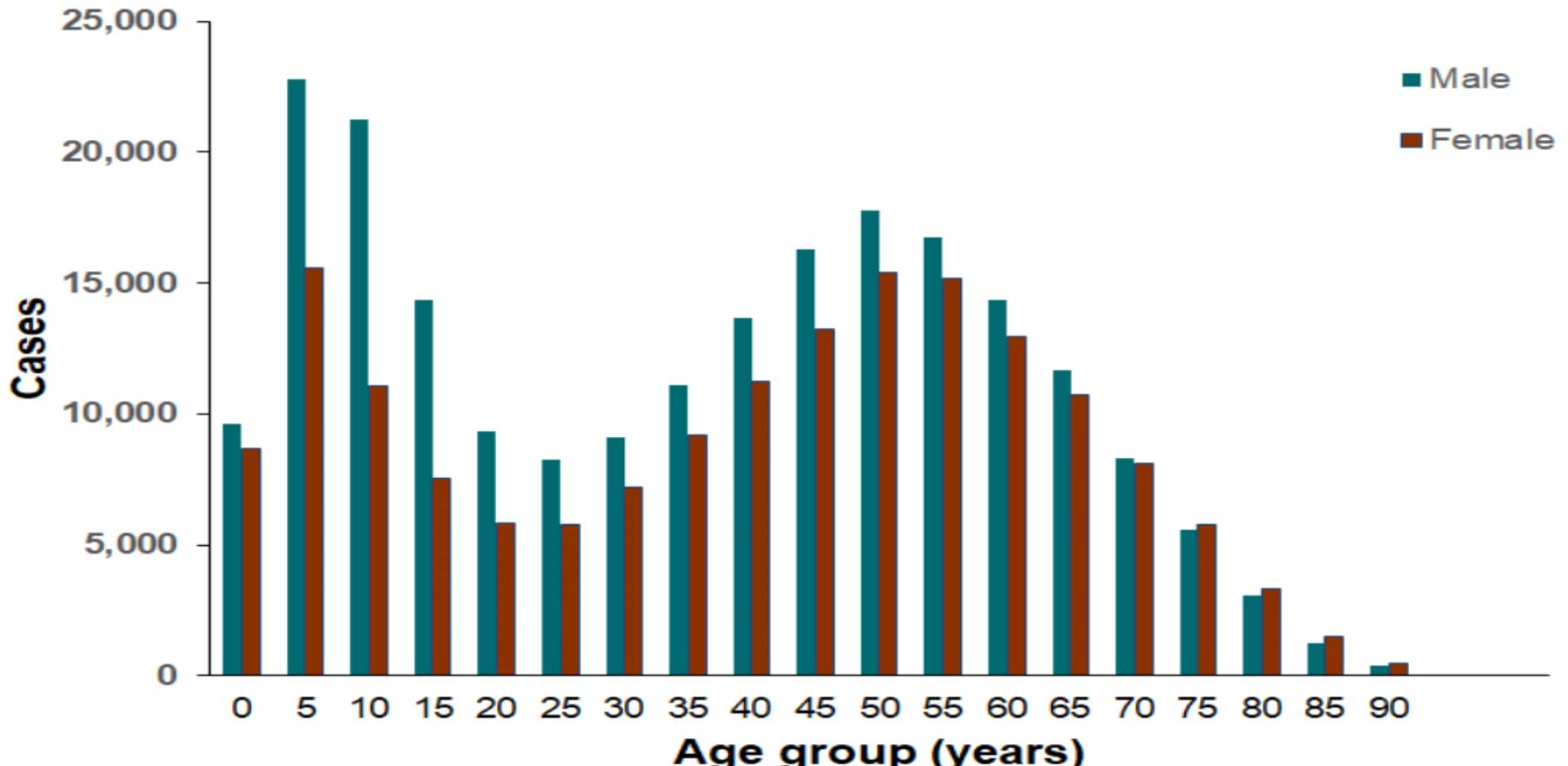


**School children are at high risk to tick bite and Lyme disease**

Elementary School



## Confirmed Lyme disease cases by age and sex--United States, 2001-2017



# QUESTIONS

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Agriculture



# Tick Management at Schools

POINT COUNT DATA FORM

4 MRS#A5TA BEVIA 6171992 2

E REGION STATION MONTH DAY YEAR VISIT NUMBER

NUMBER	TIME	SPECIES	0 - 3 MIN		3 - 5 MIN	
			< 50 M	> 50 M	< 50 M	> 50 M
1	0540	MTC	2	2		2
		HET	2			
		MWSP	3			
2	0552	BROS			1	1
		BEWR	2			
		RTCH	5	1		1
3	0559	REC	2		1	
		CTM	3			
		FWSP	1			2
		HET	3			
		SSW				1
		SSP	2			1

4. Record-keeping and evaluation

1. Identify and Monitor Ticks



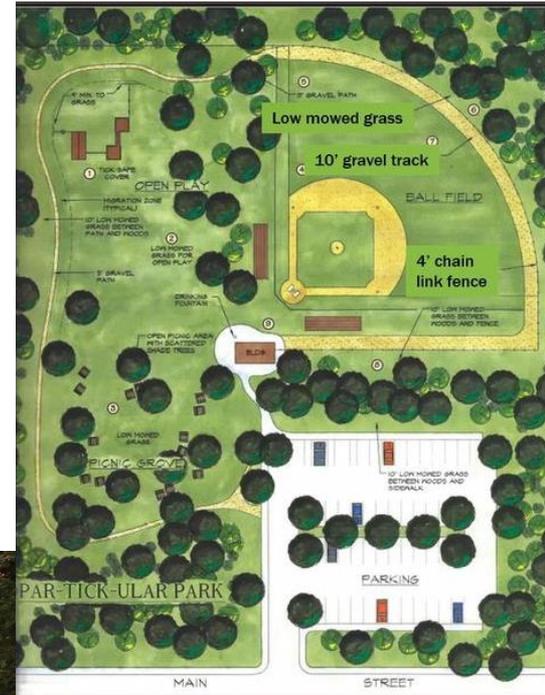
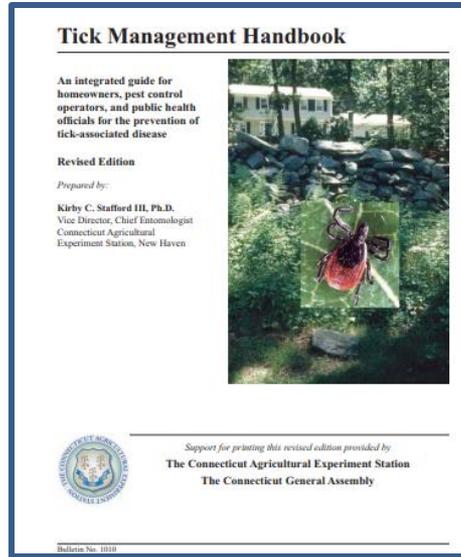
3. Employ multi-pronged tick management strategies

2. Develop Prevention & Action Plan



# Landscape Management

- Vegetation management
  - Keep grass mown
  - prune shrubs/ trees to decrease shade and humidity
  - Widen trails
- Move playground structures away from wooded edges
- Install dry barrier (gravel or paved path) at playground/woods interface



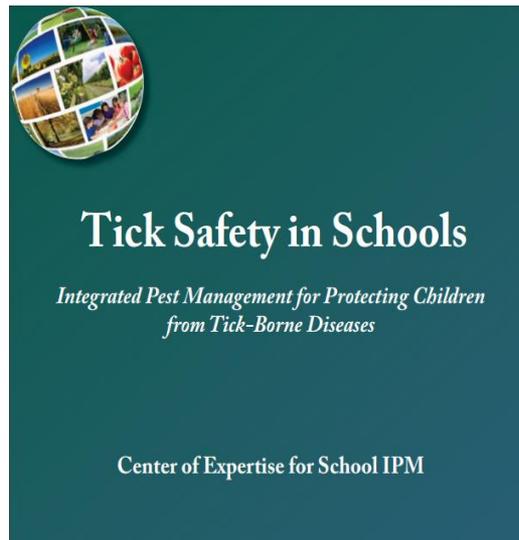
Graphic courtesy of Dr. Kirby Stafford, CT Agricultural Experiment Station



# Tick IPM Strategies (con't)

- Discourage rodent activity on playgrounds
  - Seal stone walls
  - Close up spaces under sheds
  - Eliminate bird-feeders
- Redirect human activity away from infested areas (signage, education, barriers)

[www.epa.gov/managing-pests-schools](http://www.epa.gov/managing-pests-schools)



[www.maine.gov/schoolipm](http://www.maine.gov/schoolipm)



# Personal Protection

- Apply repellent to exposed skin
- Wear protective clothing
- Body checks
- Education and communication



Art by Hailey Mealey  
haileyjaneco.com

# Pesticides

**Perimeter Treatment:** Spray or granular application at wooded margins of play areas

- Commercially licensed applicator required
- 2-3 applications (in New England: ~ mid-May, mid-June, plus September if needed)
- Select pesticides with proven efficacy.
- Follow all applicable state and federal regulations.

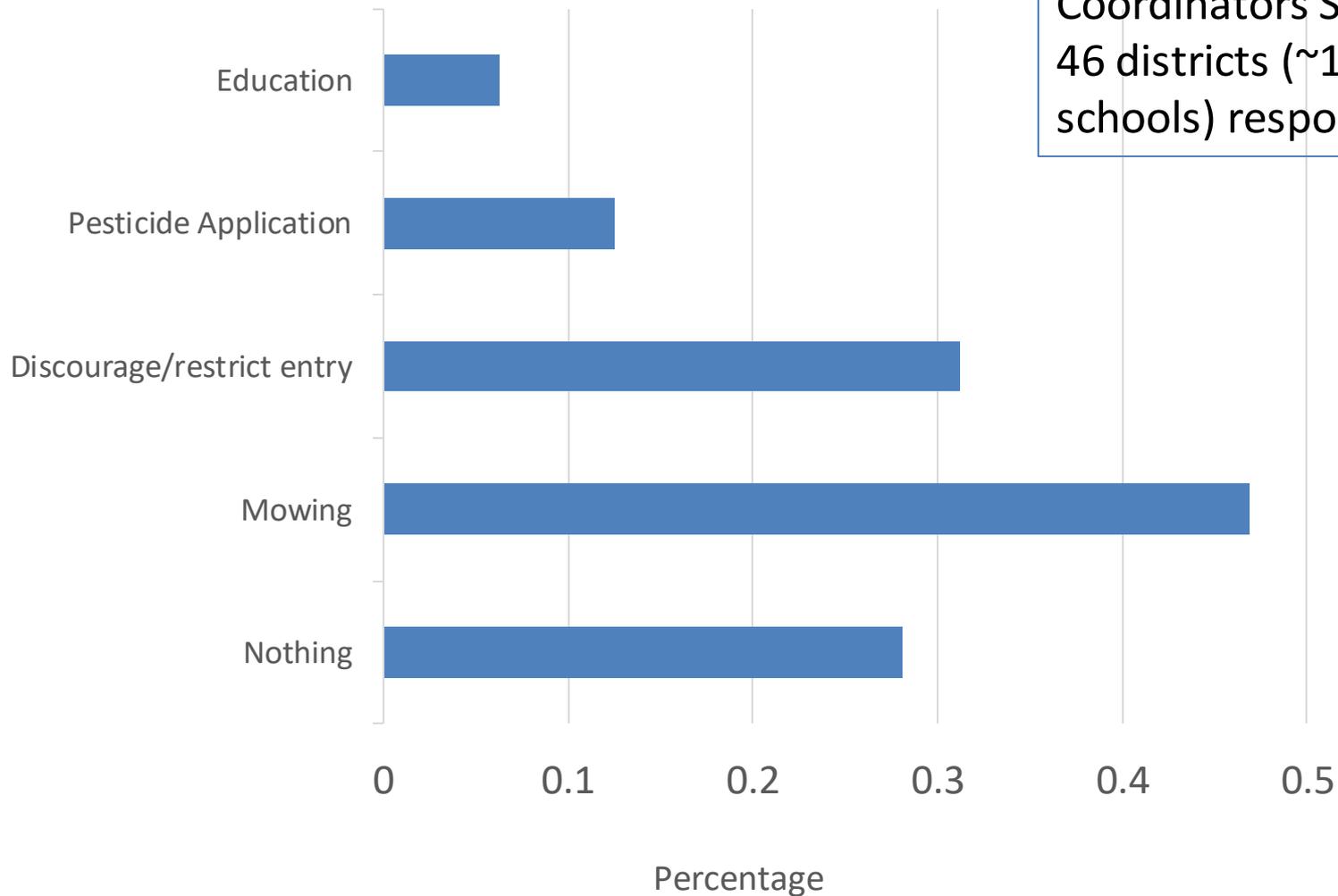


Photo: TickEncounter.org

Good resource:  
[www.TickEncounter.org](http://www.TickEncounter.org) (URI)

# How are Maine Schools Managing Ticks?

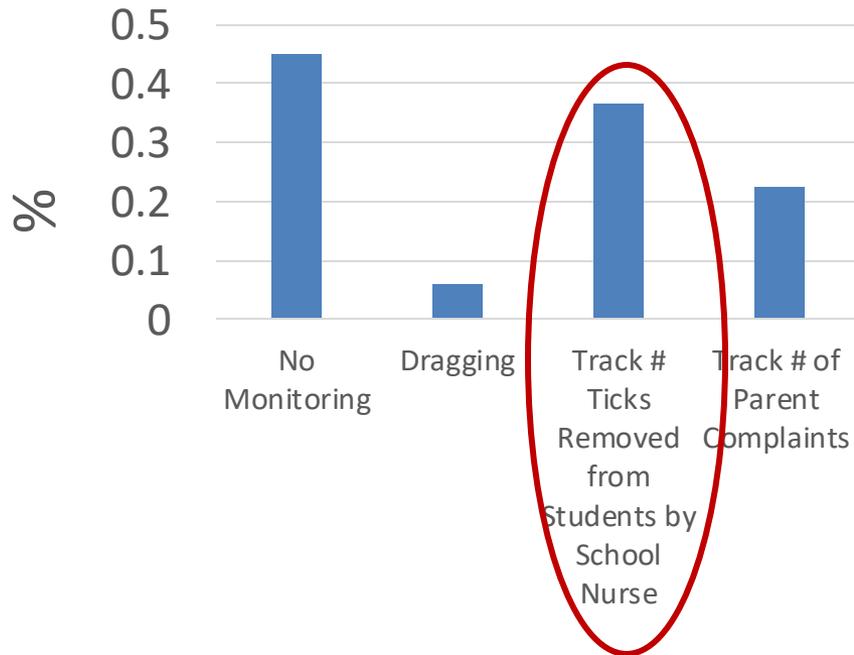
Maine School IPM  
Coordinators Survey, 2017.  
46 districts (~175  
schools) responding



# Are Schools Monitoring for Ticks?

Maine School IPM Coordinators Survey, 2017. 46 districts responding

How do you Monitor for Ticks?



# Effective School IPM is a Team Effort

**Nurse:** Diagnosis, tick removal, communication, education

**Contracted pest Service:** monitoring, control communication

**IPM Coordinator is the Team Captain**



**Business Manager:** Service contracts, budgeting

**Students. Teachers, Coaches:** education, tick avoidance, personal protection

**Maintenance Staff and Grounds Keepers:** Turf and Grounds Maintenance

**Office Staff:** communication, records, scheduling

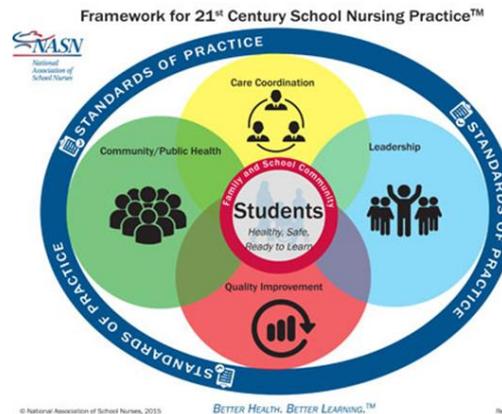
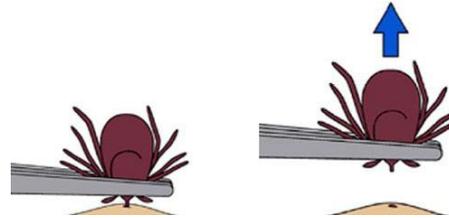


# Engage School Nurses in Tick IPM

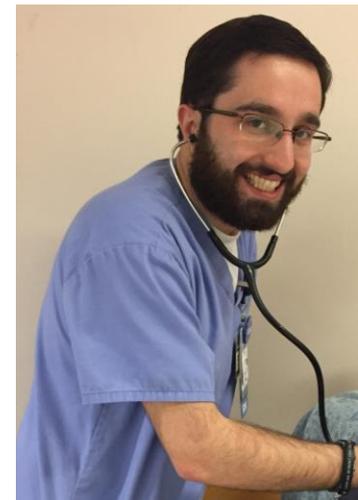
**NE School IPM Working Group**  
[www.neipmc.org/schools](http://www.neipmc.org/schools)

# Why School Nurses?

- **First-responders** for health-threat pests
- **Trained** to use **evidence-based practices**
- **Leaders** and **educators**
- **Strong Networks**



# Needs Assessment: What do School Nurses Want?



**On-line Survey**  
827 participants  
10 states



**Video Conference**

- Pre-conference survey: 46 participants  
8 states
- Conference: 27 participants  
in 5 states



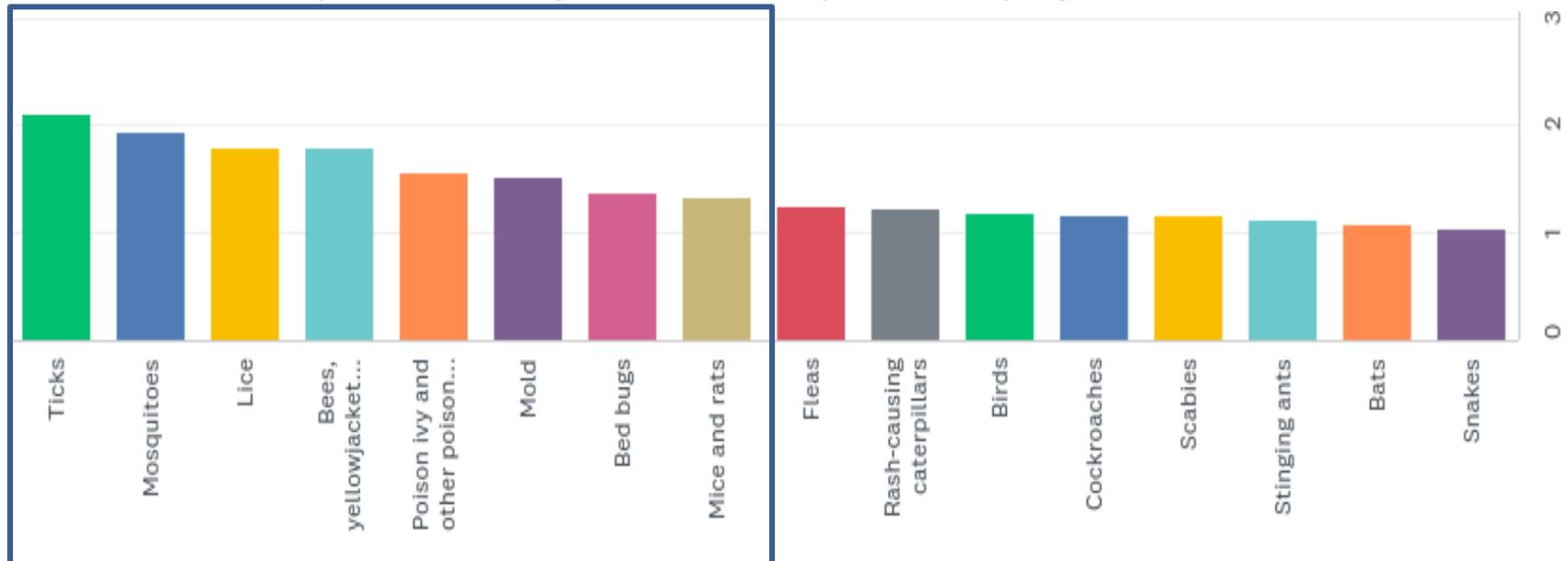
**Findings and Recorded Conference**  
[www.maine.gov/schoolipm](http://www.maine.gov/schoolipm)



# Q3: How do you view pest risk concerns in your school(s)?

- Answered: 827 Skipped: 0

*On a scale of 1(low) to 3 (high) ticks and mosquitoes are of highest concern*



# What Do School Nurses Need?

- Concise pest-specific information packets
  - Clearly written protocols
  - Action/decision guides (eg flowcharts)
  - Communication tools (eg sample parent letters and staff memos)
  - Web-based materials
- Training
  - Webinars
  - On-line self-paced modules



# Pest-Specific Guide Sheets

- Ticks
- Mosquitoes
- Head Lice
- Stinging Insects
- Rodents

**Northeastern IPM Center**

## Ticks in Schools

### Guidance for the School Nurse

Ticks bite and some species are vectors of human disease, including Lyme disease and Rocky Mountain spotted fever. The risk of tick-borne disease can be reduced through the use of Integrated Pest Management (IPM)—smart, sensible practices that include landscape management, personal protection, and education.

#### Ticks on School Grounds

Ticks are of concern on school grounds, especially species that vector diseases such as Rocky Mountain spotted fever, Lyme disease, babesiosis, ehrlichiosis, and Powassan encephalitis. Ticks can be found on playgrounds, sports fields, trails, and school yards located in and adjacent to wooded areas, especially where deer and other wildlife hosts are abundant.

#### The School Nurse's Role

School nurses can play a key role in preventing tick-borne illness by advocating for integrated pest management (IPM) policies and practices—sensible, evidence-based methods to reduce tick encounters and prevent bites. The school nurse can educate students, staff and families how to avoid ticks and when to seek medical treatment for tick-borne illness. Nurses can also play a key role in tick surveillance by reporting where, when, and what kinds of ticks are found on students. If a tick is found attached to the skin:

- Use fine-tipped tweezers to grasp the tick as close to the skin as possible. Pull gently until the tick detaches. If using a tick 'spoon', slide it forward to frame the tick in small part of the V-shaped slot, then use continuous sliding motion until the tick detaches. Do not twist or jerk the tick—this may increase the risk of disease transmission. If mouthparts break off and remain in the skin, disease transmission cannot occur after the rest of the tick is removed and the mouthparts will fall out as the skin heals.

#### Integrated Pest Management

- Place tick in a zipper-lock bag. Use reference images to contact your local extension office to identify it.
- Reduce tick habitat by mowing lawns, clearing tall grasses and brush around playgrounds and at the edge of lawns, removing leaf litter from trails, and pruning trees and shrubs to reduce shade.
- A 3-ft wide barrier of wood chips or gravel between lawns and wooded areas may discourage tick migration into lawn and reminds people not to enter tick habitat.
- Move playground equipment away from wooded areas.
- Discourage rodents by sealing gaps in and under buildings, sheds, dugouts and other structures. Eliminate bird feeders, refuse piles and stacks of stored equipment to discourage birds and rodents that can carry ticks and diseases.

#### Promote Personal Protection

- Avoid wooded or brushy areas, tall grass, and leaf litter.
- Walk in the center of trails. Keep children within designated playground areas.
- Use repellent that contains DEET, picaridin, or IR3535 on exposed skin. For additional repellent information visit: <https://www.epa.gov/insect-repellents/find-repellent-right-now>
- Consider wearing permethrin-treated clothing if going into heavily tick-infested areas.
- Use a buddy system to tick check without physical contact after recess or outdoor activity.
- Perform a full-body tick check using a hand-held or full-length mirror to view all parts of your body upon return from tick-infested areas.

#### 1. Neck & Back of Head

Prevention, registration, accurate identification, record-keeping, education. Partner with school's pest management team.

## Stinging Insects

### Guidance for the School Nurse

Bees, hornets and wasps are mostly beneficial insects but their stinging to those allergic to their venom. The risk of stings can be reduced through the use of Integrated Pest Management (IPM)—smart, sensible practices that include good sanitation practices and education.

- Avoid stinging insects as much as possible.
- Avoid wearing bright colors or floral patterns. Avoid scented personal care products.
- Inspect for nests and concentrated yellowjacket activity before mowing, moving stored equipment, or opening sheds.

## Mosquitoes in Schools

### Guidance for the School Nurse

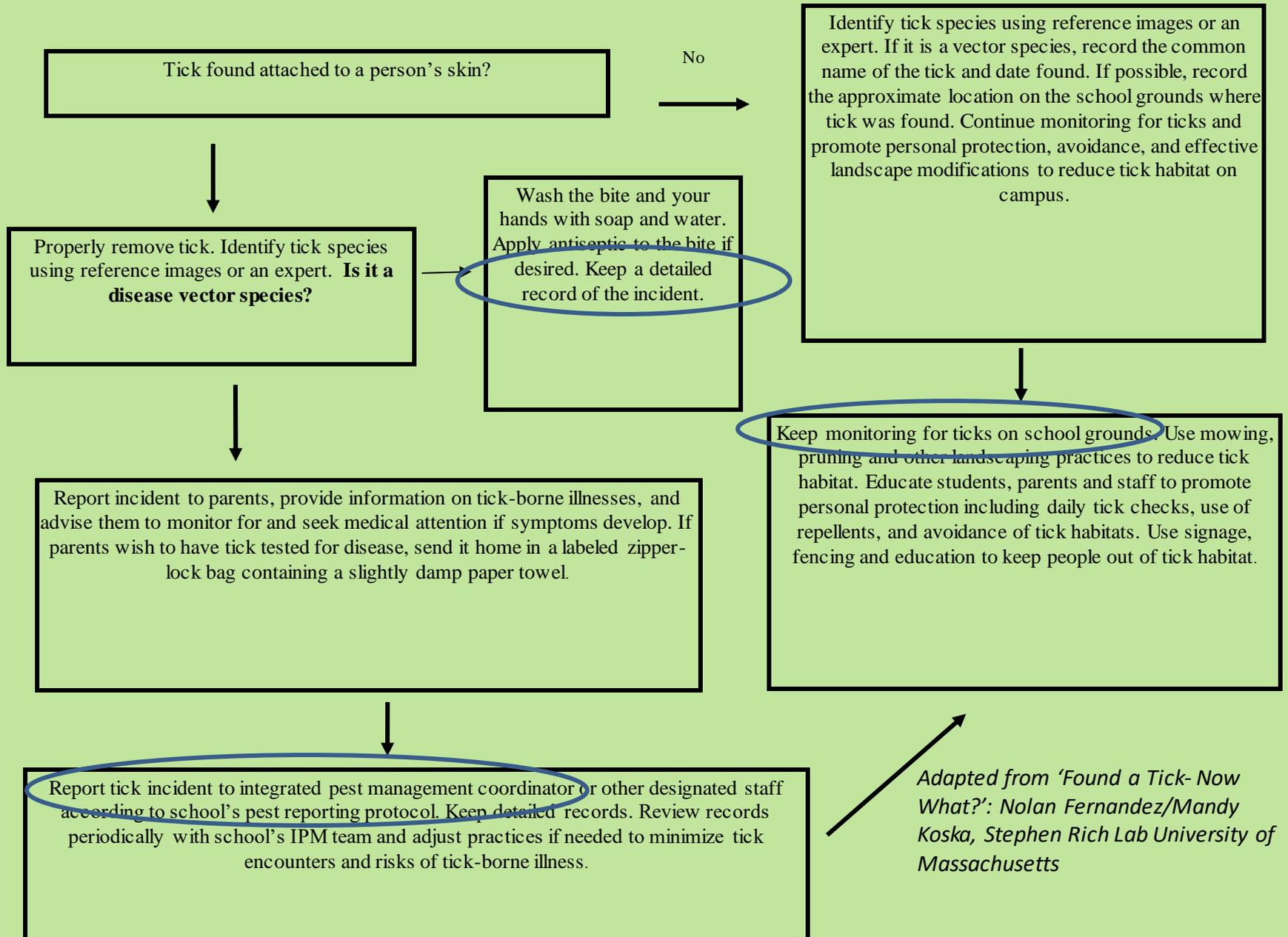
Mosquito-borne diseases including Eastern Equine Encephalitis and West Nile virus can be reduced through the use of Integrated Pest Management (IPM)—smart, sensible practices that include landscaping and maintenance to reduce mosquito habitat, reduce mosquito activity times, and educating parents and staff to encourage clothing choice and judicious use of repellent.

- Drill drain holes in playground tires and equipment.
- Keep gutters and downspouts clean and in good repair.
- Keep dumpsters and outdoor garbage cans clean, closed and well-maintained.
- Grade and fill school grounds where needed to promote water drainage and prevent puddling.
- Cut back or remove dense brush. Prune shrubs and trees to allow air movement. Keep lawns, meadows and swales mown.
- Flush bird-baths weekly.

### Monitor and Avoid Mosquitoes

- Follow and share announcements and guidance from public health authorities.

# Tick Monitoring and Response Action Chart for Schools



# Communication and Outreach Tools

- Wallet cards
- Tick “spoons” and kits
- Posters
- Sample memos



Northeastern IPM Center How You Can Prevent

## Ticks

### Identify

- Remove tick immediately.
- What is it?** Different kinds of ticks carry different diseases.
- Look Closely.** Use a magnifying lens to examine tick's coloration and markings. Compare with good quality images to identify your tick.
- Get help.** Contact your county Extension office, university or pest professional for help in identifying ticks.

### Prevent

- Protect yourself.** When going outdoors, tuck pants into socks and apply EPA-approved repellents.
- Remove ticks** with tweezers or a tick spoon.
- Maintain an Open Landscape.** Keep grass well mown. Trim trees and shrubs to reduce shade.

### Communicate

Dog tick vs Black-legged tick

**Black-legged ticks can transmit Lyme disease!**

- Teach** students and families to perform daily tick checks.
- Record** each time an attached tick is removed (date, name of student).
- Recognize symptoms** of tick-borne illnesses and notify parents accordingly.

### Manage

- Monitor** tick activity on school grounds with a "tick-drag".
- Plan.** Develop a tick management plan for your school.
- Take Action.** See [northeasternipm.org/schools](http://northeasternipm.org/schools) for guidance.

**Common hiding places for ticks!**

- Head and hair
- Chest and armpits
- Waist and groin area
- Behind the knees

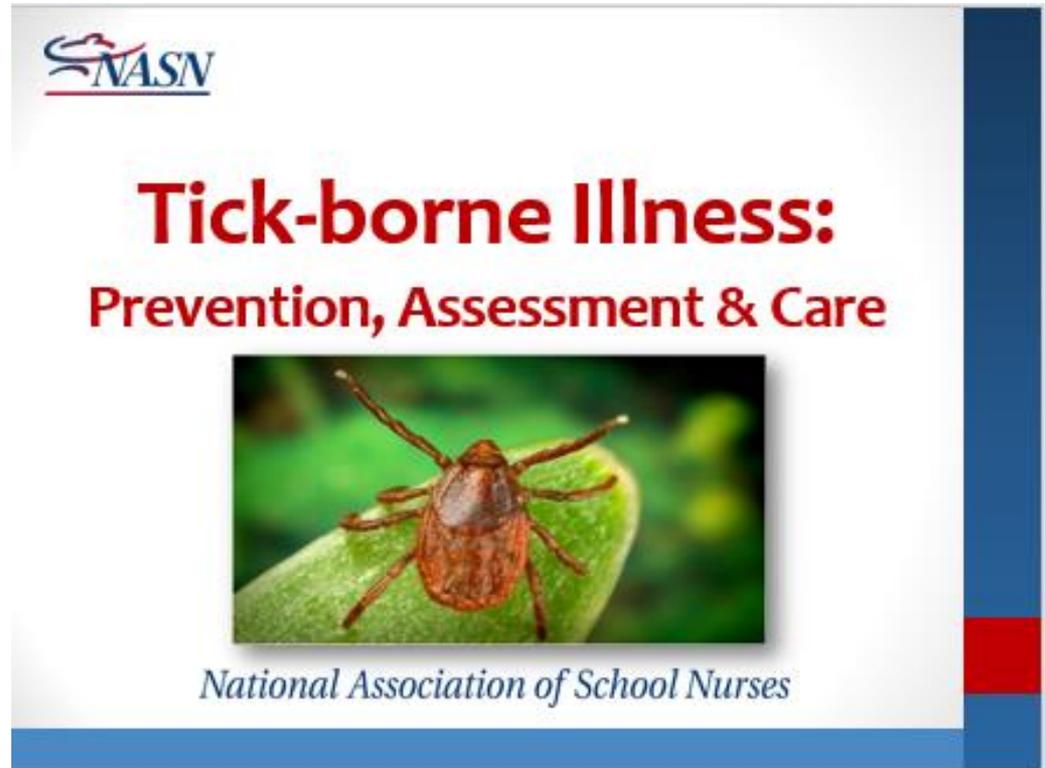
# Outreach to School Nurses

- **National School Nurse Association**
  - Annual Conference
  - Social media and e-news bulletins
- **State and local school nurse conferences**



# Updated free Training Module for School Nurses

- Tick-borne Illness: Prevention, Assessment and Care [2019]  
<https://www.pathlms.com/nasn/courses/10995>
- 1.25 CNE credits for nurses





## Tick-borne Illness: Prevention, Assessment & Care



*National Association of School Nurses*

# IPM Resources for Schools



- NE IPM Center: [neipmc.org/schools](http://neipmc.org/schools). Guidelines, posters, wallet cards, fact sheets and more



- IPM Institute: [PestDefenseforHealthySchools.com](http://PestDefenseforHealthySchools.com) certificate training modules



- eXtension: [iSchoolPestManager.org](http://iSchoolPestManager.org). Free training modules and searchable repository of resources



- US EPA: [www.epa.gov/managing-pests-schools](http://www.epa.gov/managing-pests-schools). Webinars and resources



# QUESTIONS

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# USDA Areawide Tick Control Project (2016–2021):

*Preliminary research results*

# Limited number of tick control tools available

## Tick Management Handbook

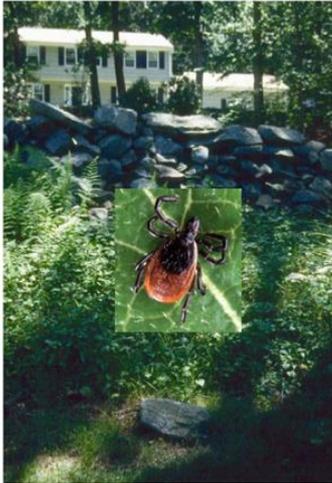
A integrated guide for homeowners, pest control operators, and public health officials for the prevention of tick-associated disease

Prepared by:

Kirby C. Stafford III  
Chief Scientist  
The Connecticut Agricultural Experiment Station, New Haven

Produced as part of the Connecticut community-based Lyme disease prevention projects in cooperation with the following Connecticut health agencies:

The Connecticut Department of Public Health  
The Westport Weston Health District  
The Torrington Area Health District  
The Ledge Light Health District



Funding provided by

The Centers for Disease Control and Prevention  
The Connecticut Agricultural Experiment Station



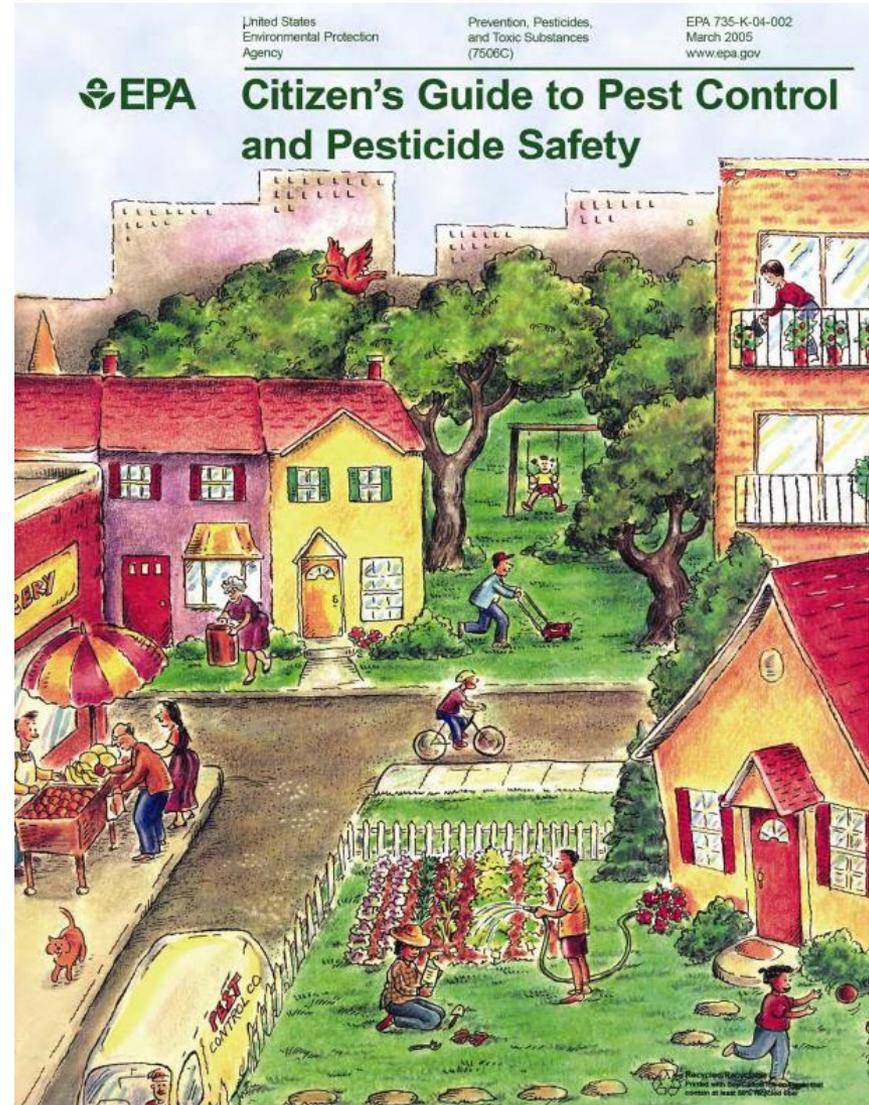
- ❑ Area spray of pesticides: *synthetic- & bio-pesticides*
- ❑ Host-targeted control (immature ticks): *Tick tube, Bait box*
- ❑ Host-targeted control (adult ticks): *4-Poster*



# Area application of acaricides & biopesticides

**Table 4.** Acaricides with products labeled for the control of ticks in the residential landscape.

Chemical	Some brand or common names*	Chemical type and usage
Bifenthrin	Talstar® Ortho® product	Pyrethroid insecticide. Available as liquid and granular formulations. Products available for homeowner use and commercial applicators.
Carbaryl	Sevin®	Carbamate insecticide. A common garden insecticide for homeowner use, some products are for commercial use only.
Cyfluthrin	Tempo® Powerforce™	Pyrethroid insecticide. Available for commercial and homeowner use with concentrates and ready to spray (RTS) products.
Deltramethrin	Suspend® DeltaGard® G	A pyrethroid insecticide for commercial applicators.
lambda-cyhalothrin	Scimitar® Demand®	A pyrethroid insecticide for commercial applicators.
Permethrin	Astro® Ortho® products Bonide® products Tengard® SFR Others	Pyrethroid insecticide. There are concentrates and ready to spray (RTS) products. Most are for homeowner use, a few are for commercial use only.
Pyrethrin	Pyrenone® Kicker® Organic Solutions All Crop Commercial & Agricultural Multipurpose Insecticide®	Natural pyrethrins with the synergist piperonyl butoxide (PBO) or insecticidal soap provide limited tick control. A combination of pyrethrin and PBO with either insecticidal soap or silicon dioxide (from diatomaceous earth) was found effective against ticks in one trial.

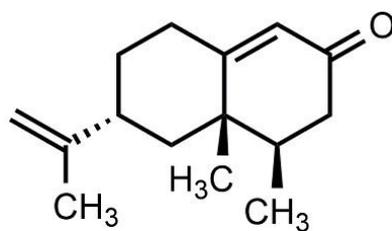


Ability of Two Natural Products, Nootkatone and Carvacrol, to Suppress *Ixodes scapularis* and *Amblyomma americanum* (Acari: Ixodidae) in a Lyme Disease Endemic Area of New Jersey

MARC C. DOLAN,<sup>1,2</sup> ROBERT A. JORDAN,<sup>3</sup> TERRY L. SCHULZE,<sup>3,4</sup> CHRISTOPHER J. SCHULZE,<sup>4</sup> MARK CORNELL MANNING,<sup>5</sup> DANIEL RUFFOLO,<sup>5</sup> JASON P. SCHMIDT,<sup>1</sup> JOSEPH PIESMAN,<sup>1</sup> AND JOSEPH J. KARCHESY<sup>6</sup>

J. Econ. Entomol. 102(6): 2316–2324 (2009)

Spray application of natural pesticides can quickly suppress and maintain control of both the blacklegged tick and the lone star tick populations at relatively low concentrations.



(+)-nootkatone

Grapefruit, Alaska Yellow Cedar

Table 1. Probit analysis of four species of ticks (unfed nymphs,  $n = 250$  for each species) 24 h after exposure to nootkatone concentrations

Species	Nootkatone $\mu\text{g}/\text{cm}^2$ (95% CI)		Slope $\pm$ SE	$\chi^2$
	LC <sub>50</sub>	LC <sub>90</sub>		
<i>Amblyomma americanum</i> (Lone star tick)	0.352 (0.259–0.481)	1.001 (0.684–2.048)	2.827 $\pm$ 0.295	3.761
<i>Dermacentor variabilis</i> (American dog tick)	0.233 (0.172–0.307)	0.644 (0.460–0.170)	2.905 $\pm$ 0.307	3.288
<i>Ixodes scapularis</i> (Black-legged ticks)	0.169 (0.138–0.202)	0.549 (0.429–0.771)	2.522 $\pm$ 0.295	2.087
<i>Rhipicephalus sanguineus</i> (Brown dog tick)	0.197 (0.169–0.228)	0.485 (0.397–0.641)	3.274 $\pm$ 0.357	0.649

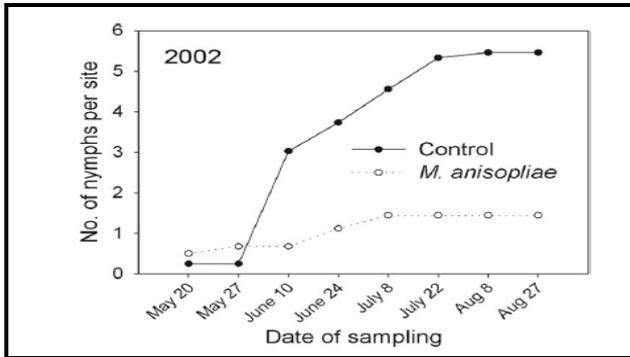
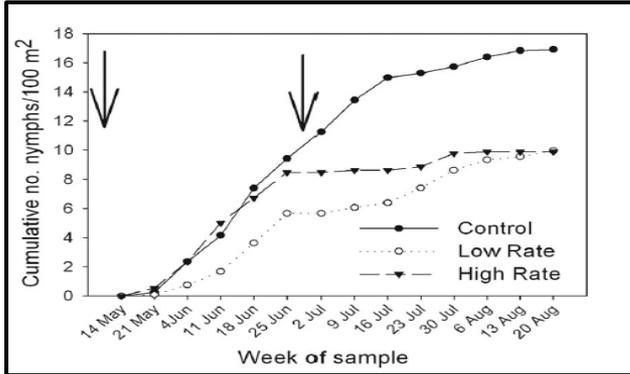
$\chi^2$  values  $< 7.81$  (0.95, 3 df) indicate that the data do not significantly depart from probit model expectations.

Evaluation of *Metarhizium anisopliae* Strain F52 (Hypocreales: Clavicipitaceae) for Control of *Ixodes scapularis* (Acari: Ixodidae)

ANUJA BHARADWAJ<sup>1</sup> AND KIRBY C. STAFFORD III

The Connecticut Agricultural Experiment Station, 123 Huntington Street - Box 1106, New Haven, CT 06504

J. Med. Entomol. 47(5): 862-867 (2010); DOI: 10.1603/ME10020



**Met52<sup>EC</sup>** bioinsecticide

**ACTIVE INGREDIENT**  
*Metarhizium anisopliae* Strain F52\* 11.0%  
**OTHER INGREDIENTS\*\*** 89.0%  
**Total** 100.0%

**KEEP OUT OF REACH OF CHILDREN**

**CAUTION**  
**PRECAUTIONARY STATEMENTS**  
**HAZARDS TO HUMANS AND DOMESTIC ANIMALS**  
 Causes moderate eye irritation. Harmful if inhaled, absorbed through skin, or swallowed. Avoid contact with skin, eyes, or clothing. Avoid breathing dust. Wash thoroughly with soap and water after handling, and before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove and wash contaminated clothing before reuse.

**NET LINE NUMBER**  
 Have the product container or label with you when calling a poison control center or doctor or going for treatment. For emergency information on this pesticide product (including health concerns, medical emergencies, or pesticide incidents), call the National Pesticide Information Center at 1-800-858-7378, 6:30 AM to 4:30 PM Pacific Time (PT), seven days a week. During other times, call the poison control center at 1-800-222-1222.

**NOTE TO PHYSICIAN**  
 Contains petroleum distillates. Handling may cause aspiration pneumonia.

**NOVOZYMES**  
 Rethink Tomorrow  
 Novozymes Biologicals Inc.  
 5400 Corporate Circle  
 Salem, VA 24153  
 1-888-744-5662

**Net Contents:** 1.06 quarts (1 L)

13202\_Met52\_EC\_Quart\_label (web) 1 12-04-02 9:30 AM



Previous studies indicate that entomopathogenic fungi can suppress host-seeking deer tick populations

Stafford and Allan, 2010

Bharadwaj and Stafford, 2010

- Reduced tick abundance 55-84% on lawn and woodland plots.

- Reduced tick abundance 87-96% 3 weeks posttreatment
- 53-74% 5 weeks posttreatment.

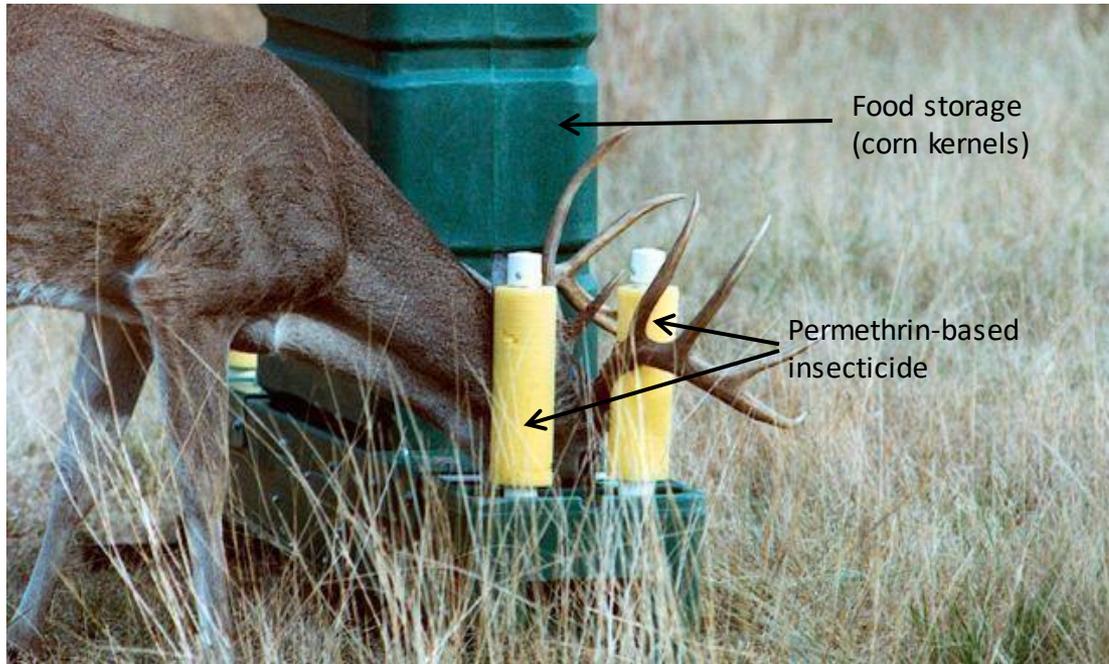


Natural fungus kills ticks

# ARS “4-Poster” Deer Treatment Bait Station



To control ticks feeding on  
white-tailed deer



An ARS-patented “4-poster” device that lures (with food!) deer so that they get tick-killing pesticide transferred to their heads, necks and ears while feeding at the device.

# Use of "4-Poster" leads to 60–80% reduction in tick population

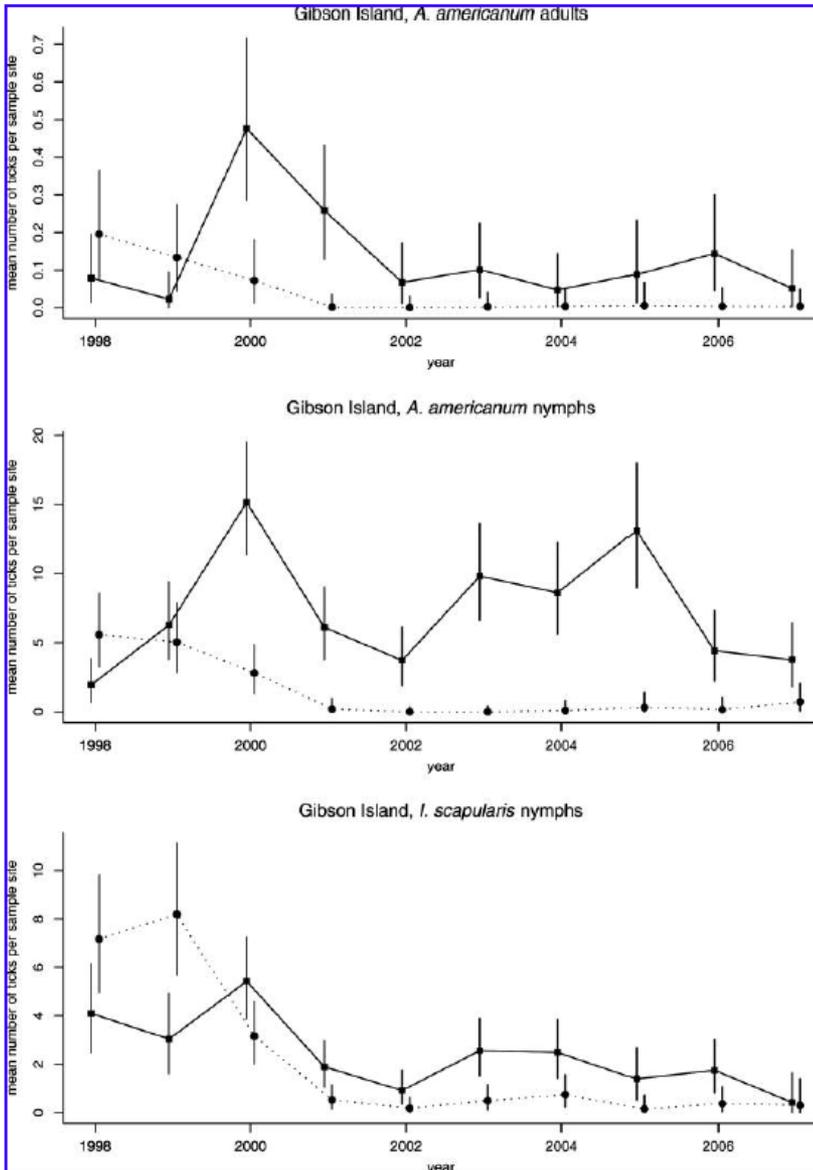
John Carroll / USDA-ARS; Gibson Island, MD

VECTOR-BORNE AND ZOO NOTIC DISEASES  
 Volume 9, Number 4, 2009  
 © Mary Ann Liebert, Inc.  
 DOI: 10.1089/vbz.2008.0166

ORIGINAL ARTICLE

## Sustained Control of Gibson Island, Maryland, Populations of *Ixodes scapularis* and *Amblyomma americanum* (Acari: Ixodidae) by Community-Administered 4-Poster Deer Self-Treatment Bait Stations

John F. Carroll,<sup>1</sup> J. Mathews Pound,<sup>2</sup> J. Allen Miller,<sup>2</sup> and Matthew Kramer<sup>3</sup>



Abstract

In 1998, as part of a long-term study to evaluate the impact of community-administered 4-poster deer self-treatment bait stations on the population of *Ixodes scapularis* and *Amblyomma americanum* on Gibson Island, Maryland, we conducted a study to evaluate the impact of community-administered 4-poster deer self-treatment bait stations on the population of *Ixodes scapularis* and *Amblyomma americanum* on Gibson Island, Maryland.

as parts of the study were conducted in 1998 and 1999.

untreated



treated





*Journal of Medical Entomology*, 54(4), 2017, 1019–1024  
 doi: 10.1093/jme/tjx044  
 Advance Access Publication Date: 15 March 2017  
 Vector Control, Pest Management, Resistance, Repellents Research article

**Evaluation of the SELECT Tick Control System (TCS), a Host-Targeted Bait Box, to Reduce Exposure to *Ixodes scapularis* (Acari: Ixodidae) in a Lyme Disease Endemic Area of New Jersey**

Terry L. Schulze,<sup>1</sup> Robert A. Jordan,<sup>2,3</sup> Martin Williams,<sup>4</sup> and Marc C. Dolan<sup>4</sup>

❖ **Schulze et al. 2017**

- 2-year study in **New Jersey**.
- Reduced host-seeking nymphs by 87.8% at 1 year post intervention.
- by 97.3% at 2 year post intervention.

VECTOR CONTROL, PEST MANAGEMENT, RESISTANCE, REPELLENTS

**Control of Immature *Ixodes scapularis* (Acari: Ixodidae) on Rodent Reservoirs of *Borrelia burgdorferi* in a Residential Community of Southeastern Connecticut**

MARC C. DOLAN,<sup>1</sup> GARY O. MAUPIN,<sup>2</sup> BRADLEY S. SCHNEIDER,<sup>1</sup> CHRISTOPHER DENATALE,<sup>3</sup> NICK HAMON,<sup>4</sup> CHUCK COLE,<sup>4</sup> NORDIN S. ZEIDNER,<sup>1</sup> AND KIRBY C. STAFFORD III<sup>2</sup>

*J. Med. Entomol.* 41 (6): 1043–1054 (2004)



❖ **Dolan et al. 2004**

- 3-year study in **Connecticut**.
- Reduced *Borrelia* infection in white-footed mice by 53%.
- Reduced questing adults by 77%.
- Also reduced *Borrelia* infection rate in ticks (31% vs 47%).

*Journal of Medical Entomology*, 54(2), 2017, 403–410  
 doi: 10.1093/jme/tjw194  
 Advance Access Publication Date: 8 December 2016  
 Vector Control, Pest Management, Resistance, Repellents Research article



Vector Control, Pest Management, Resistance, Repellents Research article

**Evaluation of Doxycycline-Laden Oral Bait and Topical Fipronil Delivered in a Single Bait Box to Control *Ixodes scapularis* (Acari: Ixodidae) and Reduce *Borrelia burgdorferi* and *Anaplasma phagocytophilum* Infection in Small Mammal Reservoirs and Host-Seeking Ticks**

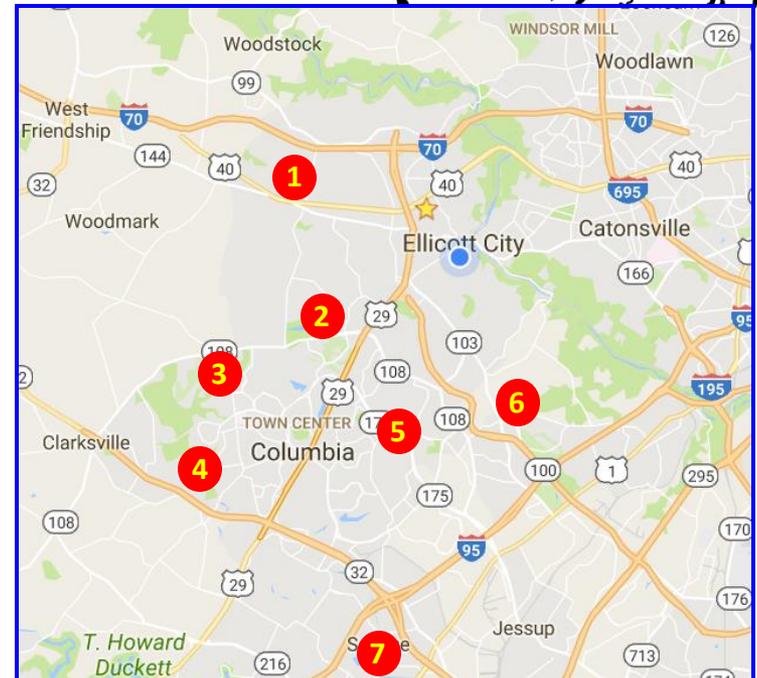
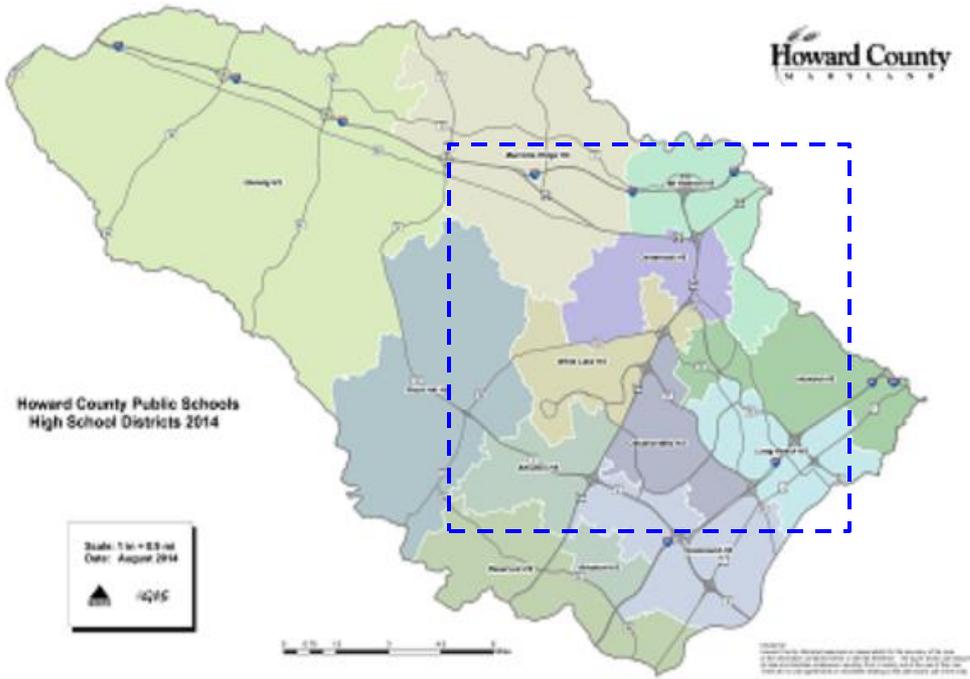
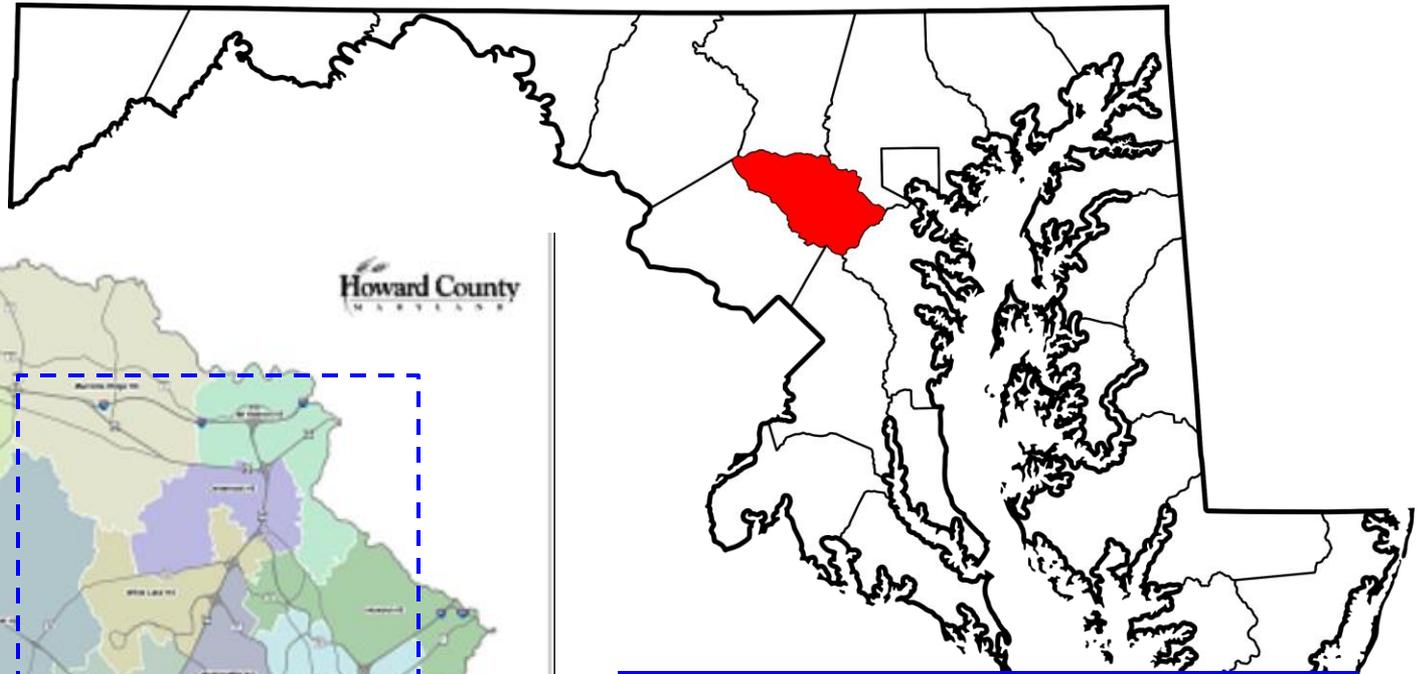
Marc C. Dolan,<sup>1,2</sup> Terry L. Schulze,<sup>3</sup> Robert A. Jordan,<sup>4,5</sup> Christopher J. Schulze,<sup>3</sup> Amy J. Ullmann,<sup>1</sup> Andrias Hojgaard,<sup>1</sup> Martin A. Williams,<sup>1</sup> and Joseph Piesman<sup>1,6</sup>

❖ **Dolan et al. 2017**

- A study in **New Jersey**.
- Reduced nymphal and larval tick burdens on small mammals by 76% and 77%.

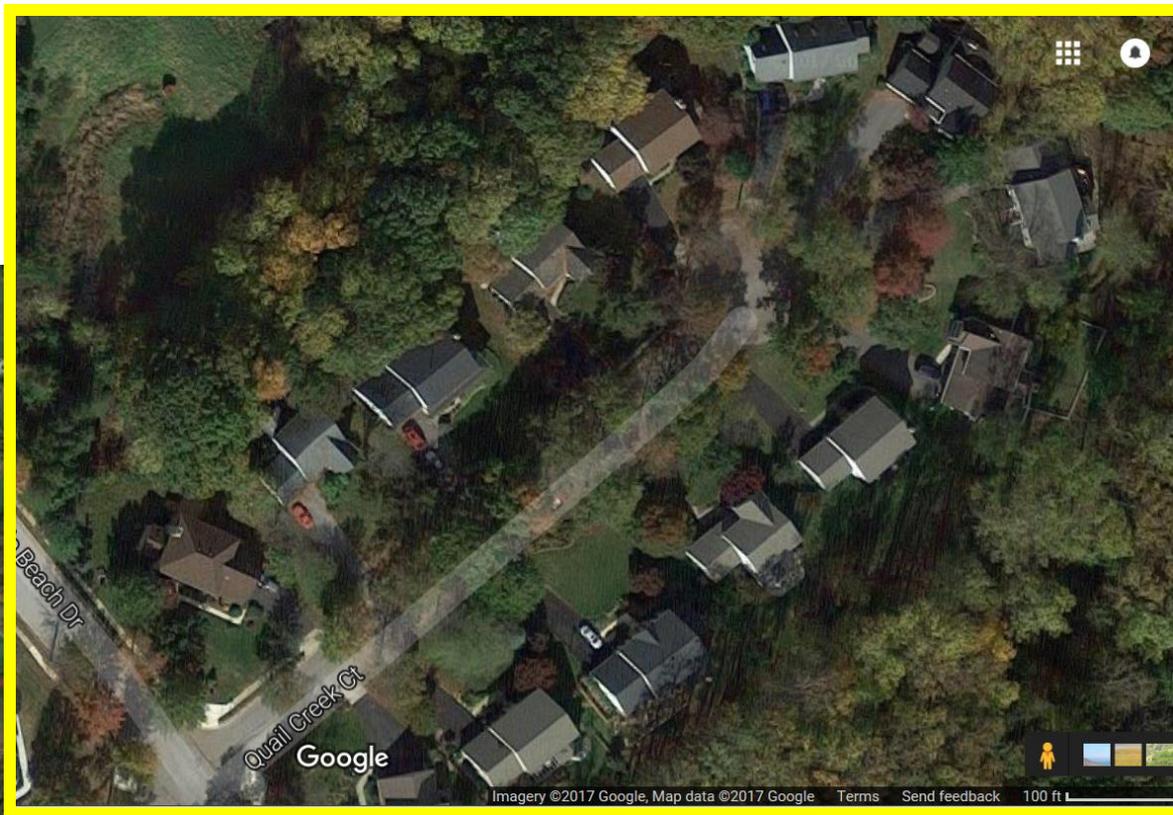


# Field study sites



1. Davis Force Park (Bait box + Met52)
2. Centennial Park (Untreated Control)
3. Cedar Lane Park (4-Poster + Bait box)
4. MPEA (4-Poster + Bait box)
5. Blandair Park (4-Poster + Bait box + Met52)
6. Rockburn Park (4-Poster + Bait box + Met52)
7. Wincopin Trail (Bait box + Met52)

# Residential neighborhood



[Handicappedoutdoors.com](http://Handicappedoutdoors.com)

# Recruitment of Homeowner Participation

Be part of the research

## Tick Sampling Mouse Sampling

**Blacklegged (or deer) ticks**  
The United States Department of Agriculture in collaboration with the University of Maryland initiated a study to evaluate an intervention located adjacent to large, public lands.

Tick sampling is done to monitor tick density in a given area. We will be using a flagging technique where a researcher gently moving a piece of ground and vegetation in the area to count tick numbers approximately 3 feet from the land interface on both sides.

White-footed mice are the primary host and causative agent of Lyme disease. We will monitor the status of the pathogen in mice. We only live trap individual mice. Animal Care and Use Committee approved.



### What are the study objectives?

We are testing the single and combined effects of three control measures on tick density and the presence of tick-borne pathogens in Howard County parks and surrounding residential areas.

- Select TCSTM rodent bait
- 4-Poster deer feeders (in residential areas)
- Met52® EO natural spray

Researchers will be sampling ticks and mice.

If you have questions, contact Dr. Li at 410-326-7100.



**Throughout the project:**

- Be wearing a white jacket
- Be sampling ticks at 3 feet from the land interface on both sides
- Be sampling for approximately 15 minutes
- Be sampling twice

### Through the project:

- Be wearing a white jacket
- Set traps along the edge of the woods
- Trap once a month, April to October
- Set mouse traps in the mid-to late afternoon
- Open mouse traps in the morning (between 6:30 am and 9:00 am)

## Meet the Team



**Dr. Andrew Li.** Andrew is a Research Entomologist with the USDA, ARS, Beltsville Agricultural Research Center (BARC). He is the Principle Investigator of this USDA-ARS supported Area-wide Integrated Tick Management Project. Andrew has a PhD in entomology, and his research focuses on ticks affecting human and animal health, particularly the control of blacklegged tick (or deer tick) that transmits Lyme disease. He is one of co-organizers of Federal Tick-borne Disease IPM working Group, and the leader of Community of Practice in Tick IPM in Beltsville-Greenbelt-College Park area.



**Dr. Erika Machtinger.** Erika is a Post-doctoral Scientist with the USDA, ARS, in the natural areas surrounding the coast of Maine which fostered her love of the environment and wildlife. Erika is the Maryland field coordinator for this area-wide project. When she is not at work, you can often find Erika on the back of a horse.



**Phil Norman.** Phil is the Deer Project Manager for the Department of Recreation and Parks, and has been working for the Department since 1990. Phil has his cumulative degree in Biology from the State University of New York College at Potsdam, and been working in natural resource management and education for 40 years.



**Grace Hummell.** Grace received her BS from the University of Maryland in Environmental Science. She is interested in the spatial dynamics of animal movement. Grace will be working in the field on all aspects of the area-wide tick IPM project. Grace hopes to attend graduate school in a couple years to further her knowledge of animal movement and behavior.



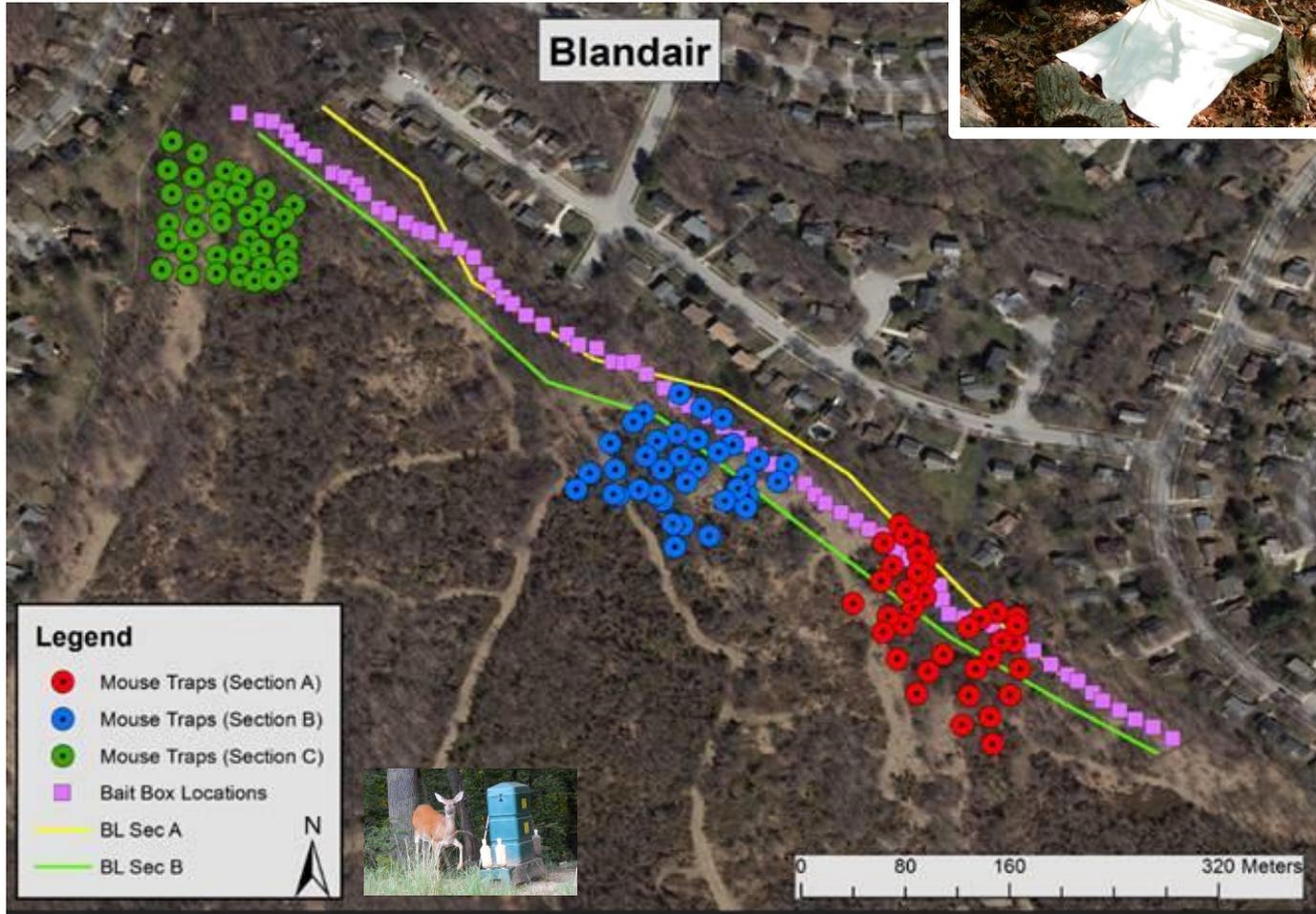
**Patrick Roden-Reynolds.** Patrick is a research technician for the Tick Control Project. He graduated from Virginia Tech in 2015 studying Wildlife Sciences. For this project, he will be conducting various fieldwork tasks (in a lovely pair of white coveralls) such as mouse trapping, tick sampling, and white-tail deer collaring. Feel free to ask any questions if you see him out in the field working!



RECREATION & PARKS

# Treatment & mouse/tick sampling

- Bait box placement
- Tick sampling
- Mouse trapping





Tick and mouse sampling



## Lyme Infection Status

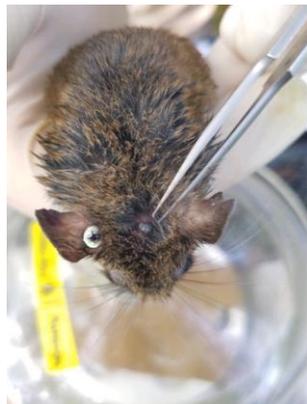
Comparison of *Borrelia burgdorferi* infection in *Ixodes scapularis* individuals removed from mice and individuals questing in 2017

### *B. burgdorferi* infection (%) in questing *I. scapularis* in 2017

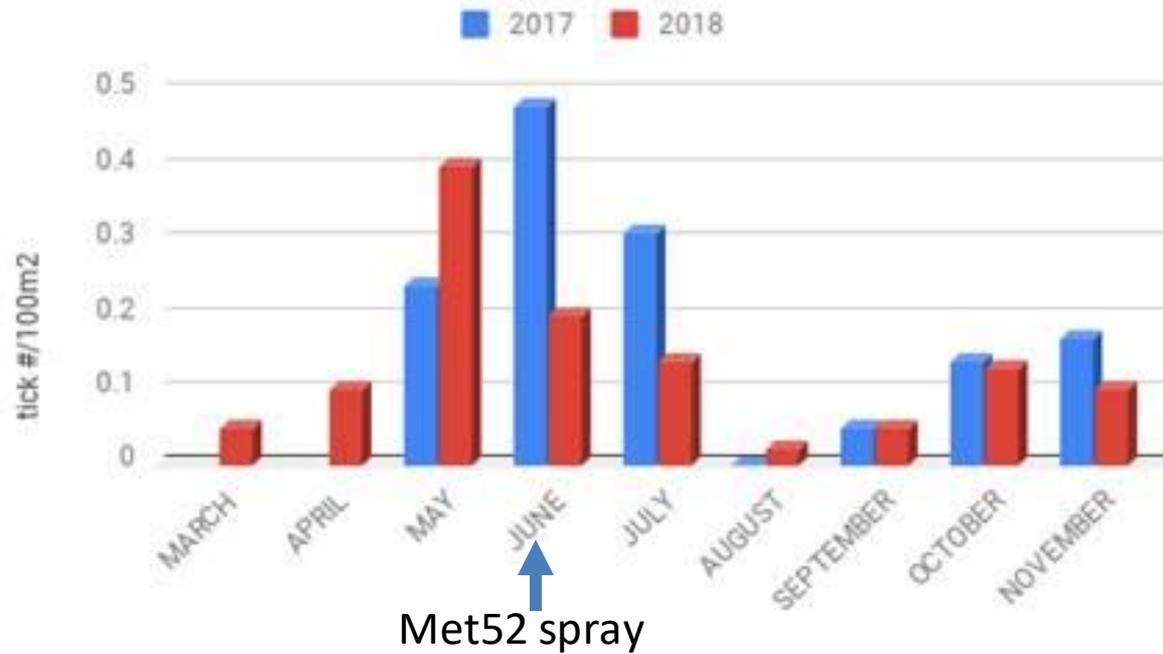
Park	n=	infected adults	n=	infected nymphs	n=	total infection
BL	2	0.0	8	0.00	10	0.0
CL	8	50.00	11	18.18	19	31.58
CT	4	25.00	15	20.00	19	21.05
DF	2	0.0	12	25.00	12	25.00
MPEA	8	12.50	18	5.56	26	7.69
RB	9	11.11	49	12.24	58	12.07
WT	9	0.00	54	0.00	63	0.0
<b>TOTAL</b>	<b>42</b>	<b>3.38</b>	<b>167</b>	<b>7.25</b>	<b>207</b>	<b>9.18</b>
<b>MEAN</b>		<b>14.09</b>		<b>11.57</b>		<b>13.91</b>

### *B. burgdorferi* infection (%) in *I. scapularis* removed from *Peromyscus* in 2017

Park	n=	infected nymphs	n=	infected larva	n=	total infection
BL	17	94.12	77	28.57	94	40.43
CL	15	26.67	59	30.51	74	29.73
CT	6	50.00	41	39.02	47	40.43
DF	31	48.39	190	53.68	221	52.94
MPEA	4	25.00	59	40.68	63	39.68
RB	3	66.67	99	37.37	102	38.24
WT	3	33.33	2	50.00	5	40.00
<b>TOTAL</b>	<b>79</b>	<b>53.16</b>	<b>527</b>	<b>41.75</b>	<b>606</b>	<b>43.23</b>
<b>MEAN</b>		<b>49.17</b>		<b>39.98</b>		<b>40.21</b>



## Questing *I. scapularis* adult & nymph density

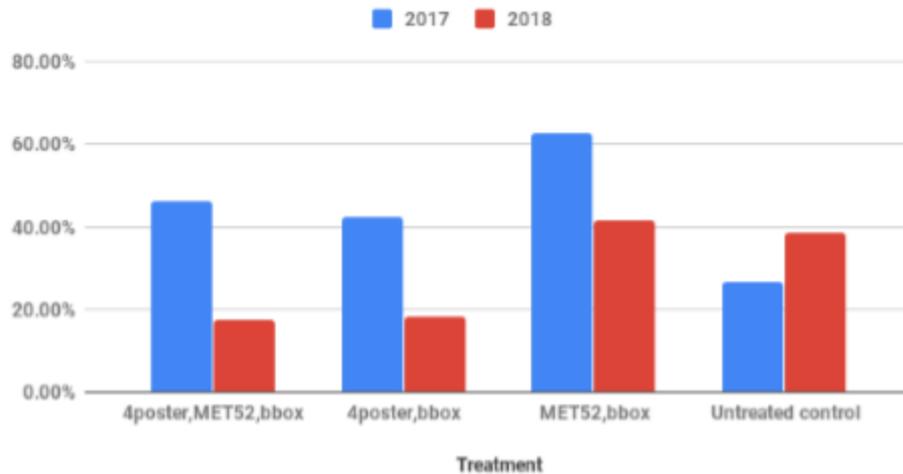


## Pathogen infection (%) in *Peromyscus* captured using Sherman traps

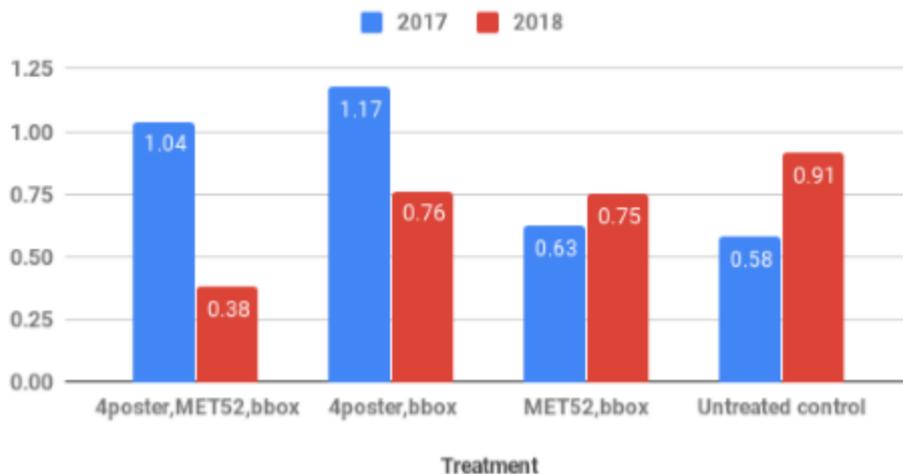
Park	2017					2018				
	# of mice	B. burgdorferi	A. phagocytophilum	B. microti	B. miyamotoi	# of mice	B. burgdorferi	A. phagocytophilum	B. microti	B. miyamotoi
BL	163	56.4	1.8	0	1.8	215	62.3	0	0	0
CL	94	33.3	1.1	0	4.3	110	36.4	0	0	0
CT	79	49.4	0	0	1.3	91	35.2	0	0	1.1
DF	151	70.7	33.8	0	1.3	163	75.5	15.3	0	1.8
MPEA	55	38.2	5.5	5.5	0	32	28.1	0	3.1	0
RB	70	52.2	0	0	0	90	43.3	0	0	0
WT	8	37.5	0	0	0	12	25	0	0	0
<b>Mean</b>		<b>48.2</b>	<b>6.0</b>	<b>0.8</b>	<b>1.2</b>		<b>43.7</b>	<b>2</b>	<b>0</b>	<b>0</b>
<b>Total</b>	<b>620</b>					<b>713</b>				

# How about ticks feeding on mice?

**% of *Peromyscus* infested with *I. scapularis* nymphs & larvae**



***I. scapularis* tick load (# of ticks/# of mice) on *Peromyscus***



## Mouse Trapping in 2017

- Monthly from May to September 2017
- At each of the 7 areawide parks
- Each trapping effort consisted of two consecutive days of captures, with 72 traps at each park.
- After each mouse was ear tagged, tissue, blood and ticks were collected.

## Results:

- Captured a total of **341 individual mice, 620 recaptures.**
- Collected a total of **1,463** mouse ear tissue and blood samples.
- Collected **625** ticks from mice.

## Invasive Insect Biocontrol & Behavior Laboratory: Beltsville, MD

[Research](#) ▾ [People](#) ▾



[ARS Home](#) » [Northeast Area](#) » [Beltsville, Maryland \(BARC\)](#) » [Beltsville Agricultural Research Center](#) » [Invasive Insect Biocontrol & Behavior Laboratory](#) » [People & Locations](#) » Andrew Li

### Related Topics

#### Andrew Yongsheng Li

[Invasive Insect Biocontrol & Behavior Laboratory](#)

Research Entomologist

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Phone: (301) 504-5401

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Room 201

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BLDG 007 BARC-WEST

BELTSVILLE , MD 20705

#### Projects

##### [Prevention of Arthropod Bites](#)

In-House Appropriated (D)

Accession Number: 427865

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##### [Deployed War Fighter Protection Program \(2018\)](#)

Interagency Reimbursable Agreement (I)

#### ARS News Articles

- [ARS Leads New Lyme Disease Control Efforts in Howard County, Md.](#)
- [Collaring the Mice that Carry Lyme Disease-Causing Ticks](#)
- [Tick Control Program Reveals High Level of Infection in White-Footed Mice](#)
- [Work With Us Home](#)

# QUESTIONS

Northeastern  
**IPM**  
Center



United States  
Department of  
Agriculture

National Institute  
of Food and  
Agriculture



# Some Questions for You

# Find a Colleague

- To post a profile about yourself and your work:

<http://neipmc.org/go/APra>

- “Find a Colleague” site

<http://neipmc.org/go/colleagues>

# Archive of Today's Webinar

- Today's Webinar will be available to view **on demand** in a few business days.

<http://www.neipmc.org/go/ipmtoolbox>

- You can watch as often as you like.

# Upcoming Toolbox Webinars

- Industrial Hemp IPM
  - May 16, 2019 at 1:00 pm

TO REGISTER:

<https://www.northeastipm.org/ipm-in-action/the-ipm-toolbox/>

# Acknowledgements



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United States  
Department of  
Agriculture

National Institute  
of Food and  
Agriculture

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- US Environmental Protection Agency
- IPM Institute of North America
- NE School IPM Working Group and National School IPM Steering Committee
- State and Regional School Nurses Associations
- NY State IPM Program
- Northeastern IPM Center
- Maine Department of Education
- Maine Department of Agriculture, Conservation and Forestry



# Acknowledgments

## USDA-ARS

### Area-wide Pest Management Program



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Erika Machtinger



Jennifer Murrow

## USDA ARS Project Team

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- Carson Coriell
- Grace Hummell
- Patrick Roden-Reynolds
- Dr. Felix Guerrero
- Dr. Beto Perez de Leon

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- Dr. Jennifer Murrow
- Phil Norman / Brenda Belensky
- Dr. Kirby Stafford & Scott Williams
- Dr. Utpal Pal / Dr. Maria Esteve-Gassent
- Dr. Lars Eisen
- Dr. Robyn Nadolny
- Ellen Stromdahl
- Dr. Steve Rich & Guang Xu



Beltsville Agricultural Research Center