



**Indiana**  
**Department**  
**of**  
**Health**

# TICKS AND TICK-BORNE DISEASES IN INDIANA

**LEE GREEN**

SENIOR MEDICAL ENTOMOLOGIST

4/16/2026

OUR MISSION:

To promote, protect, and improve the health and safety of all Hoosiers.

OUR VISION:

Every Hoosier reaches optimal health regardless of where they live, learn, work, or play.



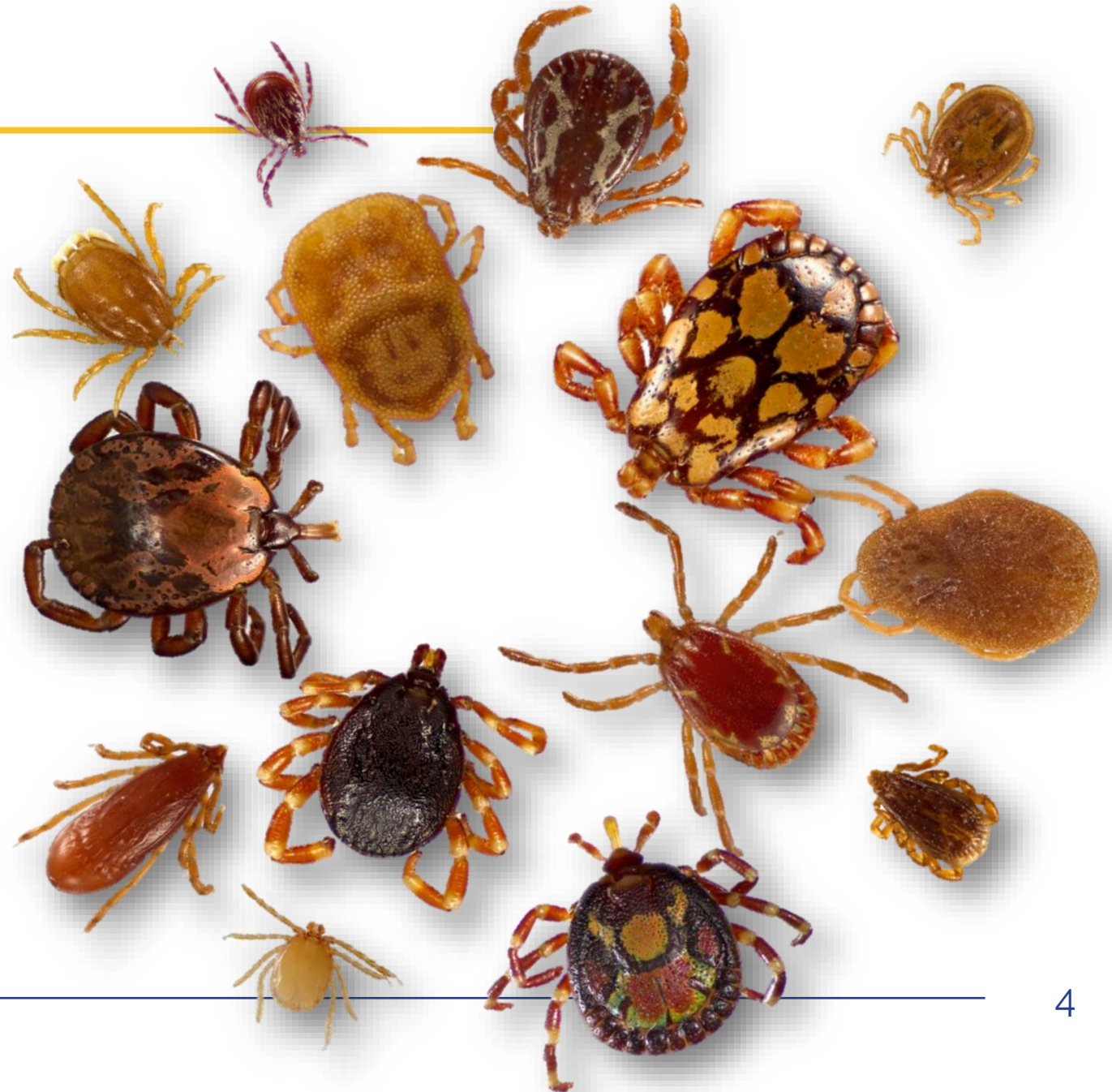
# Ticks – An Introduction

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- Among arthropod vectors of diseases, ticks are only next to mosquitoes in terms of diversity of pathogens they can transmit (bacteria, viruses, protozoans)
- At the attachments site, ticks can cause irritation and local infection of the skin
  - Allergic reactions at the bite site can be severe
- Some tick bites can trigger future serious, life-threatening allergic reactions
  - Alpha-gal syndrome (AGS)
- Ticks can cause anemia in the host if attached in large quantities
- Transmit several pathogens in Indiana

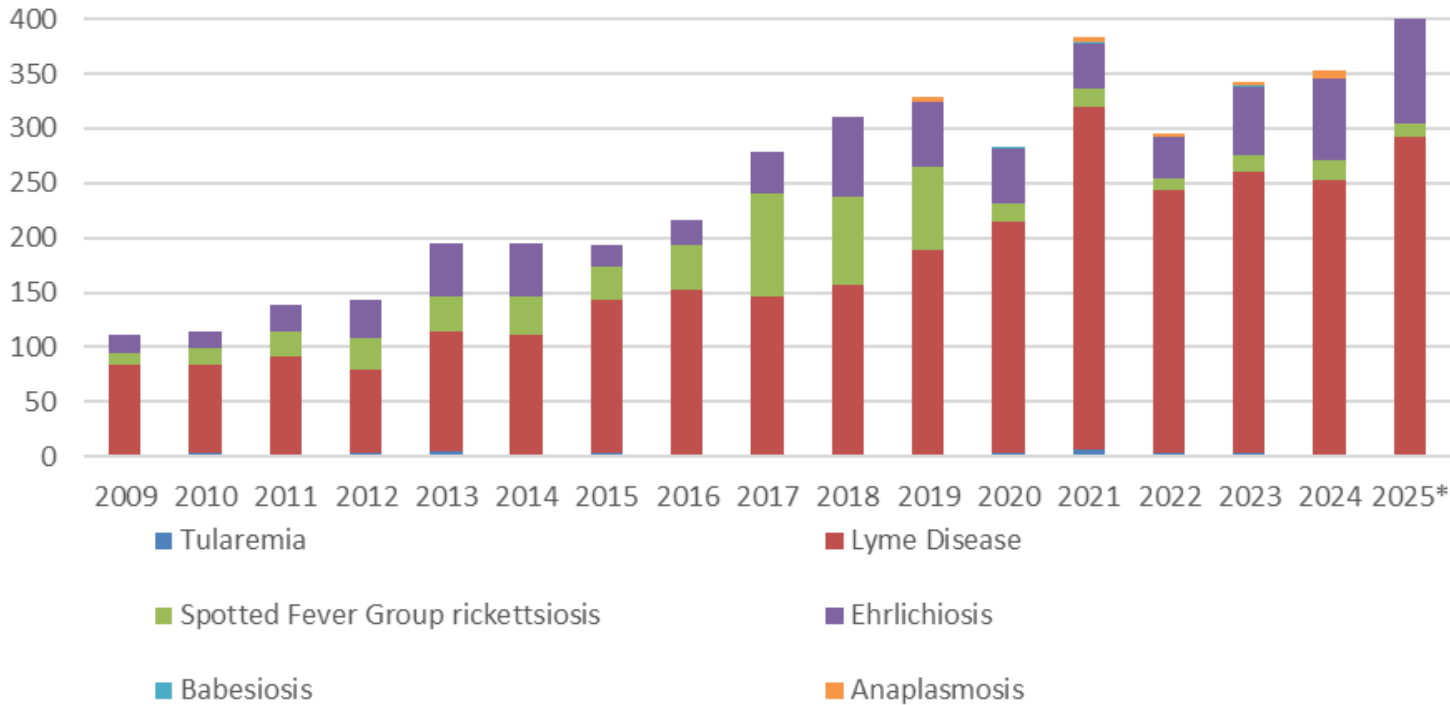
# Ticks: What are they?

- Obligate, non-permanent, blood-feeding parasites of mammals, birds, reptiles, and amphibians
- Found on every continent of the world
- Ticks are mites, NOT INSECTS



# Tick-Borne Disease in Indiana

Tick-borne Disease Cases in Indiana



## Expanded IDOH Tick Surveillance






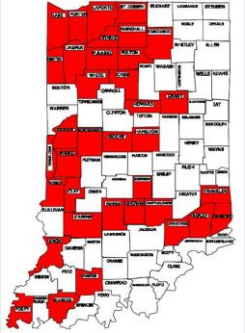
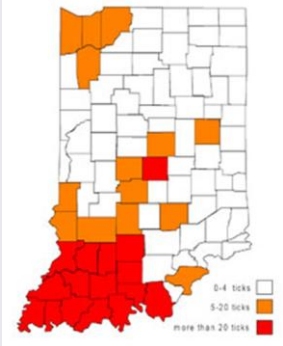
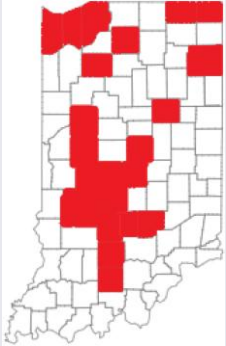



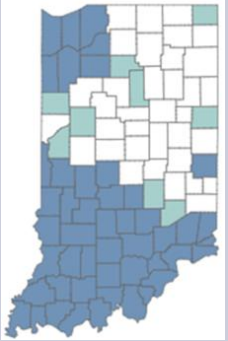



1. Determine the distribution of medically-important ticks in Indiana
2. Determine what pathogens ticks in Indiana are carrying
3. Determine level of infectivity of pathogens in ticks in Indiana

# Tick-borne Disease on the Rise

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- Reforestation
- Increases in deer and other hosts
- Increase in tick populations and distribution
- Urban sprawl
- Increase in tick-borne pathogens
- Increase in tick species

# Ticks of Medical Importance - Indiana

	Blacklegged Tick	Lone Star Tick	American Dog Tick	Gulf Coast Tick	Asian Longhorned Tick
					
<b>2016</b>					
<b>2025</b>					

# Tick Habitat

Blacklegged tick habitat



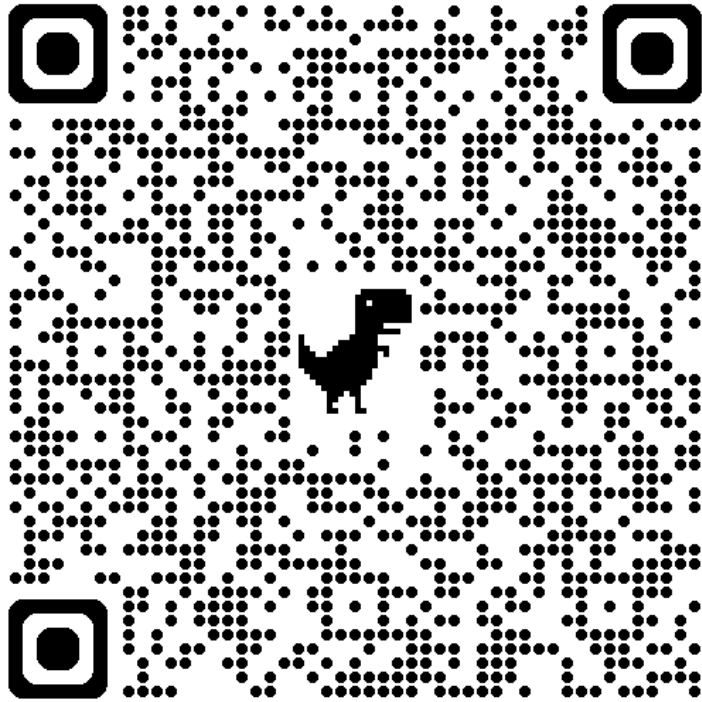
Lone Star tick habitat



American Dog tick and Gulf Coast tick habitat



# New Tick Dashboard



## Indiana Tick-borne Disease Surveillance

Tick surveillance data last updated 4/23/2025.  
Case surveillance data last updated 5/1/2025.

Start with filter selections below, which apply to everything on this page

For best results, clear all filter selections before selecting a new disease (refresh the webpage or hover over a multi-select filter and find the "Click to Show All Values" option: a funnel icon with a red x)

Select Disease: Lyme Disease | Select Pathogen(s): (All) | Select Tick Type(s): (None)

### TICK SURVEILLANCE AND TESTING

#### Lyme Disease is Selected

Lyme disease is a tick-borne disease caused by the bacteria *Borrelia burgdorferi* and *Borrelia mayonii* and transmitted by the blacklegged tick (*Ixodes scapularis*). Most reported cases are due to *B. burgdorferi*.

#### TICK SURVEILLANCE

The blacklegged tick life cycle has four stages (egg, larva, nymph, and adult); both nymph and adult ticks can transmit human pathogens.

The "Tick Distribution" map shows where blacklegged ticks are found. "Established" means that 26 ticks of the same life stage or >1 tick life stage have been collected in the county within a calendar year. "Reported" means that no more than 5 ticks of the same life stage have been collected in the county within a calendar year.

The "Infected Nymph Ticks" and "Infected Adult Ticks" statistics and maps show the percentage of blacklegged ticks collected since 2017 that were carrying the bacterium that cause Lyme disease.

The "Tick Activity by Month" chart shows the times of year when blacklegged nymph and adult ticks are expected to be most active.

Counties with Ticks Tested 2017—Present	Infected Nymph Ticks 2017—Present	Infected Adult Ticks 2017—Present
91	11.77%	33.06%
	Total tested: 3,007	Total tested: 4,842

Tick Distribution | Infected Nymph Ticks | Infected Adult Ticks



**Current County Status**  
■ Reported  
■ Established

**Infected Nymph Ticks**  
■ No Tests  
■ 0%  
■ 0.01—20%  
■ 20.01—40%  
■ >40%

**Infected Adult Ticks**  
■ No Tests  
■ 0%  
■ 0.01—20%  
■ 20.01—40%  
■ >40%

# New Tick Dashboard

## Select Disease

Lyme Disease

Anaplasmosis

Babesiosis

Ehrlichiosis

Ehrlichia muris eauclairensis

Hard Tick Relapsing Fever

Lyme Disease

Spotted Fever Rickettsiosis

Tularemia

Ticks not yet associated with human diseases

Cases are due to B. burgdorferi.



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Select Disease

Lyme Disease

Select Pathogen(s)

(All)

Select Tick Type(s)

(None)

### TICK SURVEILLANCE AND TESTING

#### Lyme Disease is Selected

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Counties with Ticks Tested  
2017 – Present

91

Tick Distribution

Blacklegged Tick



Current County Status

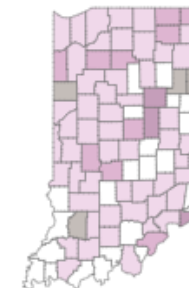
Reported  
Established

Infected Nymph Ticks  
2017 – Present

11.77%

Total tested: 3,007

Infected Nymph Ticks



Infected Nymph Ticks

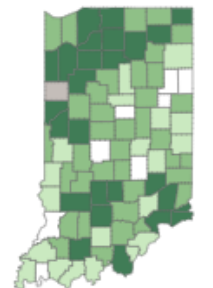
No Tests  
0%  
0.01–20%  
20.01–40%  
>40%

Infected Adult Ticks  
2017 – Present

33.06%

Total tested: 4,842

Infected Adult Ticks



Infected Adult Ticks

No Tests  
0%  
0.01–20%  
20.01–40%  
>40%

# New Tick Dashboard

## TICK SURVEILLANCE AND TESTING

### Lyme Disease is Selected

Lyme disease is a tick-borne disease caused by the bacteria *Borrelia burgdorferi* and *Borrelia mayonii* and transmitted by the blacklegged tick (*Ixodes scapularis*). Most reported cases are due to *B. burgdorferi*.

#### TICK SURVEILLANCE

The blacklegged tick life cycle has four stages (egg, larva, nymph, and adult); both nymph and adult ticks can transmit human pathogens.

The "Tick Distribution" map shows where blacklegged ticks are found. "Established" means that  $\geq 6$  ticks of the same life stage or  $>1$  tick life stage have been collected in the county within a calendar year. "Reported" means that no more than 5 ticks of the same life stage have been collected in the county within a calendar year.

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The "Tick Activity by Month" chart shows the times of year when blacklegged nymph and adult ticks are expected to be most active.

### Counties with Ticks Tested

2017 — Present

92

### Infected Nymph Ticks

2017 — Present

12.59%

Total tested: 3,495

### Infected Adult Ticks

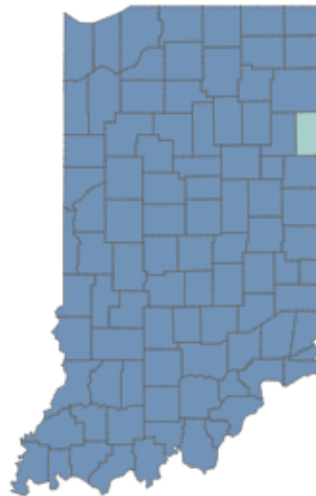
2017 — Present

33.02%

Total tested: 5,349

#### Tick Distribution

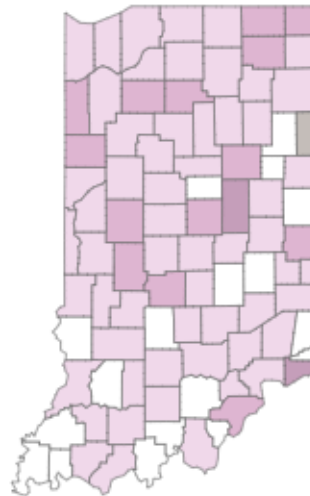
Blacklegged Tick



#### Current County Status

- Reported
- Established

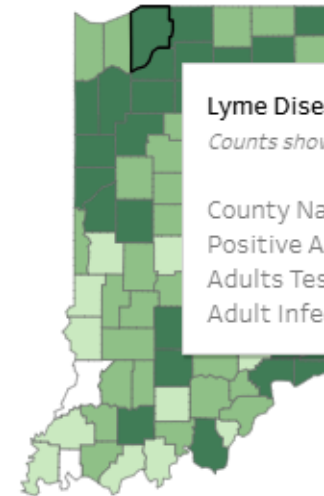
#### Infected Nymph Ticks



#### Infected Nymph Ticks

- No Tests
- 0%
- 0.01—20%
- 20.01—40%
- >40%

#### Infected Adult Ticks



#### Infected Adult Ticks

- No Tests
- 0%
- 0.01—20%
- 20.01—40%
- >40%

#### Lyme Disease: Adult Tick Infectivity

Counts shown are limited by applied page filters.

County Name: **LAPORTE**

Positive Adults: 35

Adults Tested: 64

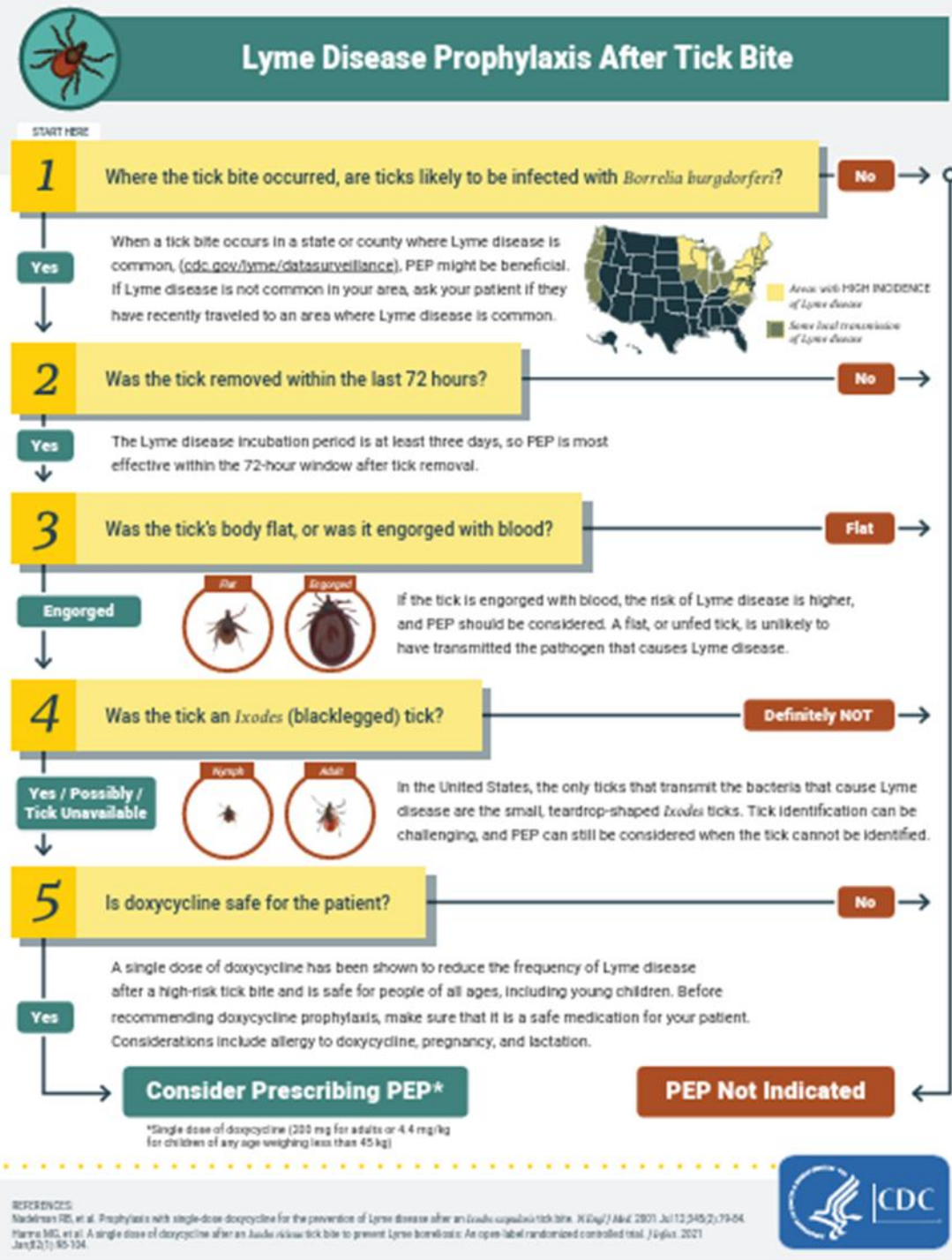
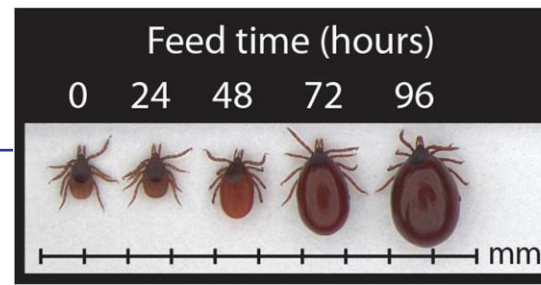
Adult Infectivity: 54.69%

# Lyme Prophylaxis

## 5 questions to consider

1. Where the tick bite occurred, are the ticks likely to be infected with *Borrelia burgdorferi*?
2. Was the tick removed within the last 72 hours?
3. Was the tick's body flat, or was it engorged with blood?
4. Was it a blacklegged tick?
5. Is doxycycline safe for the patient?

Figure 3. Blacklegged nymphal ticks at various stages of engorgement.

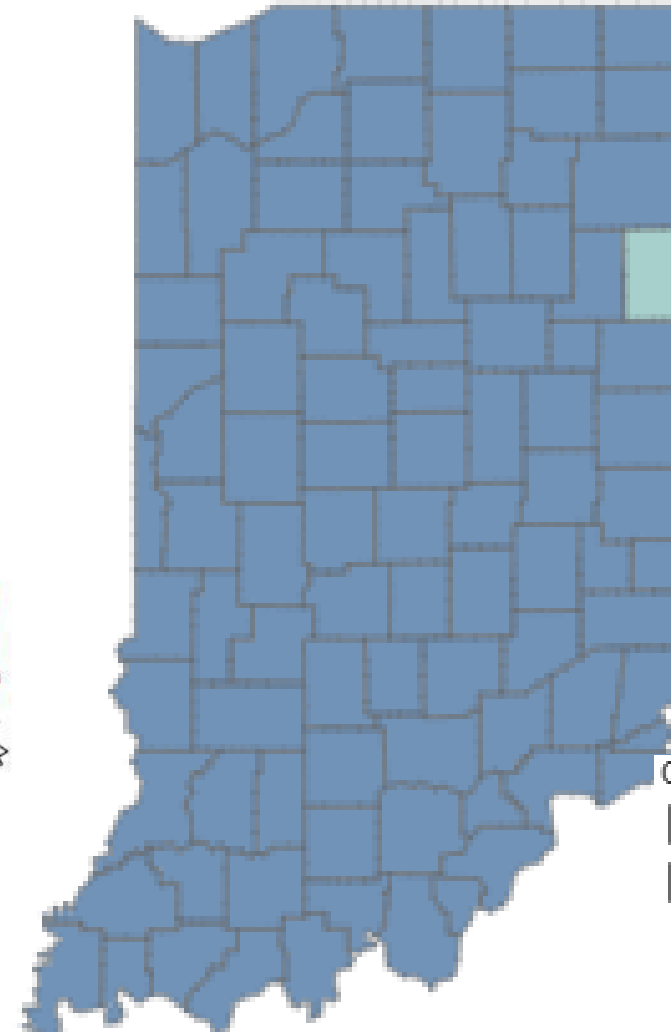
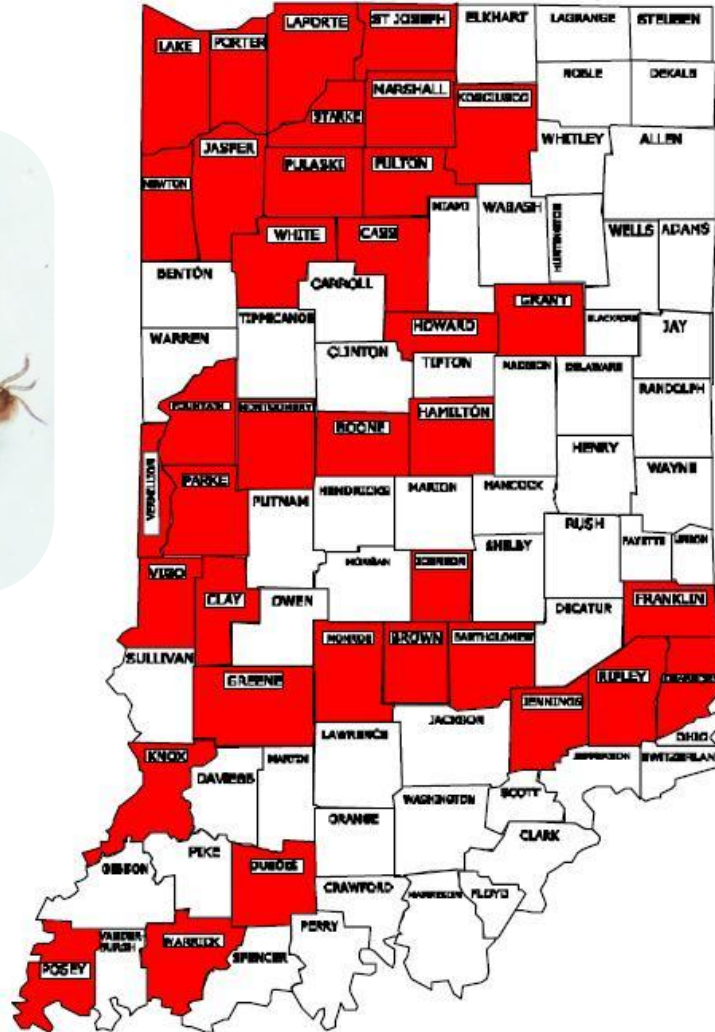


# Tick Surveillance – Blacklegged Ticks



2016

2025

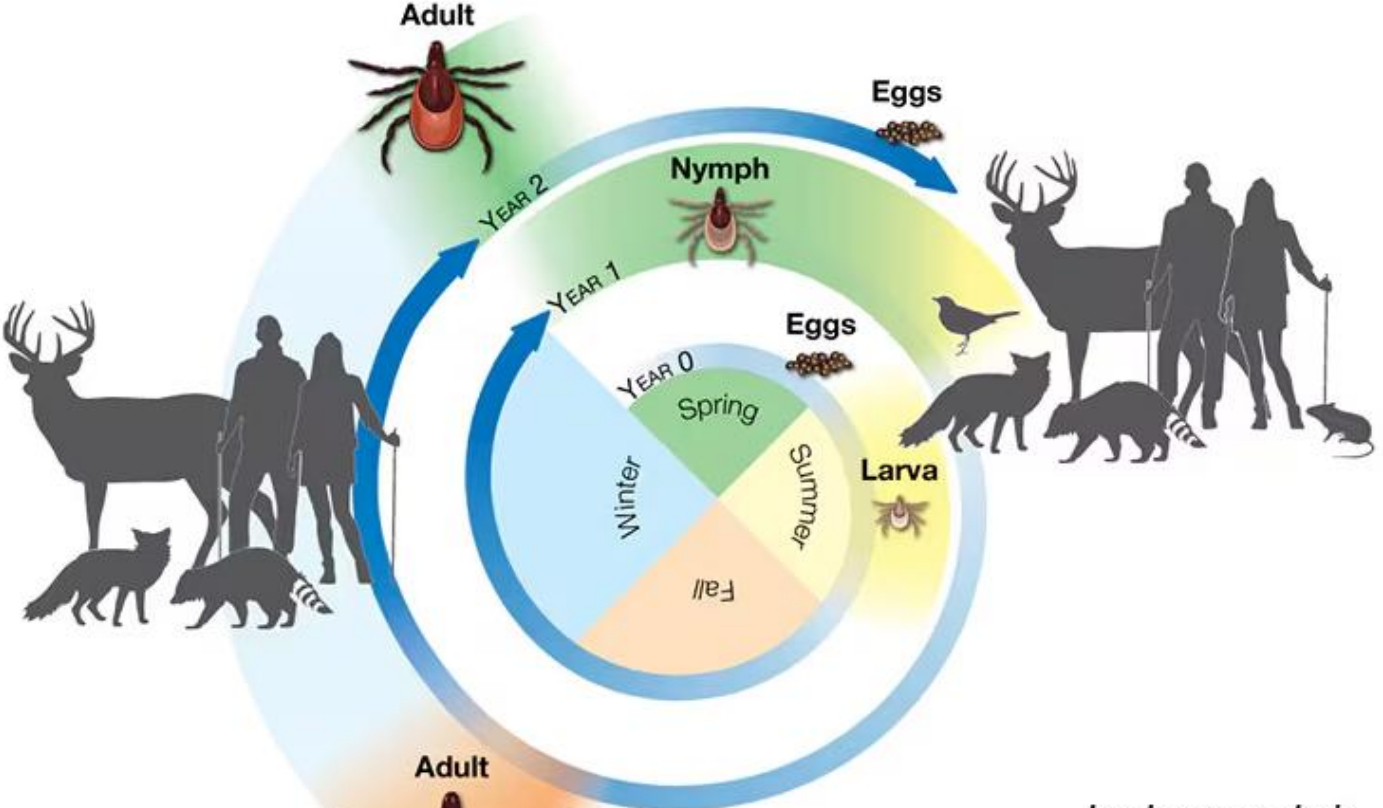


Current County Status

Reported

Established

# Biology of Blacklegged Ticks



*Ixodes scapularis*

-  Year
-  Hosts
-  Host-seeking/ Blood-feeding

# Biology of Blacklegged Ticks

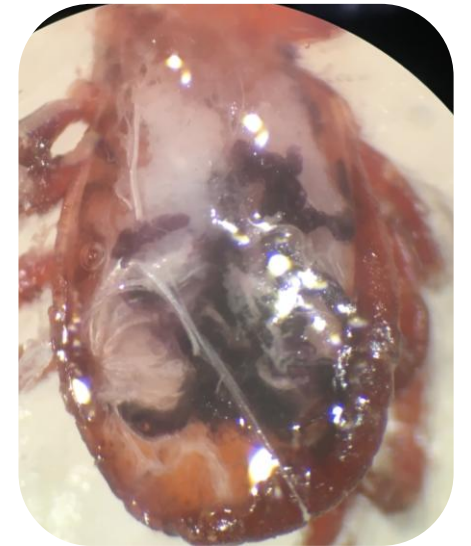
## Desiccation




*Dermacentor rhinocerus*



*Ixodes scapularis*



# Tick Desiccation



	Species	%/hr
Hydrophilic	<i>I. scapularis</i>	0.67
	<i>A. americanum</i>	0.28
	<i>D. albipictus</i>	0.24
	<i>D. variabilis</i>	0.21
	<i>R. sanguineus</i>	0.15
	<i>A. maculatum</i>	0.14
	<i>D. andersoni</i>	0.11
Xerophilic	<i>A. cajennense</i>	0.06

# Biology of Blacklegged Ticks

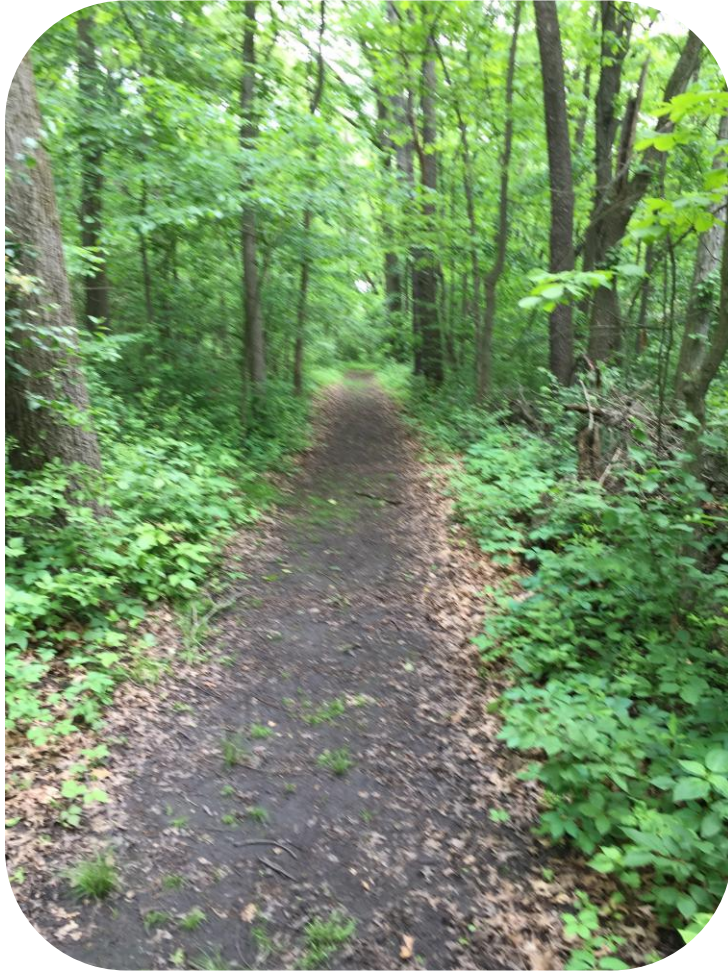
## Habitat



# Biology of Blacklegged Ticks

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## Habitat



# Biology of *Ixodes scapularis*

## Disease Transmission

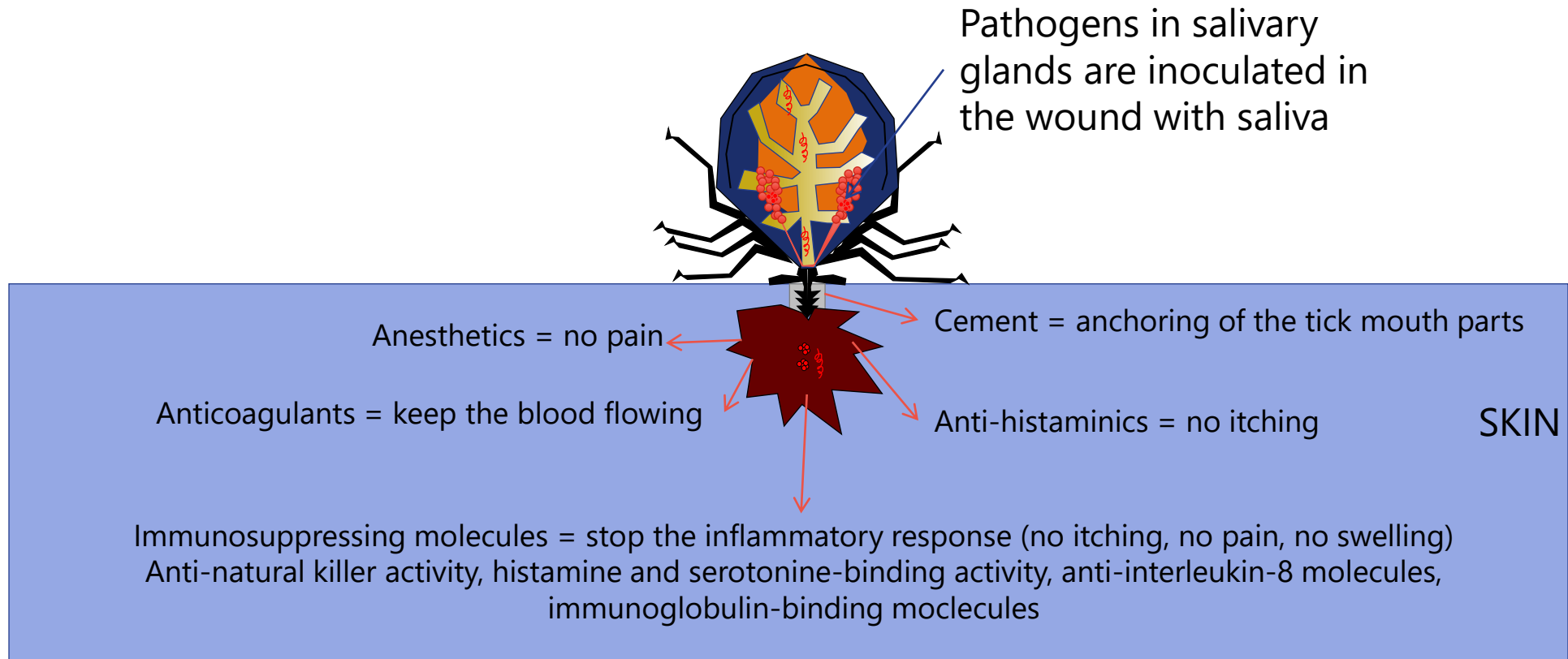


Diagram: L. Beati Ga. Southern

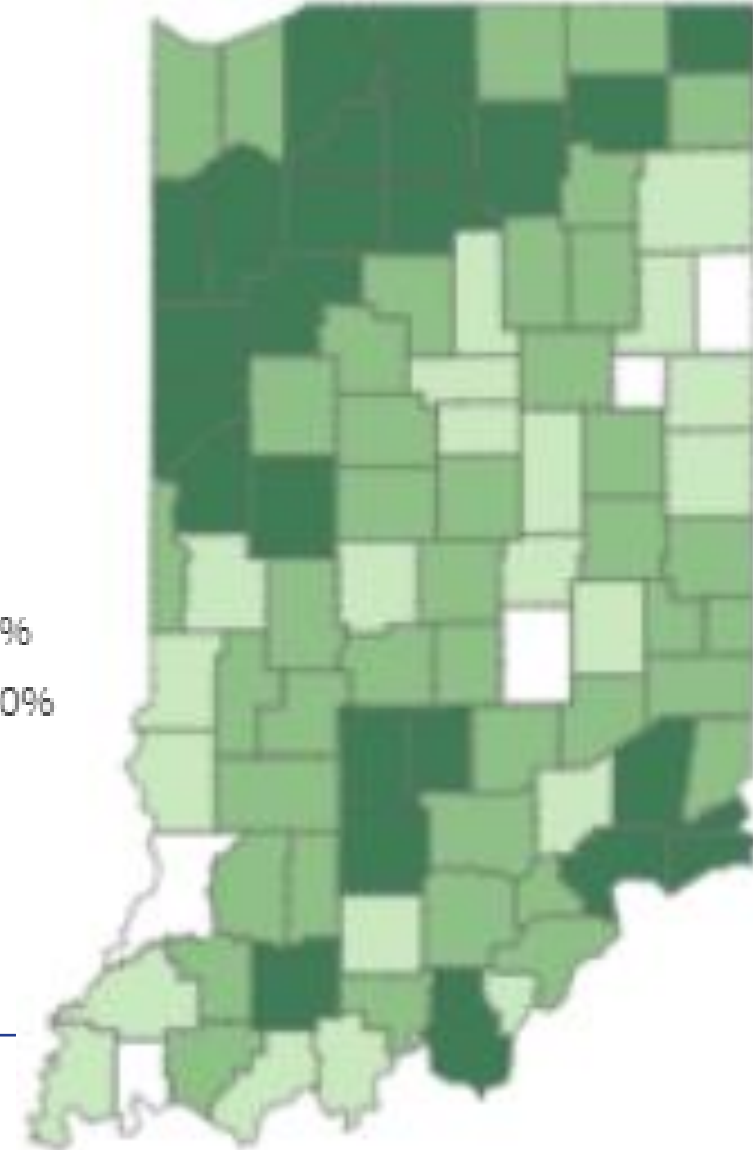
# Percentage of adult *Ixodes scapularis* ticks infected with *Borrelia burgdorferi*, 2017-2025



**Total Tested:** 5,349

**Infection rate:** 33.02%

- No Tests
- 0%
- 0.01–20%
- 20.01–40%
- >40%

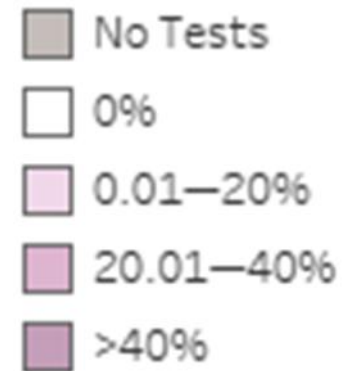


# Percentage of nymph *Ixodes scapularis* ticks infected with *Borrelia burgdorferi*, 2017-2025

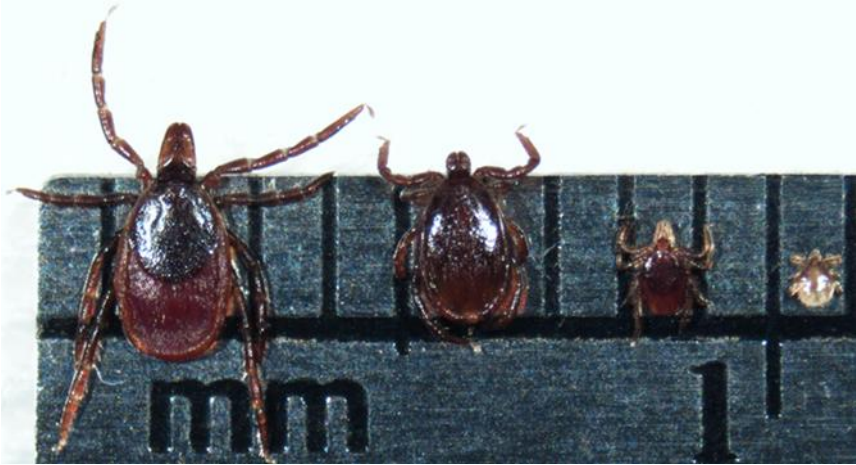


**Total Tested:** 3,495

**Infection rate:** 12.59%



# Blacklegged Ticks and Lyme Disease



## HUMAN CASE SURVEILLANCE

**Lyme Disease is Selected**

HUMAN CASE SURVEILLANCE

Indiana Administrative Code (410 IAC 1-2.5) requires healthcare providers and laboratories to report notifiable disease cases to the Indiana Department of Health (IDOH). These cases are investigated by local health departments and classified by IDOH using national surveillance case definitions established by the Council of State and Territorial Epidemiologists and endorsed by the Centers for Disease Control and Prevention (CDC).

This dashboard reports confirmed and probable cases according to the national surveillance case definition that was in effect at the time of the case report. Human case data for the current calendar year should be considered provisional. These data may change substantially before they are finalized. Provisional data from the current year should not be combined with or compared to final data from previous years.

Click anywhere on this description for a pop-up hyperlink to the CDC National Surveillance Case Definitions website.

Select Year(s)  
*Filter applies to all human data on page*

(All)

Human Cases

2,523

Human Cases  
1 356

**Tick Activity by Month**  
2017— Present

Blacklegged Tick

Legend: Nymphs Collected (purple), Adults Collected (green)

**Human Cases by Month**

Human Cases

# Other Blacklegged Tick Pathogens

## *Anaplasma phagocytophilum*

- 1.6% Infectivity

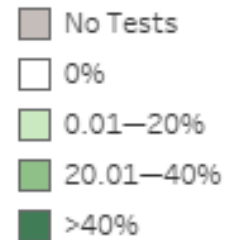


## *Borrelia miyamotoi*

- 1.3% Infectivity



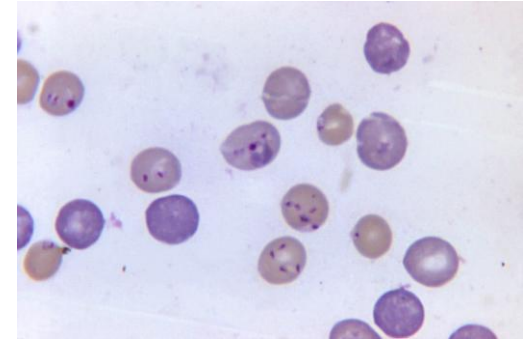
Infected Adult Ticks



# Other Blacklegged Tick pathogens

## *Babesia microti*

- Parasite that causes babesiosis
  - Most cases NE & Upper MW
  - Tick Detections
    - Only 2 Sites
      - 15%
- (200+ collected 5 miles away, no detections)



# Other *Ixodes* pathogens

- ***Ehrlichia muris eauclairensis***
  - First isolated in WI in 2009
  - Cases have been limited to Minnesota and Wisconsin
- CDC tested some 2019 Indiana ticks to develop their new assay
- 392 were tested for EME
  - 3 Positive males, 1 positive nymph
    - St. Joseph and Tippecanoe Co's.



## Ehrlichiosis caused by *Ehrlichia muris eauclairensis*: Information for Health Care Providers

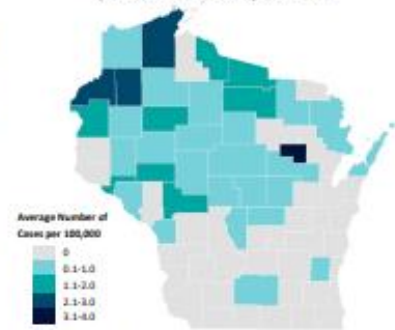
- ▶ *E. muris eauclairensis* (EME), formerly called *Ehrlichia muris*-like agent, is an emerging bacterium spread to people through the bite of an infected deer tick (blacklegged tick).
- ▶ The tick that spreads EME also spreads *Borrelia burgdorferi* (Lyme disease), *Anaplasma phagocytophilum* (anaplasmosis), and *Babesia microti* (babesiosis).
- ▶ EME was first isolated in 2009 from a resident of Eau Claire, Wisconsin.

### Epidemiology



- ▶ While other species of *Ehrlichia* (*Ehrlichia chaffeensis* and *Ehrlichia ewingii*) occur primarily in the southeastern and eastern United States, cases of EME have been limited to people from Minnesota and Wisconsin or individuals who have travelled to these areas.
- ▶ Young deer ticks (called nymphs) are most active during the spring and summer, which corresponds with the peak of EME cases in June and July.

Average Annual Incidence of Ehrlichiosis (*E. muris eauclairensis*) 2009-2021

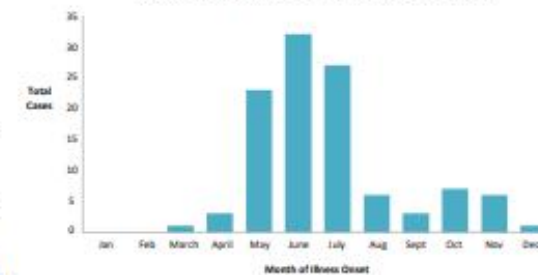


### Clinical Presentation



- ▶ Signs and symptoms of EME are similar to ehrlichiosis caused by other *Ehrlichiae*. Most patients experience an acute onset of:
  - ▶ Fever
  - ▶ Headache
  - ▶ Myalgia
  - ▶ Malaise
  - ▶ Anemia
  - ▶ Elevated hepatic transaminases
- ▶ Laboratory findings:
  - ▶ Leukopenia
  - ▶ Thrombocytopenia
- ▶ No fatal cases of EME have been reported.
- ▶ Ehrlichiosis, including EME, is a Category II reportable disease in Wisconsin; refer to the Wisconsin Department of Health Services communicable disease reporting requirements for more details (<https://www.dhs.wisconsin.gov/disease/reporting.htm>).

Most cases of Ehrlichiosis (*E. muris eauclairensis*) are reported during May—July (Data from 2009-2021)



See page 2 for more information!



# Lone Star Ticks



## Ehrlichiosis is Selected

Ehrlichiosis is a tick-borne disease caused by the bacteria *Ehrlichia chaffeensis* and *Ehrlichia ewingii* and transmitted by the Lone Star tick (*Amblyomma americanum*). Most reported cases are due to *E. chaffeensis*.

### TICK SURVEILLANCE

The Lone Star tick life cycle has four stages (egg, larva, nymph, and adult); both nymph and adult ticks can transmit human pathogens.

The "Tick Distribution" map shows where Lone Star ticks are found. "Established" means that 26 ticks of the same life stage or >1 tick life stage have been collected in the county within a calendar year. "Reported" means that no more than 5 ticks of the same life stage have been collected in the county within a calendar year.

The "Infected Nymph Ticks" and "Infected Adult Ticks" statistics and maps show the percentage of Lone Star ticks collected since 2017 that were carrying the bacteria that causes ehrlichiosis.

The "Tick Activity by Month" chart shows the times of year when Lone Star nymph and adult ticks are expected to be most active.

## Counties with Ticks Tested 2017— Present

40

## Infected Nymph Ticks 2017— Present

1.09%

Total tested: 1,198

## Infected Adult Ticks 2017— Present

4.14%

Total tested: 3,619

Tick Distribution

Lone Star Tick



Current County Status

- Not Detected
- Reported
- Established

Infected Nymph Ticks



Infected Nymph Ticks

- No Tests
- 0%
- 0.01—20%
- 20.01—40%
- >40%


Infected Adult Ticks



Infected Adult Ticks

- No Tests
- 0%
- 0.01—20%
- 20.01—40%
- >40%

# Tick Desiccation



	Species	%/hr
Hydrophilic	<i>I. scapularis</i>	0.67
	<i>A. americanum</i>	0.28
	<i>D. albipictus</i>	0.24
	<i>D. variabilis</i>	0.21
	<i>R. sanguineus</i>	0.15
	<i>A. maculatum</i>	0.14
	<i>D. andersoni</i>	0.11
Xerophilic	<i>A. cajennense</i>	0.06

# Lone Star Tick Habitat



Oklahoma Agricultural Experiment Station



Tick stage sampled	Grasses		Brush or low trees	Medium trees	Climax forest	
	> 2 ft	2-4 ft	< 4 ft	20 ft	20-40 ft	40 ft +
			Number samples taken			
	63	272	73	39	323	96
	Average number of ticks/sample					
Adults	.8	1.3	1.8	6.2	2.2	.9
Nymphs	4.8	4.4	9.7	146.0	10.9	7.2

**Figure 2.** Average number of adult and nymphal ticks collected per sample from within or under different vegetative types according to overstory height in Cookson Hills State Game Refuge during June and July, 1969.

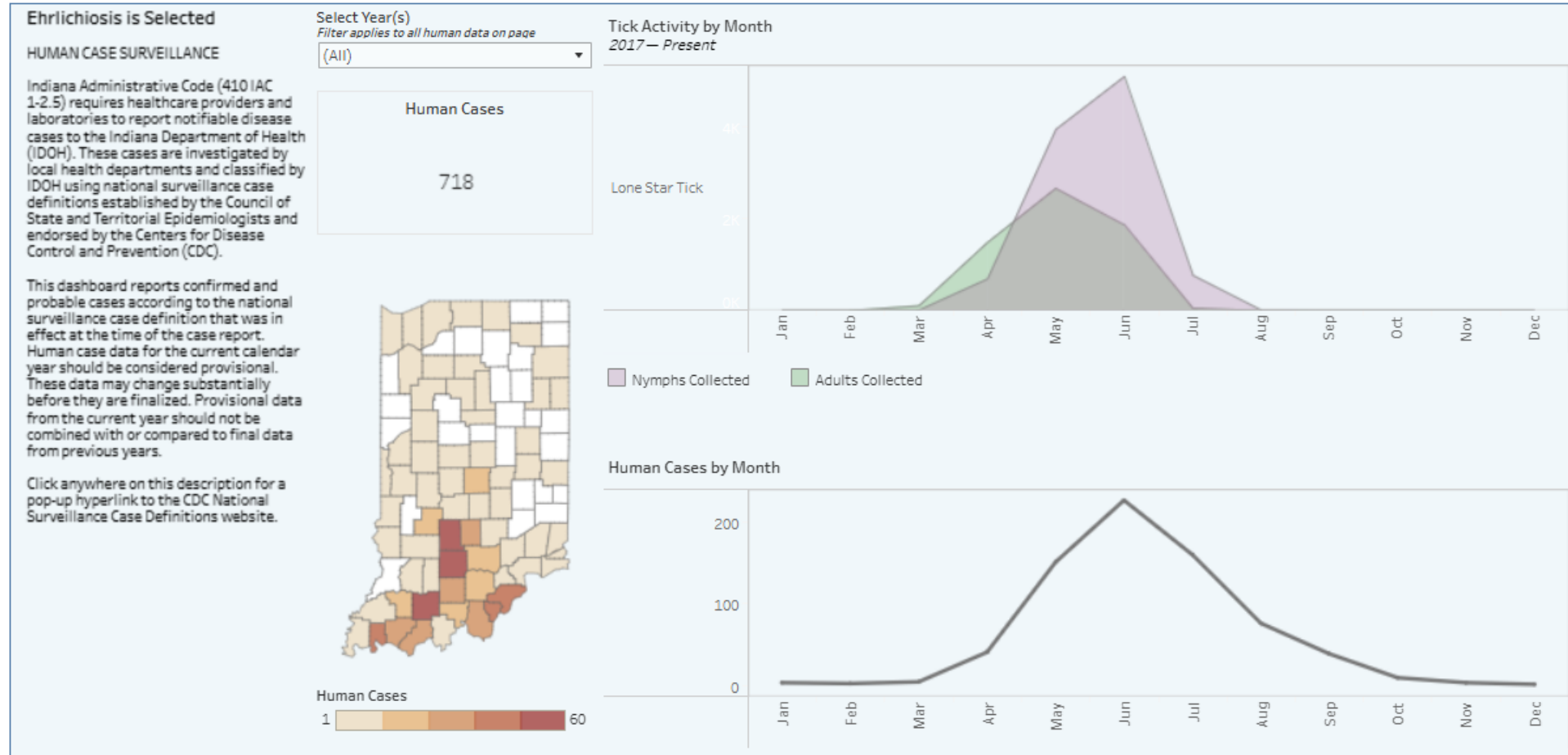
Hair, Jackie A., and Dariel Elza Howell. "Oklahoma Agricultural Experiment Station, Bulletin no. 679, July 1970: Lone star ticks; Their biology and control in Ozark recreation areas." (1970).

# Ehrlichiosis

*E. chaffeensis*

*E. ewingii*

*E. muris eauclairensis*



# Alpha-gal syndrome

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- Alpha-gal (galactose- $\alpha$ -1,3-galactose) is a sugar molecule found in most mammals (except in people, apes, and monkeys)
- Alpha-gal is not normally found in fish, reptiles, or birds
- An alpha-gal allergy is an allergy to the alpha-gal sugar molecule. Allergic reactions typically occur after people eat meat from mammals that have alpha-gal or are exposed to products made from mammals
- Most cases of alpha-gal allergy have been reported in the southeastern and midwestern United States
- Both children and adults can develop alpha-gal allergy; however, most cases of alpha-gal allergy appear to be in people >50 years of age

# Alpha-gal syndrome

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## Clinical Presentation

- Hives or itchy rash
- Nausea or vomiting
- Heartburn or indigestion
- Diarrhea
- Cough, shortness of breath, difficulty breathing
- Drop in blood pressure
- Swelling of lips, throat, tongue, or eye lids
- Dizziness or fainting
- Severe stomach pain

## Clinical Management

- Patient-centered approach
  - Prevention of tick bites
  - Antihistamine use
  - Elimination of mammalian meat from diet
  - Avoid mammal-derived medical products
  - Follow-up visits with healthcare provider

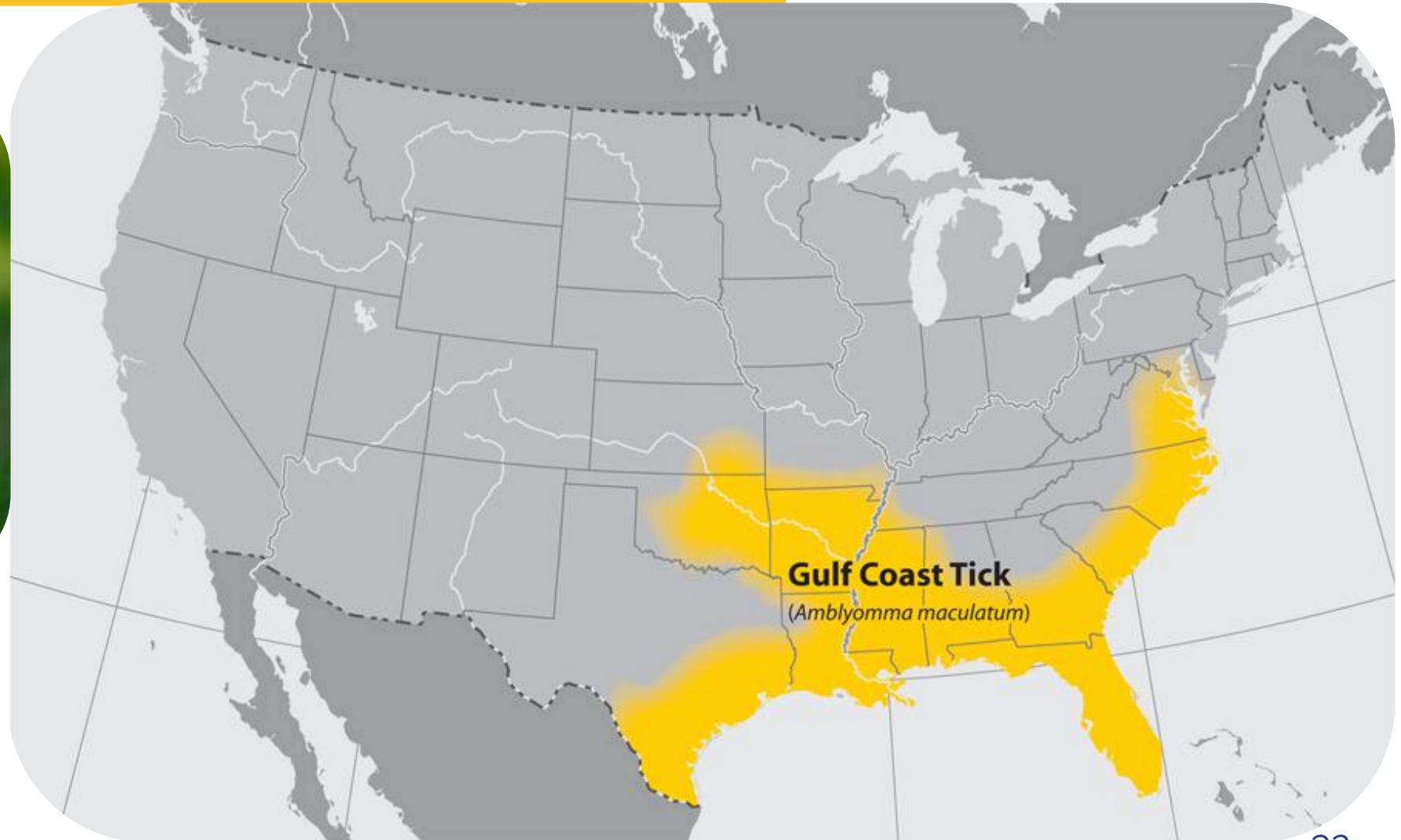
## Prevention

- Tick bite prevention

# *Amblyomma maculatum* – Gulf Coast Tick



CDC



# Gulf Coast Tick

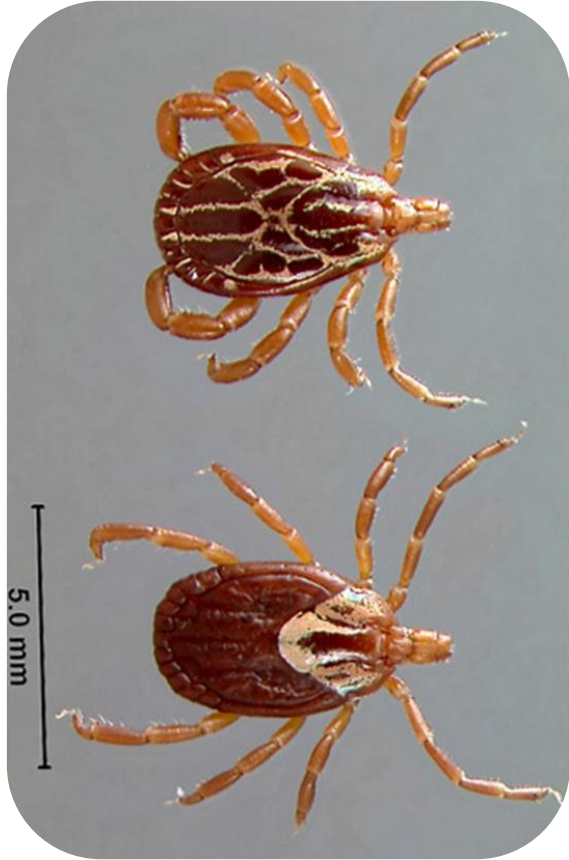


Photo: U of FL Ento

## Spotted Fever Rickettsiosis is Selected

Spotted fever rickettsiosis is a group of tick-borne diseases that include Rocky Mountain spotted fever (RMSF), which is caused by the bacterium *Rickettsia rickettsii* and transmitted by the American dog tick (*Dermacentor variabilis*), and *Rickettsia parkeri* rickettsiosis, which is caused by the bacterium *R. parkeri* and transmitted by the Gulf Coast tick (*Amblyomma maculatum*).

### TICK SURVEILLANCE

The life cycle of these ticks has four stages (egg, larva, nymph, and adult); both nymph and adult ticks can transmit human pathogens.

The "Tick Distribution" map shows where the ticks that carry these bacteria are found. "Established" means that ≥6 ticks of the same life stage or >1 tick life stage have been collected in the county within a calendar year. "Reported" means that no more than 5 ticks of the same life stage have been collected in the county within a calendar year. Scroll to the right or left to see additional tick distribution maps.

The "Infected Nymph Ticks" and "Infected Adult Ticks" statistics and maps show the percentage of blacklegged ticks collected since 2017 that were carrying the bacteria that cause spotted fever rickettsiosis.

The "Tick Activity by Month" chart shows the times of year when the ticks that carry these bacteria are expected to be most active.

## Counties with Ticks Tested 2017—Present

9

## Infected Nymph Ticks 2017—Present

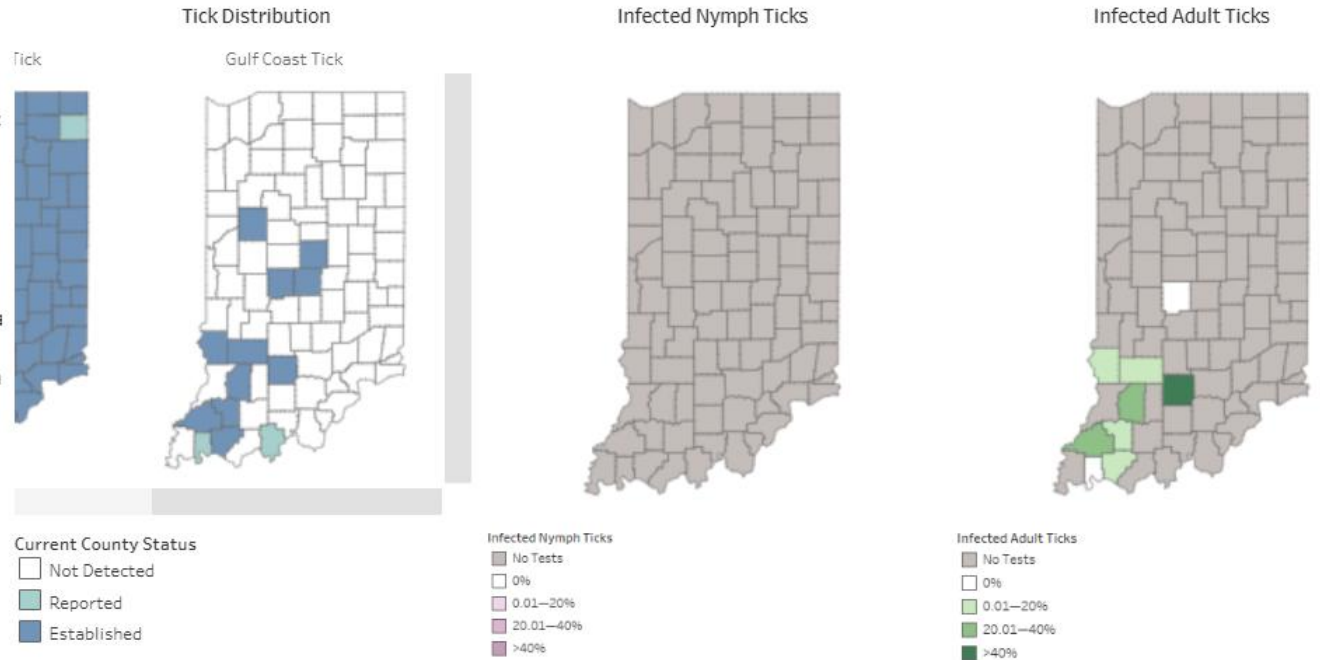
No Tests

Total tested: N/A

## Infected Adult Ticks 2017—Present

16.38%

Total tested: 531





LG



DG

# *Amblyomma maculatum* Habitat

- Grass/shrub land
- Populations decrease if canopy is allowed to close in (Nadolny and Gaff 2018)
- Xerophilic
- Better adapted to burned habitat than LST (Gleim et al. 2013)
- Immature stages hard to find/ freshly mowed grass fields (Nadolny and Gaff 2018)



# *Amblyomma maculatum* Host Preference

- Immature- rodent and birds (important in long distance dispersal)
- Adults- Medium-large mammals
  - Including whited-tailed deer, coyotes, dogs, cattle, horses, sheep, swine (Teel et al. 2010)



CDC

# *Haemaphysalis longicornis* – Asian Longhorned Tick



L. Beati, Georgia Southern



USDA

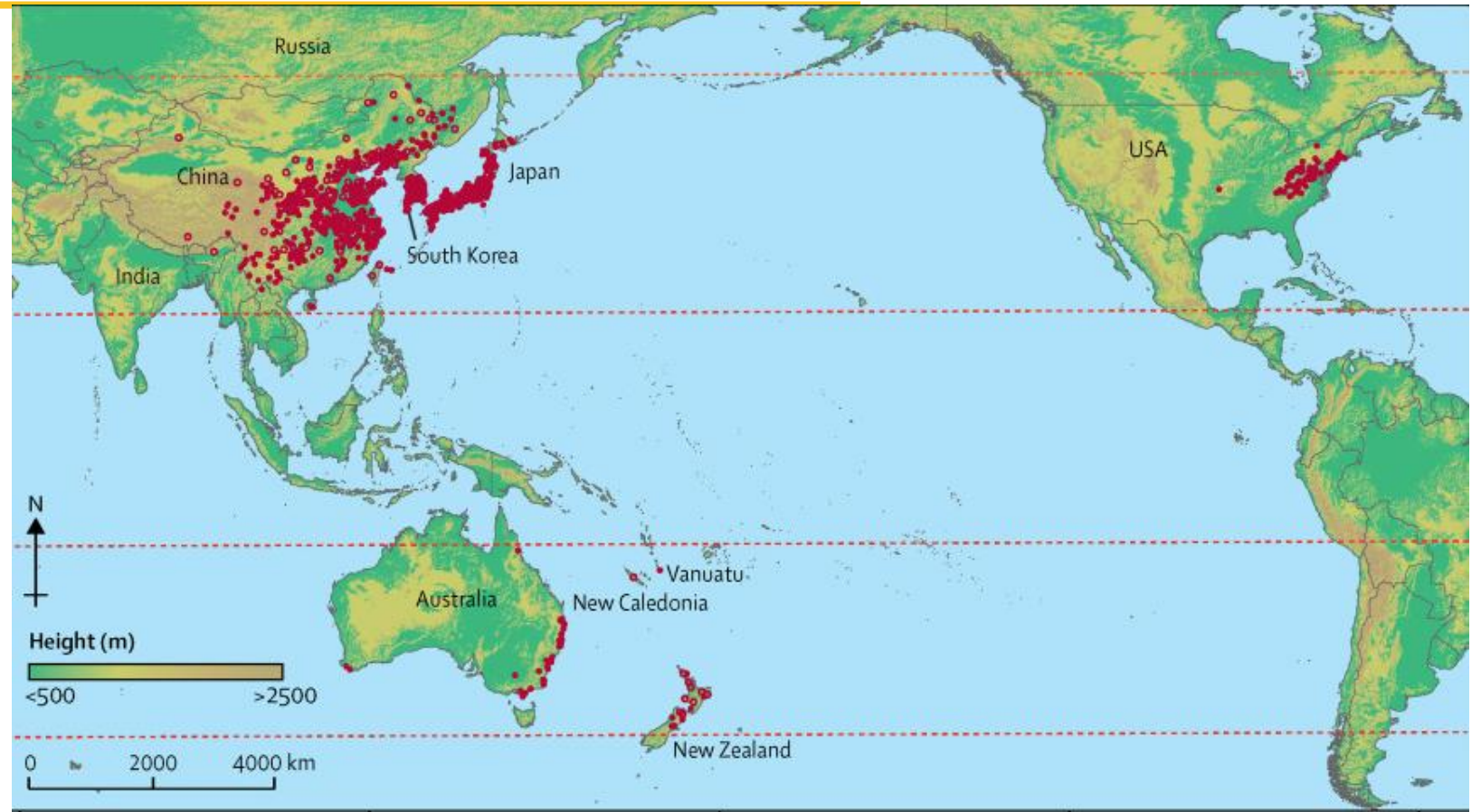
# *Haemaphysalis longicornis* – Asian Longhorned Tick

- 3-host hard tick
- Parthenogenetic and aggressive cofeeder
- Bisexual populations – 2 year life cycle
- Parthenogenetic – much faster, multiple life stages on animals



# Asian Longhorned Tick Distribution

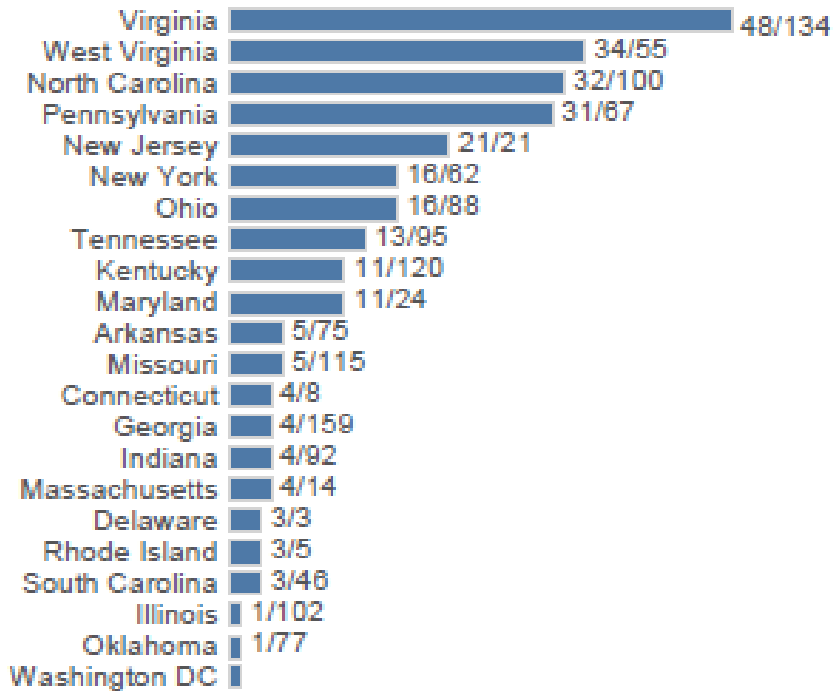
- Indigenous to East Asia
- Expanded into Australia and New Zealand
- New Jersey, 2017 (sheep)
  - WV, 2010 (deer)
  - NJ, 2013 (dog)
  - NC, 2017 (opossum)
- 3 Haplotypes in U.S.



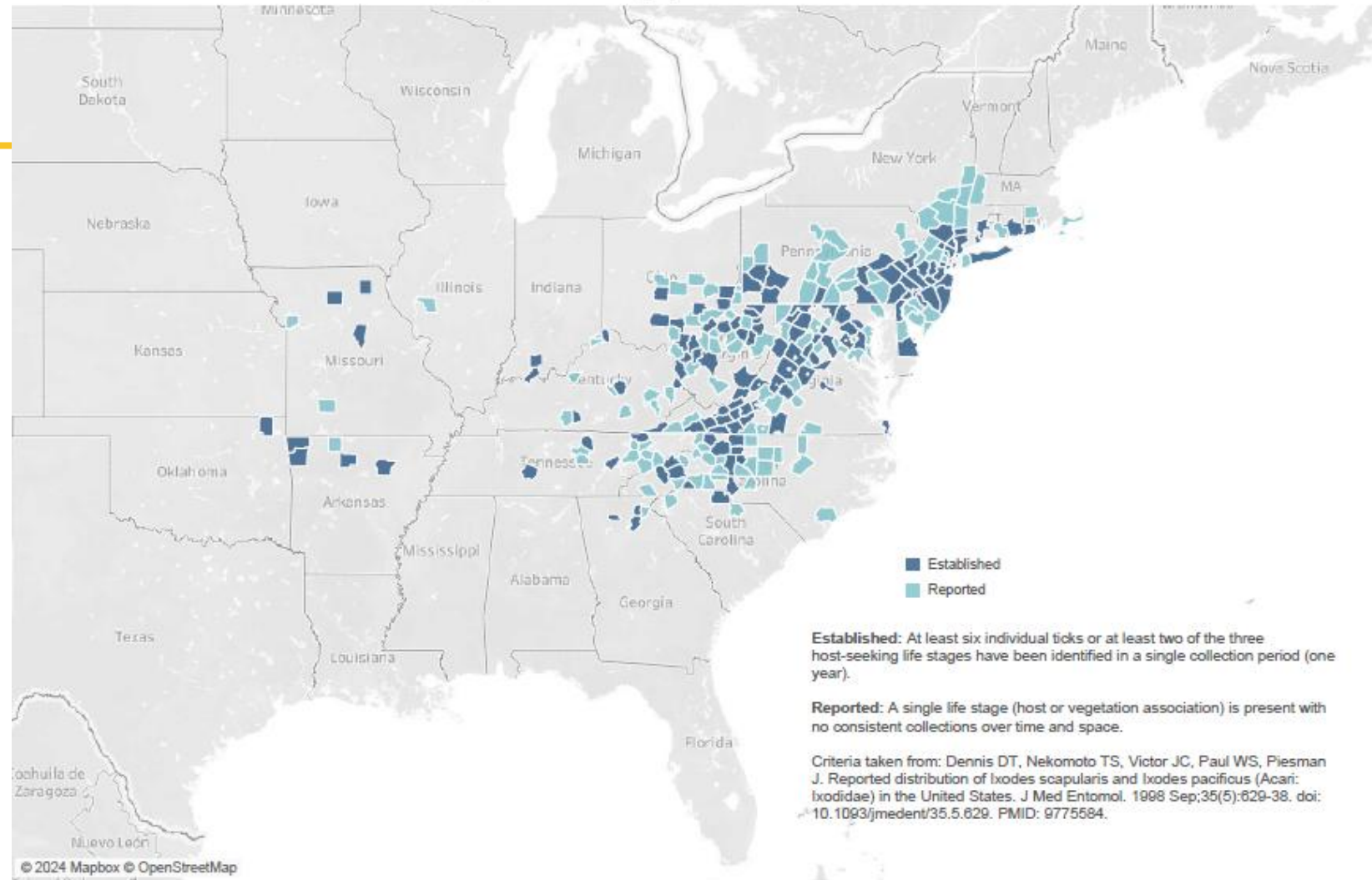
in Zhao, Jie Li, Xiaoming Cui, Na Jia, Jiatae Wei, Luoyuan Xia, Haitao Wang, Yuhao Zhou, Qian Wang, Xueyuan Liu, Chaonan Yin, Yusheng Pan, Hongling Wen, Qing Wang, Fuzhong Xue, Yi Sun, Jiafu Jiang, Shixue Li, Wuchun Cao, Distribution of *Haemaphysalis longicornis* and associated pathogens: analysis of pooled data from a China field survey and global published data, *The Lancet Planetary Health*, Volume 4, Issue 8, 2020, Pages e320-e329

# ALT Distribution

States with confirmed local Asian longhorned tick populations with number of counties in each state. (# of confirmed counties / total # of counties)



Counties with established Asian longhorned tick populations



These data, and all the information contained therein, have been collected by the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS), or by its cooperators on APHIS' behalf, for restricted government purposes only. This information is the sole property of APHIS. See full disclaimer here: [aphis.usda.gov/help/map-disclaimer](https://aphis.usda.gov/help/map-disclaimer).



# Asian Longhorned Tick Host Preference

Ranked  
Host/  
Source

Tick Source	March 2024	March 2024 rank	April 2024	April 2024 rank
Environment**	1100^	1	1151^	1
White-tailed Deer	166	2	166	2
Human	97^	3	97	3
Dog	86^	4	86	4
Raccoon	60	5	60	5
Cow	46^	6	46	6
Virginia opossum	32	7	32	7
Elk	16	8	16	8
Striped skunk	14	9	14	9
Gray squirrel	10	10	10	10
Groundhog	10	11	10	11
Grey catbird	9	12/13	9	12/13
Cat	9	12/13	9	12/13
Red-tailed Hawk	8	14/15	8	14/15
Red Fox	8	14/15	8	14/15
Eastern cottontail rabbit	6	16	6	16
Horse	5	17	5	17
Coyote	4	18/19/20	4	18/19/20
Gray Fox	4	18/19/20	4	18/19/20
Chicken	4	18/19/20	4	18/19/20

Went up in rank

^= Increased

\*\* Arbonet entries



# What are the risks?

- Massive infestations can occur
  - Swarm hosts in huge numbers
  - Prefers unmowed prairie/pasture/meadow near forests
  - Active May-November
  - Severe anemia and exsanguination
- **Pathogens associated with ALHTs**
  - *Rickettsia rickettsii* (lab)
  - Heartland virus (lab)
  - Powassan virus (lab)
  
  - *Theileria orientalis* Ikeda
    - Bovine theileriosis



Heeke ADDL, Purdue University

# ALT vs. LST



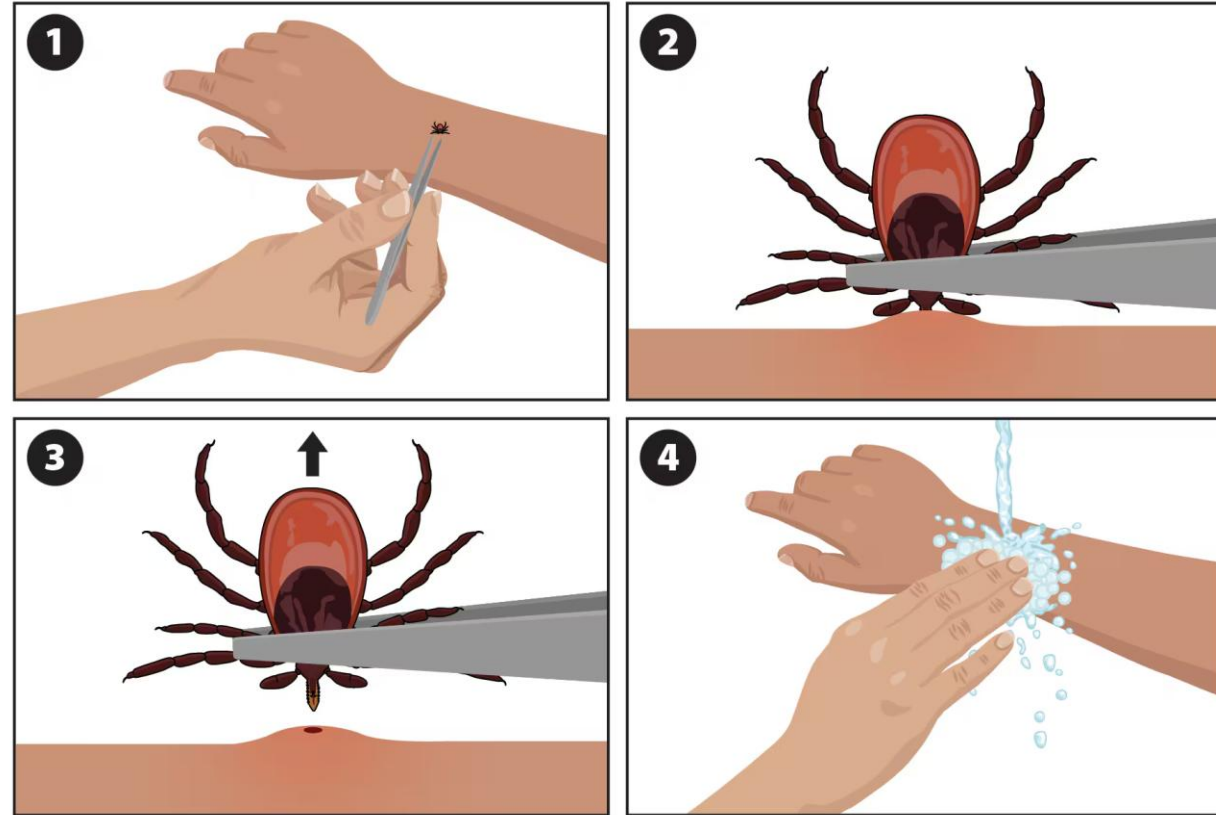
# Personal Protection Measures

- AVOID TICK AREAS
- Protective clothing
- Repellent
  - DEET, Picaridin, OLE, IR3535 on skin
  - Permethrin on clothing
- TICK CHECKS!
- Prompt, proper tick removal



# Proper Tick Removal

- If you find a tick attached to your skin, simply remove the tick as soon as possible
- There are several tick removal devices on the market, but a plain set of fine-tipped tweezers works very well
- If you develop a rash or fever within several days to weeks after removing a tick, see your doctor



# Landscape Modification

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# Landscape Modification

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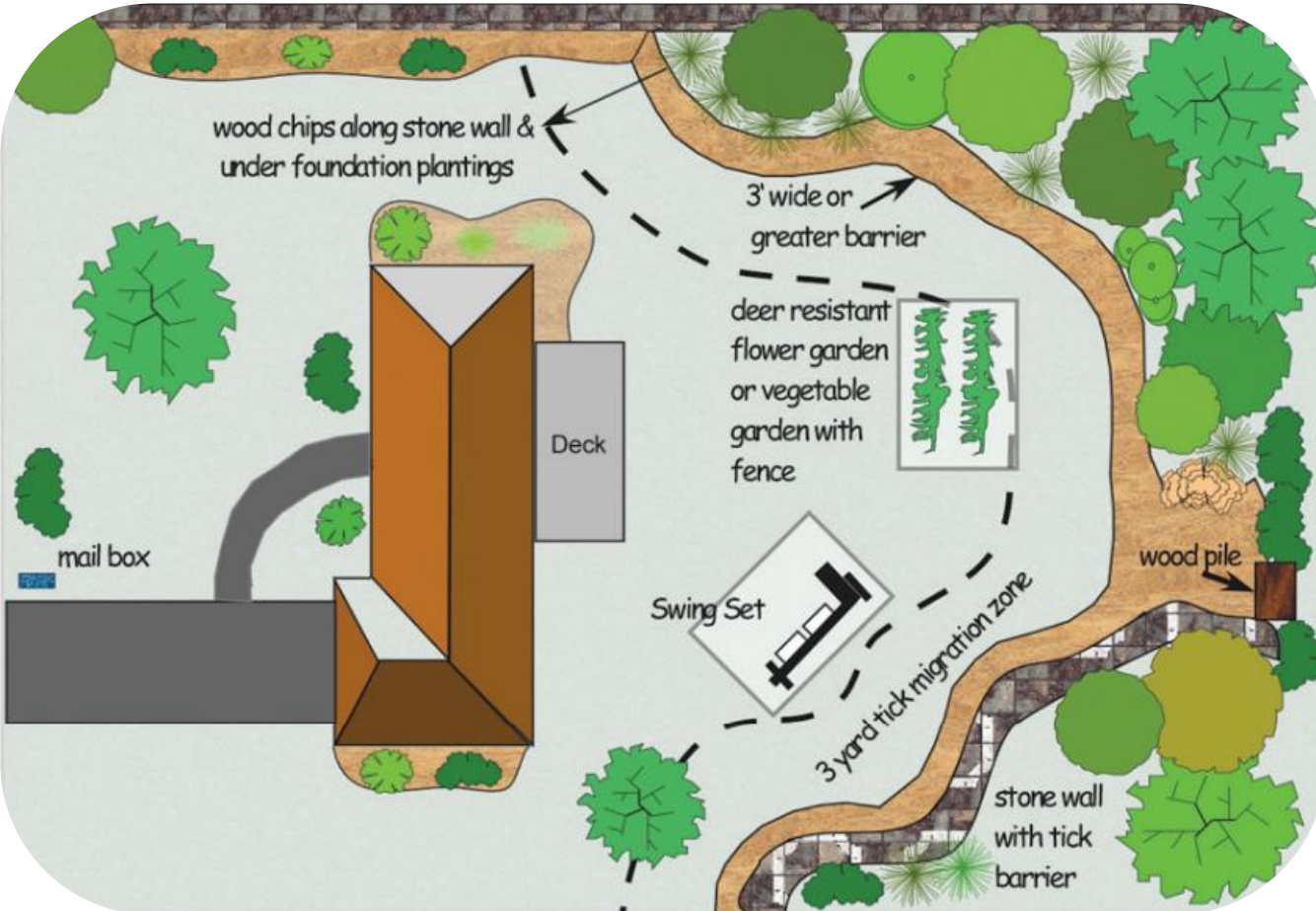
# Landscape Modification

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CAES Tick Management Handbook

# Create a Tick Safe Zone



# Control of Ticks on Pets

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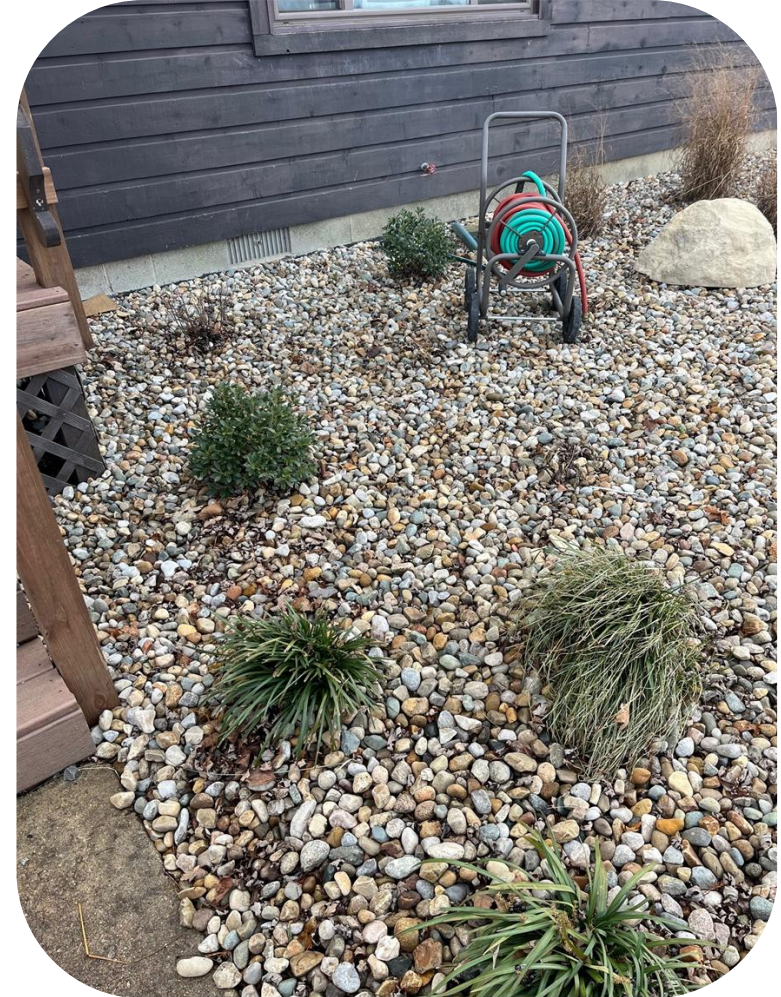
- **CONSULT YOUR VETERINARIAN**
  - **Tick Collars**
    - Seresto
  - **Chewables**
    - Nexgard
  - **Topicals**
    - K9 Advantix II
    - Vectra 3d
    - Frontline
  - **Repellents**
    - Permethrin



# Reduce Tick Habitat



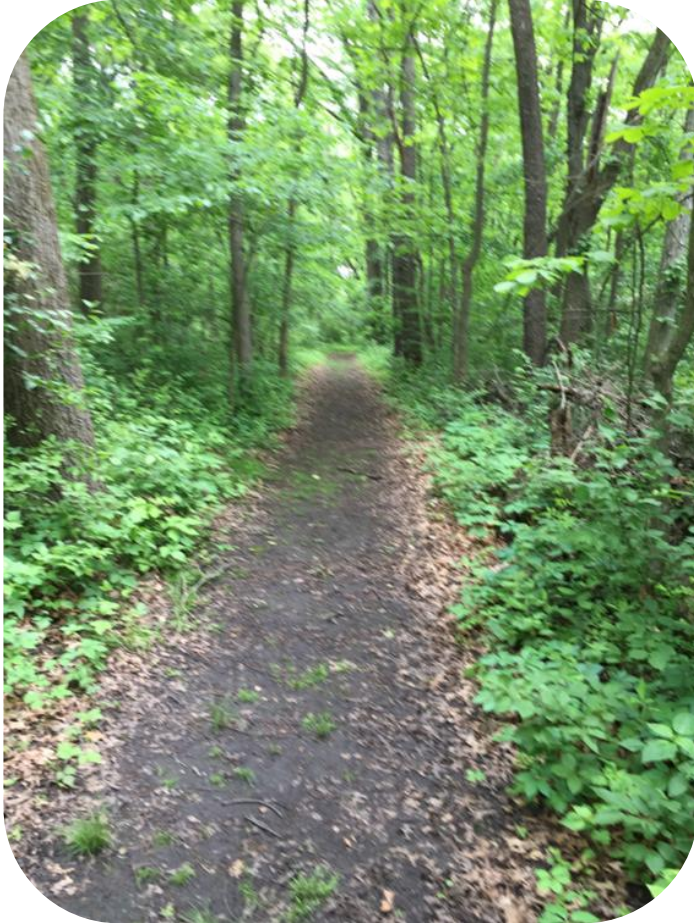
CAES Tick Management Handbook



IDOH

# Landscape Modification

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# Landscape Modification



# Controlling Ticks in the Environment

- Acaricides
  - Most common method of tick control
- Synthetic Acaricides
  - Carbamate (~46-96% control)
  - **Pyrethroids (~87-100% control)**
- Microbial Biopesticides
  - Metarhizium brunneum Strain 52 (~36-96% control)
- 25b products
  - Nootkatone

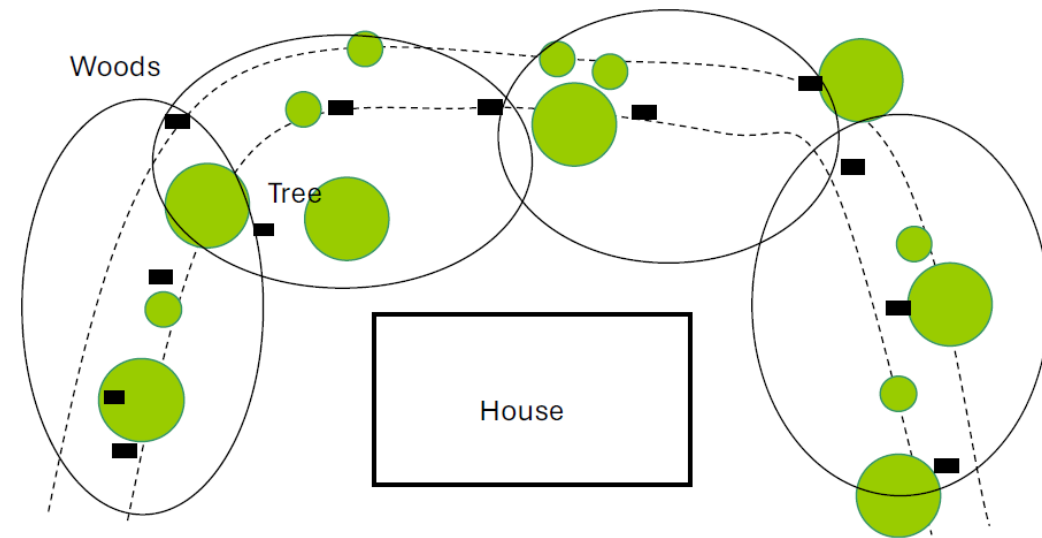


# Host-Targeted Tick Control

## Control of Ticks on Mice



- Place 10 yards apart 2x/yr
- 48 tubes/year/acre
- \$3/tube



# Integrated Tick Management Toolbox

Personal Protection Measures	Landscape Modification	Killing host-seeking ticks	Rodent-targeted approaches	Deer-targeted approaches
Avoid tick habitat Awareness	Xeroscaping/ hardscaping	Synthetic chemical acaricides	Tick tubes	4-poster feeding station
Protective clothing	Short grass	25b products	Acaricide bait boxes	Deer reduction
Repellents and permethrin- treated clothing	Remove leaf litter and brush	Nootkatone	Oral lyme disease vaccine	Exclusions
Tick check and prompt removal	Remove rodent harborage	Met 52	<b>Oral baits</b>	<b>Oral baits</b>

# Questions?

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