UIUC Illinois Natural History Survey Medical Entomology Lab: Guide to Fieldworker Tick Safety

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INHS Medical Entomology Lab - Illinois Statewide Tick Surveillance Program
https://medical-entomology.inhs.illinois.edu/

BEFORE YOU GO OUTDOORS

Optimal prevention of tick bites requires taking personal action on four intersecting domains of protection: Chemical, Physical, Behavioral, and Environmental (Fig. 1). Information to support these actions is provided in this guide.

Before ever venturing into potential tick habitat, make your own personal tick-bite prevention plan. Gather preferred chemical protection, prepare gear, familiarize yourself with ticks that may be present in habitats you're visiting, and make plans for what you will do with encountered ticks – both attached to the skin or crawling around (on skin or clothing, possibly while driving away from the field site!)

Here is a 50-minute presentation I gave for the University of Illinois Extension program that covers our program's best practices for tick-bite prevention and includes information on the habitats, disease agents, and active times of year of the main tick vectors in Illinois. Much of the information provided is applicable outside Illinois: https://youtu.be/T_ViBXofQaU

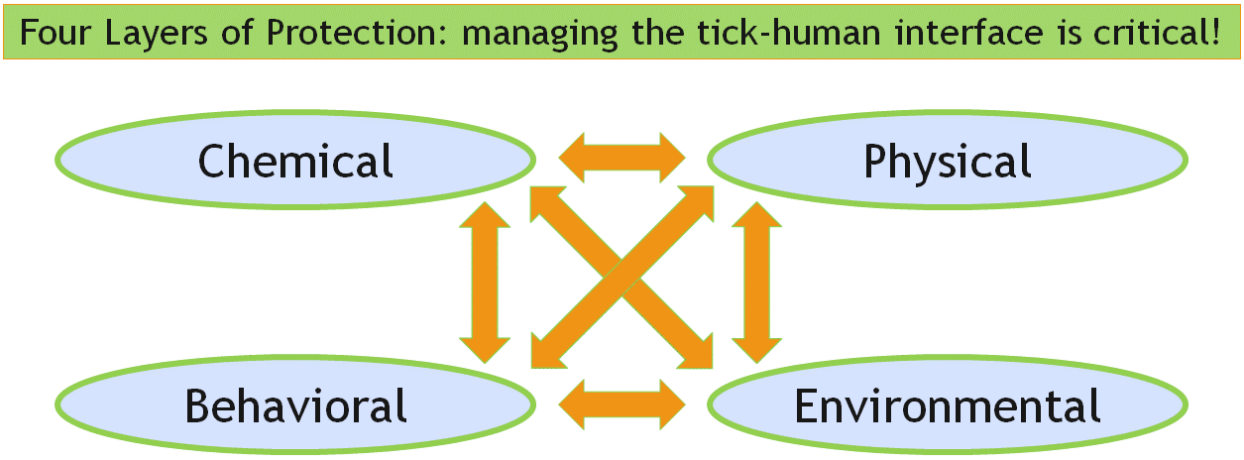

Figure 1. The four domains of personal protection for preventing tick bites

TICK BEHAVIOR

For species of main human concern in Illinois, their host-seeking behavior can be typified as "Sit & Wait" (e.g., wait on a blade of grass to transfer onto a passing host) or "Pursuit" (e.g., actively run towards a host detected through cues such as exhaled breath or radiant heat). These ticks can be found actively questing (e.g., waving forelegs while waiting for a host to pass) or resting leaf litter and ankle- to chest-high grassy, brushy, woody vegetation. Most species and life stages are constrained by water balance and found more often in shaded, humid microclimates – but they can occur on sunny, exposed vegetation too (especially the Gulf Coast tick). Location and behavior of ticks in the environment depends on the tick species and time of year (more details under species sections below).

- Video of a tick questing on blade of grass: https://www.youtube.com/watch?v=gGa6AkriVFw
- Video of lone star tick nymphs running up a boot (and getting trapped in sticky tape): https://www.youtube.com/watch?v=q8YVqdHoMq0
- Video of an adult Gulf Coast tick running across cloth: https://www.facebook.com/holly.tuten.355/videos/820899802187822

COMMON TICK SPECIES ENCOUNTERED OUTDOORS IN ILLINOIS BY PEOPLE AND PETS

Downloadable photos of these species at:
https://medical-entomology.inhs.illinois.edu/illinois-tick-photos/

Illinois Department of Public Health distribution maps of these species (based on the INHS-MEL field tick surveillance program results & periodically updated):
https://idph.maps.arcgis.com/apps/MapSeries/index.html?appid=976061db733441eb977ef5cf2facd5c4

Amblyomma americanum, the lone star tick

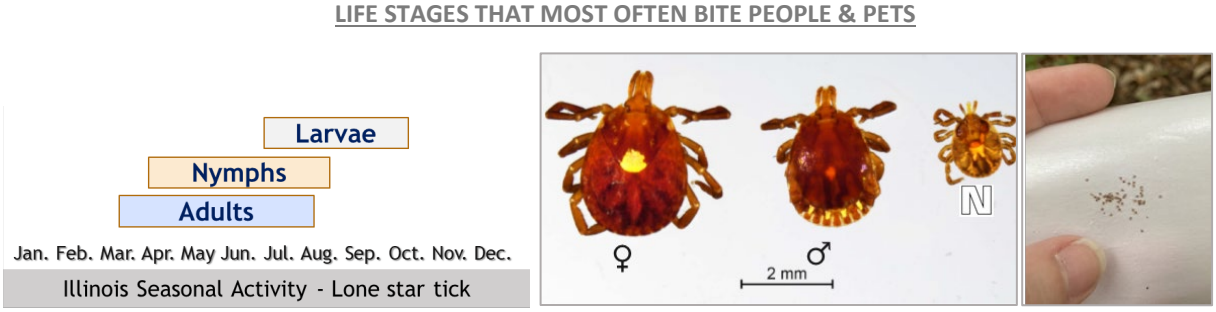

Figure 2. Image on left: General periods of seasonal activity of different life stages by month; Center Image: (from left to right) adult female, adult male, nymph; Image on right: clutch of larvae trapped on lint roller paper; Credits: Holly Tuten/UIUC INHS Medical Entomology Lab – image on left, image on right; Emily Struckhoff/UIUC INHS Medical Entomology Lab – center image.

- **Host seeking behaviors:** "Sit & Wait" and "Pursuit" behaviors. They will typically quest on ankle to thigh-high vegetation but can also rest in leaf litter and soil. If they pick up signs of a host (e.g., CO2, heat, vibration) they can actively run towards it. This is worth remembering when sitting on the ground in tick habitat. [Continued Next Page]

- **Illinois distribution:** Can be found statewide but most dense in southern and central Illinois; populations increasing northwards and expected to eventually be common throughout the state.
- **National distribution:** https://www.cdc.gov/ticks/geographic_distribution.html
- **Habitat:** Wooded areas, especially hardwood dominated. Common in areas with invasive plants or secondary growth (e.g., forests with dense underbrush or in old field successional areas); especially along ecotonal edges like vegetation or scrub along rivers/creeks near forest edge or between meadows and forest. Found in a wide range of habitats from dense forest interior with lush leaf litter to regularly flooded environments with depauperate leaf litter to grassy edges of forests with several hours of direct sun per day.
- **Human diseases (and the disease agents) associated with lone star ticks:** Alpha-gal Syndrome (aka "red meat allergy"), Bourbon virus disease (Bourbon virus), Ehrlichiosis (*Ehrlichia* spp.), Heartland virus disease (Heartland virus), Southern Tick-Associated Rash Illness (disease agent unknown), Tularemia (*Francisella tularensis*).

Amblyomma maculatum, the Gulf Coast tick

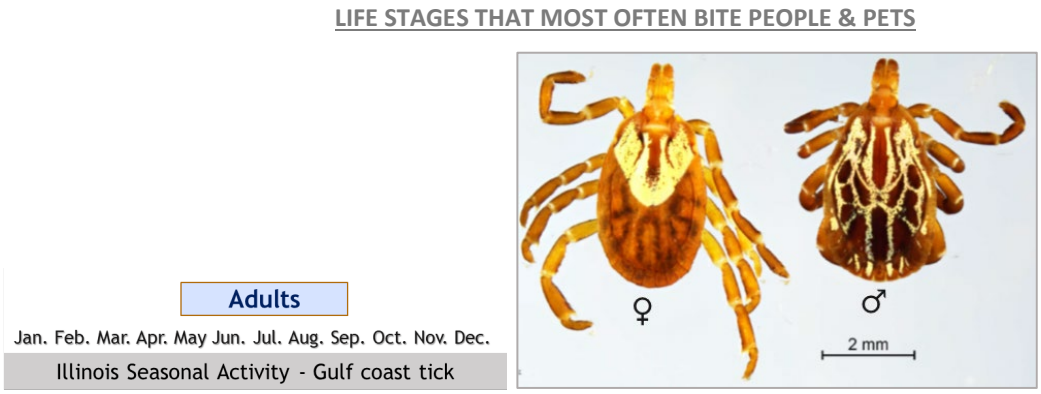

Figure 3. Image on left: General periods of seasonal activity of different life stages by month; Center Image: (from left to right) adult female, adult male; Credits: Holly Tuten/UIUC INHS Medical Entomology Lab – image on left; Emily Struckhoff/UIUC INHS Medical Entomology Lab – image on right.

- **Host seeking behaviors:** "Sit & Wait" and "Pursuit" behaviors. They will typically quest on calf to chest-high vegetation but can also rest in soil (even, dry cracked soil). If they pick up signs of a host (e.g., CO2, heat, vibration) they can actively run towards it. This is worth remembering when sitting on the ground in tick habitat.
- **Illinois distribution:** Found in focal areas in southern Illinois and central Illinois; more common in southern IL than central and might be invading northwards. Can occasionally be found in Chicagoland during late summer.
- **National distribution:** https://www.cdc.gov/ticks/geographic_distribution.html
- **Habitat:** Open habitats (e.g., prairie), including mowed fields, old fields undergoing succession to forest, roadside ditches. Can be found in unusually dry habitats, but often near sources of water. Uncommon to occur in areas where canopy has fully closed in.
- **Human diseases (and the disease agents) associated with Gulf Coast ticks:** *Rickettsia parkeri*-rickettsiosis (*Rickettsia parkeri*), a member of the Spotted Fever Group Rickettsioses (SFGRs).

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Dermacentor variabilis, the American dog tick (aka "wood tick")

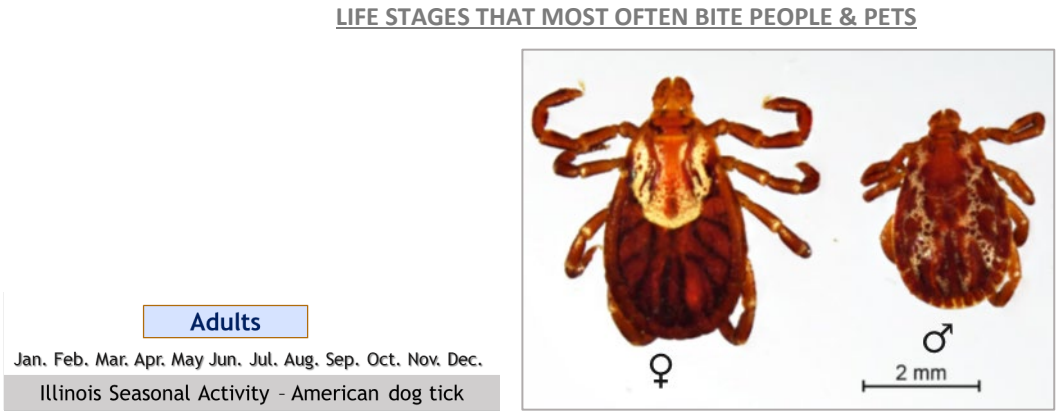

Figure 4. Image on left: General periods of seasonal activity of different life stages by month; Center Image: (from left to right) adult female, adult male; Credits: Holly Tuten/UIUC INHS Medical Entomology Lab – image on left; Emily Struckhoff/UIUC INHS Medical Entomology Lab – image on right.

- **Host seeking behaviors:** "Sit & Wait" behavior. They will typically quest on ankle to thigh-high vegetation. They can also display a "mobbing" behavior and may be found in clumps on objects in the environment.
- **Illinois distribution:** Considered broadly-distributed throughout Illinois.
- **National distribution:** https://www.cdc.gov/ticks/geographic_distribution.html
- **Habitat:** Wooded areas, forest/field edges, overgrown abandoned lots, fallow fields, roadsides, grassy edges of hiking trails, scrub along rivers/creeks. Typically found near the interior and exterior of the forest edge.
- **Human diseases and disease agents associated with American dog ticks:** Tularemia (*Francisella tularensis*), Rocky Mountain Spotted fever (*Rickettsia rickettsii*).

Ixodes scapularis, the blacklegged tick (aka "deer tick")

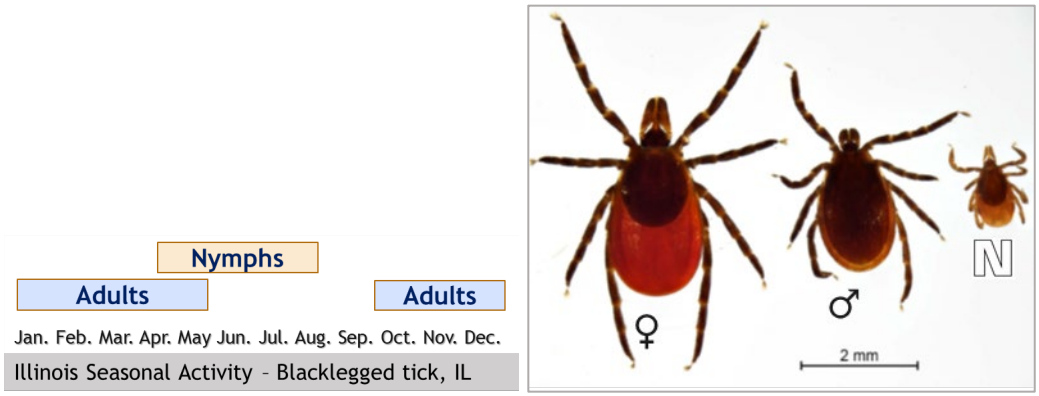

Figure 5. Image on left: General periods of seasonal activity of different life stages by month; Center Image: (from left to right) adult female, adult male, nymph; Credits: Holly Tuten/UIUC INHS Medical Entomology Lab – image on left; Emily Struckhoff/UIUC INHS Medical Entomology Lab – image on right.

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- **Host seeking behaviors:** "Sit & Wait" behavior. They will typically quest on ankle to thigh-high vegetation.
- **Illinois distribution:** Throughout Illinois with uneven distributions. Populations with nymphs that actively quest for large mammals most dense in northern Illinois. This species does occur in southern Illinois but nymphs in those populations may have a different questing behavior that keeps nymphs below the leaf litter, so they encounter large mammals less often.
- **National distribution:** https://www.cdc.gov/ticks/geographic_distribution.html
- **Habitat:** Upland, oak-dominated, sandy/loamy soils; from forest interior to trail edge. In high density areas can be associated with suburban woodlots, brush piles in yards. Strongly tied to humid microclimates; most often found in mesic, upland, oak-hickory dominated forests or areas with dense evergreen needle litter.
- **Human diseases and disease agents associated with blacklegged ticks:** Anaplasmosis (*Anaplasma phagocytophilum*), Babesiosis (*Babesia microti*), Lyme (*Borrelia burgdorferi* s.s. & *Borrelia mayonii*), hard tick relapsing fever (*Borrelia miyamotoi*), Ehrlichiosis (*Ehrlichia muris euclairensis*), Powassan virus disease (Powassan virus).

PREVENTING TICK BITES

When visiting environments that may harbor ticks a few precautions can increase safety. Because ticks quest on grass stalks or in the leaf litter, they are typically going to transfer onto hosts that walk by at waist-level or below. After transferring onto hosts from vegetation, ticks stereotypically crawl up.

Layer clothes from the bottom to the top to make an ascending barrier: high boots, with pants tucked into calf-high socks, and long-sleeved shirt that's tight at the wrist and tucked into pants. Or wear a jumpsuit over clothing. Light and solid-colored clothing makes ticks easier to spot. Wear a hat and tuck in hair. My team puts double-sided carpet tape around the tops of our boots to stop any ticks from crawling past that point.

When outdoors regularly scan your body looking for ticks – every time I stop to check my drag, I first scan myself. I start at my chest, scan down my legs, then scan back up - front, back, sides for both passes.

Chemical protection can also be very powerful – use EPA-registered chemicals[1] and read labels thoroughly, both for the first use and when a new bottle is purchased (labels can change). Our team treats our clothing and gear with an 0.5% permethrin spray formulated specifically for clothing and gear and I highly recommend this product if you regularly work in tick habitats. We spray our gear outside, let it dry thoroughly (and remember that it is highly toxic to cats).

- The EPA has a personal repellent choice tool at (scroll down page): https://www.epa.gov/insect-repellents/find-repellent-right-you
- Here is an excellent brief guide to repellents from Cornell: https://ecommons.cornell.edu/handle/1813/66722

[1] We do not use repellents for the Illinois Tick Surveillance program to prevent contaminating our drags & traps. Head nets over a wide-brimmed hat can keep mosquitoes and other biting flies away from the face.

- *A repellent, such as a spray containing DEET, can be used in conjunction with permethrin.* Here is an informative article on using permethrin and DEET in combo: https://www.consumerreports.org/insect-repellent/how-deet-and-permethrin-can-protect-you
- **Outdoor workers are at particularly high risk** – check out this NIOSH fact sheet here: https://www.cdc.gov/niosh/docs/2010-119/pdfs/2010-119.pdf

This is PPE my crew uses:

- Always read chemical labels before using and every time you buy a new bottle.
- All cloth and leather gear is treated with 0.5% permethrin spray *formulated for clothing and gear*. Permethrin is the foundation of our PPE – we consider it essential for preventing tick bites.
  - Spray outdoors, always allow to dry for at least 24 hours
  - Keep away from cats – it's toxic to cats!
- Wear a white FOD suit (treated with permethrin) over season-appropriate athletic clothing that is *not treated with permethrin*.
  - https://www.fodcontrol.com/product/the-fod-suit-coveralls/
  - FOD-suits are sturdy enough to last multiple field seasons, but stakeholders on 1-2 day investigations (e.g., personnel from local health depts) have applied the same treatment to long-sleeved Tyvek suits with success.
  - They get hot!
  - We take off suit before entering car and store in bag in trunk.
- Field bags treated with permethrin.
- Calf-high leather/cloth boots (treated with permethrin), or rubber boots (*not treated w/permethrin*).
- Regardless of boot type, double-sided carpet tape wrapped around the circumference of boot about an inch below the top edge of boot (this can trap ticks in the sticky tape).
  - Here is a video of lone star ticks getting stopped by double-sided carpet tape: https://www.facebook.com/holly.tuten.355/videos/793379098273226
- Calf-high socks, treated with permethrin
  - I use compression socks because lone star tick larvae can't crawl through them, but using these depends on health status
  - Tight weave socks in general work better than looser weaves.
- Hair pulled back or under hat.
- Carry a lint roller to quickly roll larval ticks off pants. Here is a video of lone star larvae being trapped with lint roller tape: https://www.facebook.com/holly.tuten.355/videos/812902949654174

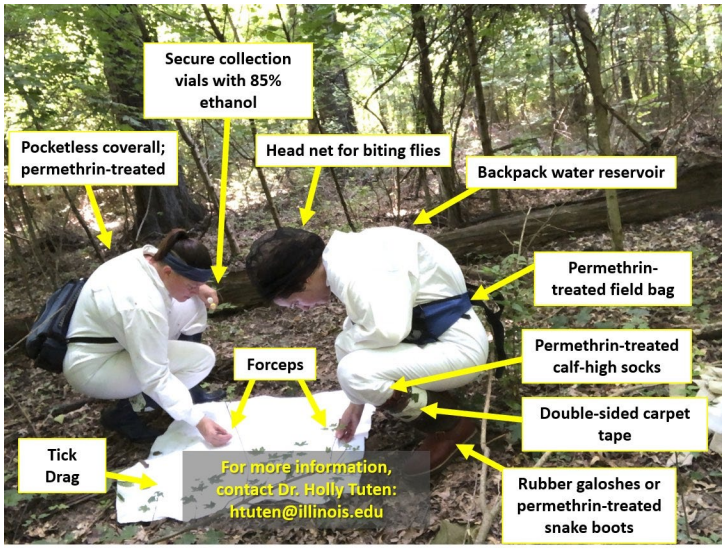


Figure 6. Diagram outlining major parts of PPE used by the INHS-MEL tick surveillance crew.

When outdoors:
Remember that while spring and fall, and to a lesser extent summer, are typically the most active times for most ticks, they can seek hosts year-round when the ground is dry (no rain, no snow) and the ambient or microclimate temperature is above freezing (e.g., sunny south-facing slope on an autumn or winter day). Ticks can be out questing on a dry, sunny winter day.

Specific behaviors can help prevent tick bites when outdoors:

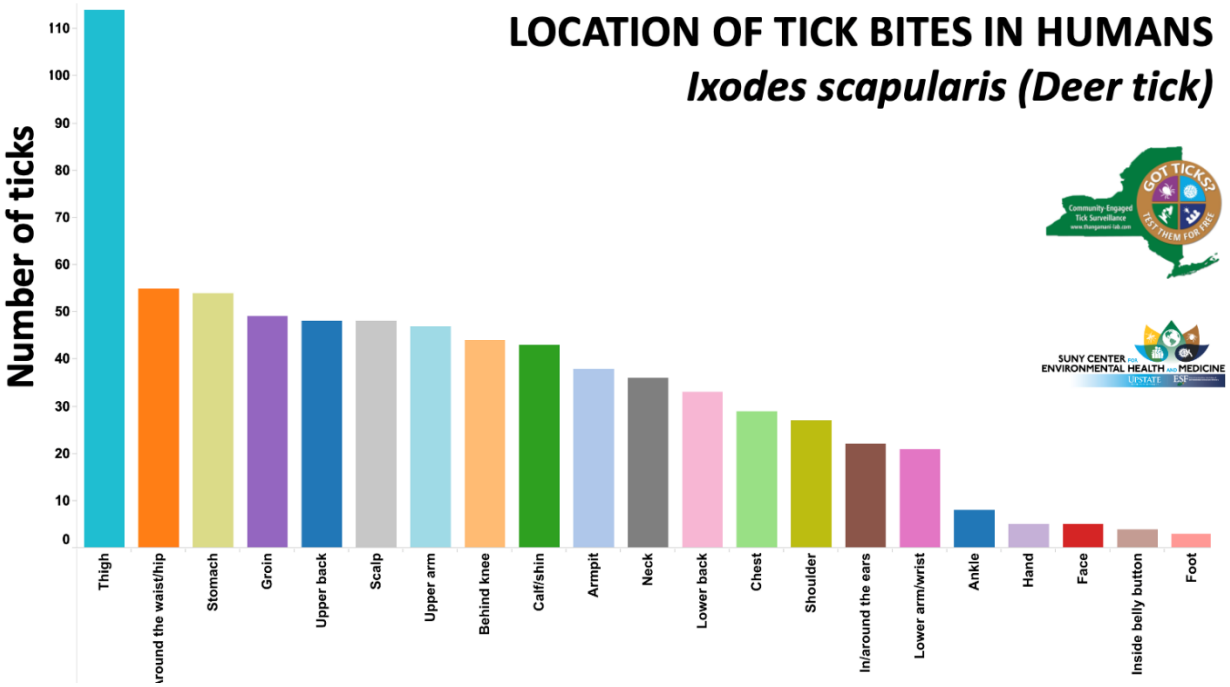
- Ticks typically transfer off vegetation at thigh-level or below and then stereotypically crawl up. Create an ascending barrier: pants into socks, shirt into pants.
- While moving through grass, shrubs, or forest, perform a visual assessment every 10-20 meters (every 15-40 steps at a normal walking pace) by scanning body looking for ticks. Start at chest, visually scan down front, sides, and back, and then scan back up.
- If possible, stick to the middle of trails and try not to brush up against or sit in shrubby/grassy areas.
- If you find a loose tick crawling, you can flick it off, wrap it in lint roller paper or tape and save or throw away later, or preserve it in a vial of 85% ethanol. *This is a personal choice.* However, when conducting tick surveillance, collect any ticks found on field personnel and label with the transect number and as collected from "self".

CHECKING FOR TICKS

After returning from the field, a tick check is essential. Some ticks can bite very quickly (e.g., lone star ticks), and thus be readily visible (e.g., on a shin or arm), or they and other species (e.g., blacklegged "deer" ticks) can roam on the body to find cracks and crevices where they can attach (e.g., between toes).

- Remove clothes and put in a dryer on high heat until thoroughly dry (e.g., 20 minutes); if you can't do that, at least wash them in hot water. Heat, not water, kills ticks.
- If you don't have access to a laundry, shake your clothes far from where you will sleep, check them for ticks, and hang them outside.
- Conduct a full body check for ticks alone or with a partner, pay careful attention to cracks and crevices (e.g., between toes); use a hand mirror and headlamp/flashlight if you check yourself alone. As a parent, I check my children rather than having them check themselves.
- If possible, take a shower within two hours of being in the field and do tick check by sight and feel (running your hands along skin feeling for the flap of an attached tick). Check common areas, like hairline/behind ear, and hidden parts, like between toes!
- If an area of the body starts itching later, inspect it well; sometimes the site of tick attachment will get irritated and itch, which can be a clue.

Here is a graph of locations on the body where blacklegged ticks have been found (from www.nyticks.org):



TICK REMOVAL AND WHAT TO DO WITH ATTACHED TICKS

There is a lot of conflicting information regarding what to do with an attached tick – *what you do is a personal choice*. While there are many tick-testing services, the CDC does not recommend using a tick test to determine potential human exposure to a disease agent. It could be that the tick tests negative but did infect someone, or vice versa. However, identifying and saving loose ticks can be useful. By identifying the tick, I can be aware of diseases associated with it. By saving the tick, it is ready in case a doctor or public health official decides that tick testing is necessary.

After removing, identifying, and saving a tick, I familiarize myself with the signs and symptoms of diseases associated with that species. If I developed any symptoms of tick-borne illness within several months of removing a tick, I would contact my doctor; making sure to tell them about the recent tick bite, when the bite occurred, the species of tick, and where I most likely acquired it. *I always save removed ticks and always contact a medical provider if I'm concerned.*

The CDC has information on proper tick removal here: https://www.cdc.gov/ticks/removing_a_tick.html

Video of proper tick removal technique: https://www.youtube.com/watch?v=1Vj-qhxCJbA

This is what I personally do with an attached tick (I am not a medical provider, and this is not medical advice):

1. I clean fine-tipped tweezers or tick-removal device with rubbing alcohol and/or soap and water.
    - I keep these tools with me (just examples, not endorsements, other effective devices available): Pro-tick remedy keychain tool: https://tickinfo.com/protickremedy; "TickEase" tool: https://tickease.com/
2. I use tweezers or tool to grasp the tick as close to the skin's surface as possible. I don't attempt to burn, smother, twist, or crush/pop the tick!
3. I pull upward with slow, steady, even pressure. I don't twist or jerk the tick. If mouthparts break off in skin, per CDC instructions I try to remove the mouthparts with clean tweezers. If unable to remove the mouthparts easily with clean tweezers, I leave it alone and let the skin heal.
4. I put removed tick in a container (e.g., Ziploc or vial or pill bottle) and stick in freezer.
    - If in the field for a few days, the tick can be put in a Ziploc bag with fresh, green tree or bush leaves and it will remain alive until it can be frozen. Or it can be put it in 85% ethanol. Once back at home or lab, tick can be placed in freezer.
5. After removal, I clean the bite area and hands with rubbing alcohol and/or soap and water.
6. I write a small note with information on:
    - Individual the tick was removed from
    - Date of removal
    - When and where (like city, zip code) the tick was found
    - Suspected location (like the name of a park, city, zip code) and date of tick encounter
    - Whether the individual traveled outside the county of residence for the past 10 days
7. Once dead, I take tick out of freezer to get a good picture of it and then put the note in the container.
8. I take a picture of the tick:
    - Take unobstructed photos of the top and bottom of individual ticks against a light, solid-colored background
    - Make sure tick is in focus and body parts are clearly visible
    - Use well-lit area
9. I return tick to freezer and leave it there – do not repeatedly freeze-thaw the tick as this can damage specimen.
10. I identify the tick:
    - Numerous tick ID keys and pictures exist on-line; here is an interactive one with specific diagnostic characters and pictures: http://us-tick-key.klacto.net/startpage.html
    - Pictures of commonly encountered tick species and life stages can be viewed at: https://web.uri.edu/tickencounter/fieldguide/
    - Pictures of ticks can also be uploaded to iNaturalist for community crowd-sourced identifications.

Loose and attached ticks encountered in Illinois can be sent to the INHS Medical Entomology Lab for free identifications and professional archiving. More information can be found at: https://medical-entomology.inhs.illinois.edu/research/free-tick-identifications/

The INHS-MEL cannot return ticks submitted to our program – if you think you might want the tick later, save it*.

For ticks on pets, see: https://www.showusyourticks.org/

*For INHS-MEL fieldworkers: bring any attached ticks to Holly for identification and archiving.

Questions? Contact: Holly Tuten, PhD – INHS Medical Entomology Lab; htuten@illinois.edu

APPENDIX

Free tick identification and/or testing services by state

- If you don't see a resource listed, check with a county extension office or local or state health department
- If you would like to update, add, or remove a resource on this list, contact Holly Tuten: htuten@illinois.edu
- For ticks from pets, check out Show Us Your Ticks
- For Department of Defense personnel and dependents, check out MilTICK
- For identification of ticks from pictures, check out iNaturalist or TickSpotters or TickCheck
- Tick reporting "apps": TickTracker, The Tick App, NCSU TickID, TAMU Tick App, eTICK (Canada), TickReport, Vermont Tick Tracker

Alabama: The Great Alabama Tick Survey
Alaska: Alaska Submit-A-Tick program
Arizona: Arizona Extension handout on ticks; University of Arizona Insect Identification
Arkansas: The Arkansas Tickborne Disease Project
California: Labs offering tick IDs and/or testing
Colorado: Co. Dept Public Health tick information; Veterinarian submission of ticks to CDPHE
Connecticut: The Connecticut Agricultural Experiment Station Tick Submissions
Delaware: DNREC Tick Program
Florida: FL Health Dept. Tickborne Diseases page; UF Insect ID Lab
Georgia: Georgia DPH Tick ID
Hawaii: Agricultural Diagnostic Service Center
Idaho: Idaho Dept. HW tick information; UI Insect Identification Request
Illinois: The INHS Medical Entomology Lab Illinois Statewide Tick Surveillance Program
Indiana: Tick INsiders
Iowa: Iowa State University Medical Entomology Lab
Kansas: KSU Extension handout on ticks; Kansas State University Insect Diagnostics Program
Kentucky: KY CHFS page on ticks; University of Kentucky Insect Identification
Louisiana: LA Dept. Health page on ticks; Louisiana State University Insect Identification
Maine: Tick Testing for the People of Maine
Maryland: University of Maryland Tick Identifications
Massachusetts: Massachusetts Tick Identification and Testing Services
Michigan: Michigan Department of Health & Human Services Tick Identification
Minnesota: Minnesota Department of Health Tick Monitoring Program
Mississippi: Mississippi State Department of Health Vector Identification
Missouri: Missouri ticks and tick-borne pathogen surveillance
Montana: Montana DPHHS page on ticks
Nebraska: Tick-Tag-Go project
Nevada: Nevada DHHS Handout on Lyme; Nevada Department of Agriculture Entomology ID Services
New Hampshire: NH DHHS page on ticks; NH Dept. of Agriculture Tick ID form
New Jersey: NJ DH Vectorborne Diseases page; Monmouth Co. Tick Identifications
New Mexico: NM DOH page on ticks; Museum of Southwestern Biology Division of Arthropods
New York: New York Ticks Lab
North Carolina: NCDHHS Tick Identification Form
North Dakota: North Dakota Health Tick Surveillance

Ohio: Submit-A-Tick program
Oklahoma: OK DH tickborne disease page; Find local Extension office
Oregon: OHA Lyme page; Oregon Extension Tick ID services
Pennsylvania: Identify-My-Tick
Rhode Island: TickSpotters Program
South Carolina: No service – link to SCDHEC Diseases spread by ticks
South Dakota: No service – link to map of Ticks in South Dakota
Tennessee: TN DH tick-borne diseases page; UTN Insect ID service; TN Co. Extension Offices
Texas: DSHS Tick Submission and Testing
Utah: UT DH Lyme page; Utah Plant Pest Diagnostic Lab
Vermont: Passive Tick Surveillance Program
Virginia: Fairfax Co. Tick Identification; No statewide service – link to VA DH tick flyer
Washington: Washington State Dept. of Public Health Tick Identification
West Virginia: No service – link to WV DHHR tick information and identification service for veterinarians
Wisconsin: University of Wisconsin Tick Identification; University of Wisconsin Insect Diagnostic Lab
Wyoming: WY DH tick information; University of Wyoming Extension Arthropod Identification Service