

Illinois Natural History Survey Medical Entomology Lab: Quick-Start Guide to Tick Dragging

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INHS Medical Entomology Lab - Illinois Statewide Tick Surveillance Program

Lab Information: <https://medical-entomology.inhs.illinois.edu/>

Surveillance Maps: <https://arcg.is/15fDSO>



[What's this?](#)

PREPARING FOR TICK COLLECTIONS

Collecting ticks takes us into potential high-risk tick habitats. The University of Illinois INHS Medical Entomology Lab has stringent personal protection measures to prevent tick bites. The foundation of our protection is a FOD-suit¹ treated with an 0.5% permethrin spray formulated for clothing and gear (Fig. 1). This specific permethrin spray formulation can be purchased on-line or at most outdoor/farm supply stores and can be applied to cloth or leather suits, socks, boots, and other field gear (make sure to thoroughly read directions on every new bottle purchased as labels can change). FOD-suits are a good value and sturdy enough to last years, but stakeholders have applied the same treatment to long-sleeved Tyvek suits or long-sleeved shirts and pants. Tuck suit/pant legs into permethrin-treated calf/knee high socks with a tight weave (so small ticks cannot burrow through). We use rain or snake boots with double-sided carpet tape around top (to catch ticks climbing boots). For more information on avoiding and responding to tick bites, refer to the INHS-MEL “Guide to Fieldworker Tick Safety v.4”.



Figure 1. Personal protection and gear needed to drag for ticks; Photo Credit: Erica Cimo, INHS-MEL.

¹ <https://www.fodcontrol.com/product/the-fod-suit-coveralls/>

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Essentials supply list:

- Field clothing (hat, suit, socks)
- Boots (rubber, cloth, or leather)
- 0.5% permethrin spray formulated for clothing & gear
- Tick drag (see “How to build a drag” on p. 4)
- Field bag
- 1.5ml plastic tubes with rubber O-rings (or similar) filled with 85% ethanol (the INHS Med Ent Lab can provide these for IL partners; send requests to Holly Tuten: htuten@illinois.edu)
- Jeweler’s forceps (to move ticks from drag to vials)
- Slips of regular paper and pencils (for date/location/collector labels)
- Wide painter’s masking tape (can apply to pants to write on and keep track of transects and stops)
- Visibility gear, such as orange vests or hats, if working in an area open to hunting
- Water for hydration
- Lint roller or wide painter’s masking tape (to capture clutches of larval ticks on drags or clothing)
- Ziploc bags (to put individual lint roller sheets in after capturing ticks)
- Wide permanent marker (for writing on Ziploc bags with lint roller sheets)

CHOOSING A SITE TO DRAG

Questing blacklegged ticks are most likely to be found in forests, heavily shaded grassy areas, and transition areas between these two habitats. They are strongly associated with shade, and soil and litter conditions that promote humid, but not flooded, microclimates – such as upslope areas with full canopy and sandy/loamy soils covered by dense leaf litter and duff (created by decomposing leaves and needles) and creeping ground vegetation. The shaded, grassy edges of trails (human or animal) next to or in forests can be highly productive habitats. Other tick species (e.g., the lone star tick) can be found in a wider range of habitats – for more information on those environmental conditions, please refer to the species notes on pp. 2-3 of the INHS-MEL “Guide to Fieldworker Tick Safety v.3”.

Known tick habitats (e.g., from reports of tick activity or previous sampling) are great sites to drag. Local recreational parks with hiking trails and/or campgrounds are also good sites to drag. If possible, it is recommended to prioritize areas of greater human risk within a site (e.g., popular trails, picnic areas, playgrounds, campgrounds).

OPTIMAL WEATHER AND TIMES FOR DRAGGING

It is not advised to drag directly after or during rain or any time of day when the ground vegetation might be dewy or wet. In general, and probably due to a lowered chance of exposure-based mortality (e.g., desiccation), questing blacklegged ticks are most likely to be captured via dragging at air temperatures above freezing and below 86 °F and when relative humidity is above 75%. Keep in mind, that beyond general weather conditions, microclimatic conditions can exert a strong impact on tick questing behavior. For instance, it’s possible to sample questing blacklegged ticks on winter days in hilly areas on a south-facing slope in full sunlight, even if water in the valley is frozen; likewise, even on hot summer days, ticks might still be active in shaded areas with dense leaf litter or grass mats under a full canopy. Keeping these limits in mind, throughout the year we strive to avoid drag sampling during times of the day when blacklegged ticks are less likely to be questing for hosts.

The two peak seasons for blacklegged ticks in Illinois are mid-April to end-June and late-September to early-December. If you want to conduct additional dragging outside of these collection season windows (e.g., to capture different species), we will accept those ticks as well. For more information on known tick and pathogen distributions in the state and times of year different tick species and life stages are active, refer to the INHS-MEL “Guide to Fieldworker Tick Safety v.4”.

TICK DRAGGING FUNDAMENTALS

Tick dragging is a method for collecting ticks where you pull a drag attached to a heavy wooden dowel behind you, parallel to the ground, along the leaf litter, ground cover, plants, and low shrubbery while walking through favorable tick habitat at a leisurely steady pace (Fig. 2). When large obstacles, like thorn bushes are encountered, divert around them.

As the drag is pulled behind you, questing ticks will attach themselves to the drag. While dragging, stop every 10 meters to inspect for ticks. The easiest way to estimate distance is by counting steps, and for most people 15-20 steps is equal to 10 meters. It's best to use measuring tape or rulers before going in field to determine how many of your steps cover 10 meters.



Figure 2. Images of dragging for ticks in the woods; Photo Credit: Fred Zwicky, Illinois Newsroom.

At each inspection stop, always check yourself first by visually scanning your body, start at your chest, scan down legs, then scan back up - front, back, sides for both passes. Then check both sides of the drag, including the dowel, seams, and edges, for ticks. Transfer any ticks found to one of two labeled vials containing 85% ethanol:

- 1) A vial labeled "T" for transects for ticks from the drag; or
- 2) A vial labeled "S" for self for ticks from your person.

Label the vials by writing with pencil on slip of paper the date (mm/dd/yyyy), site name/abbreviation, and collector's initials, then put the piece of paper inside the vial with the ticks (Fig. 3, next page).

You can either collect all ticks at a site into single vials labeled either "T" or "S", or collect them by transect (e.g., T1/S1, T2/S2, T3/S3, T4/S4, T5/S5). Using separate vials for each transect will yield higher resolution of tick and pathogen distributions at the site. Each collector can use their own set of vials.

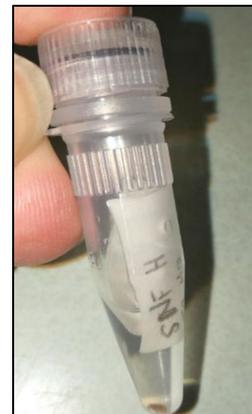


Figure 3. Tick in vial with paper label written in pencil.

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A note about tick larvae: If you see a single or just a few larvae on a drag, collect them into ethanol with forceps. But some tick species (lone star, winter tick) have clutches of larvae that transfer as a patch of dozens at a time. These are too time-consuming to transfer with forceps and can be collected with lint roller sheets or wide painter's masking tape. Apply the sheet/tape strip repeatedly to surface until all larvae are gathered – then firmly press the non-sticky side of another sheet/strip on top of the sticky side with trapped ticks, then add the sticky side of a 3rd sheet/strip to the exposed sticky side of the 2nd sheet. Put in Ziploc and record collection details (date, site name, collector, T/S w/optional #) with permanent marker on the bag.

Video of single blacklegged tick larva on a drag:

<https://www.facebook.com/holly.tuten.355/videos/351876835756790>

Video of a clutch of lone star larvae on a drag and lint roller sheet:

<https://www.facebook.com/holly.tuten.355/videos/812902949654174>

CDC REQUIREMENTS

The CDC has two requirements for each sampling site which must be met for tick surveillance:

- *To obtain an estimate of tick density:*
A minimum of 750 meters must be dragged at each site (i.e., 1125-1500 steps total). See below for details.
- *To obtain an estimate of pathogen prevalence:*
A minimum of 25 ticks of each host-seeking life stage (i.e., 25 nymphs and 25 adult female blacklegged ticks) must be collected within a calendar year; ideally 50 or more of each will be collected. The target number of 25 ticks doesn't have to be reached in a single visit – it can be obtained over several sampling visits to a site within a calendar year.

The 750 meters required by the CDC is based on pulling a 1 meter-square piece of cloth (the drag) over 750 linear meters. This can be completed by dividing the total distance into several smaller transects spread throughout the site (e.g., 5 x 150 meter transects, 50 x 15 meter transects). If necessary, a single 750 meter transect can be dragged (e.g., forward along one side and back along the other side of a popular hiking trail) but CDC prefers several different drag locations at a site (e.g., multiple hiking trails). Ideally, you will visit a site 2-3 times during the collection season, sampling 750 meters each time, for several measures of tick abundance. Dragging more than 750 meters during a visit is fine.

Dragging 750 meters usually takes 1-2 people ca. 3 hrs for the first visit and 2 hrs for subsequent visits. Keep track of total meters dragged per individual and sum them together for total meters dragged at the site.

For more information on CDC dragging requirements, you can find their surveillance guides here:

<https://www.cdc.gov/ticks/surveillance/index.html>

HOW TO BUILD AN “INHS-MEL QUICK DRAG”

A tick drag is a white one-meter square of cloth which is pulled across the top of the forest floor, plants, and shrubbery to pick up ticks. Tick drags can be constructed for less than \$20 using supplies purchased from stores such as JoAnne Fabrics, Walmart, Home Depot/Lowe’s, or similar (Fig. 3). You will need:

- A 110 cm x 100 cm square of sturdy white cloth (e.g., corduroy, mattress ticking, crib flannel, and canvas)
- To keep edges of cloth from fraying and prolong drag life cut an extra 5 cm in every direction and fold the excess 5 cm back on itself and glue with “liquid stitch” for fabrics or similar.
- To add weights to trailing end of drag leave an extra 10 cm at bottom edge of cloth. Fold cloth over 3 zinc-plated washers (2” outer diameter, 3/4” inner diameter) and glue in place, one at each side and one in middle.
- A 1^{1/8}” x 48” wooden dowel (in stock at molding/chair rail sections of home improvement box stores)
- “SharkBite” brand 1” disconnect clamps x 4 (on-line and in plumbing sections)
- Rope – we use paracord

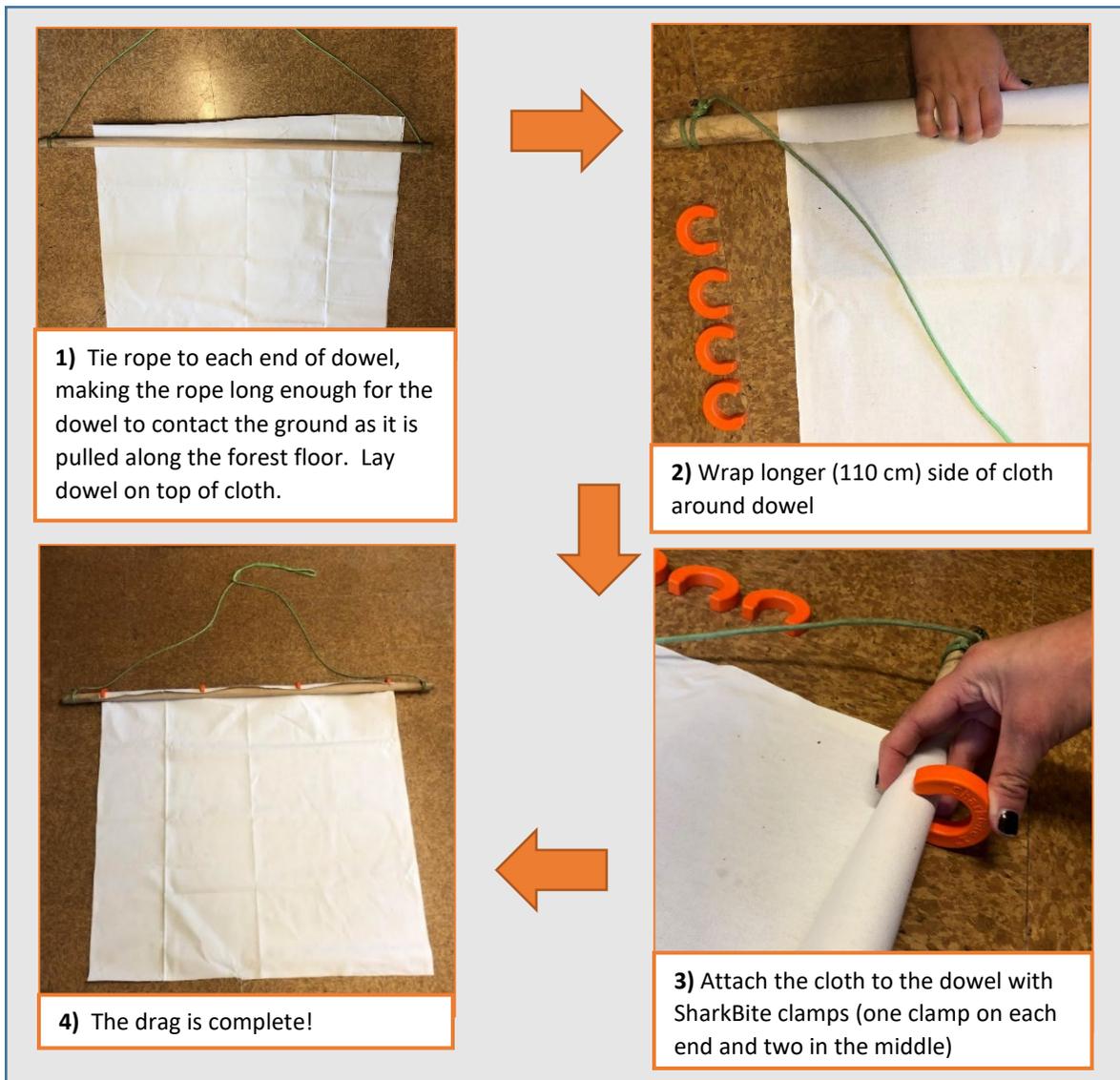


Figure 3. How to construct an “INHS-MEL Quick Tick Drag”

RETURNING FROM THE FIELD

- 1) Visually check self, gear, and drags for ticks one last time before getting in car.
- 2) Shake gear, suits, and drag out before putting in car – store in closed trash bags in back of car or trunk. Store suits separate from drags.
- 3) Heat, not water, kills ticks. As soon as possible after returning home, place field clothes in the dryer on the hottest temp for 10-20 minutes (longer for damp clothes) to kill any hidden ticks.
- 4) Take a shower within two hours of leaving the field and perform a thorough tick check of the whole body, especially in areas where ticks commonly attach (Fig. 4), by both sight and fingertip feel. Using a mirror can be helpful.

5) If you find an attached tick

- CDC “Tick Removal” instructions: https://www.cdc.gov/ticks/removing_a_tick.html
- The CDC does not recommend testing ticks for xenodiagnosis of potential human infection.
- What we do with attached ticks - put them in a container (e.g., Ziploc or vial) labeled with the person, date, and site, then store in the freezer (*don't ship to INHS-MEL*).
- We mark the date of the bite on a calendar and stay aware for any symptoms of tick-borne illness for at least 60 days.
- Knowing the tick species and life stage can be helpful. If you would like assistance identifying a tick, please see instructions for e-mailing Holly photos, here:

<https://medical-entomology.inhs.illinois.edu/research/free-tick-identifications/>

- 6) Before shipping, double-check that all ticks collected in the field are in vials with 85% ethanol, each containing a paper label with the date, site name, collector initials and either “drag” or “self” designation written in pencil. Make sure all vial tops are secure.
- 7) For local health department partners, enter sampling metadata into fillable “Tick Submission Form” sent with this guide.
- 8) Mail the form along with the ticks to the INHS Medical Entomology Lab (shipping instructions next page).

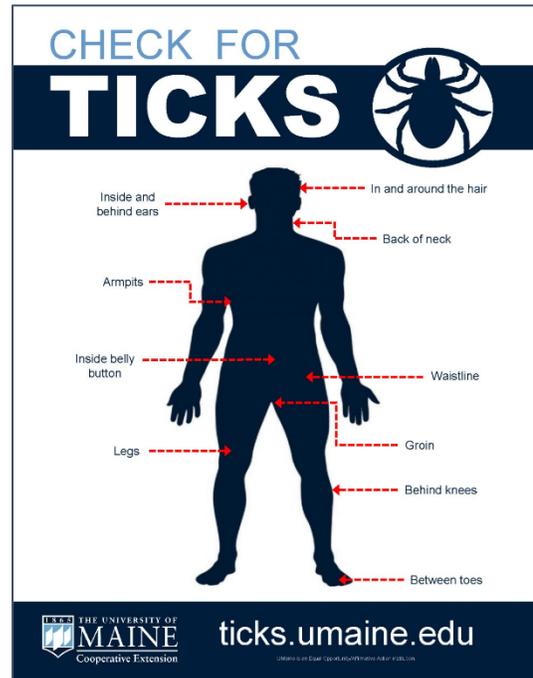


Figure 4. Outstanding tick check diagram from the University of Maine Cooperative Extension Tick Lab

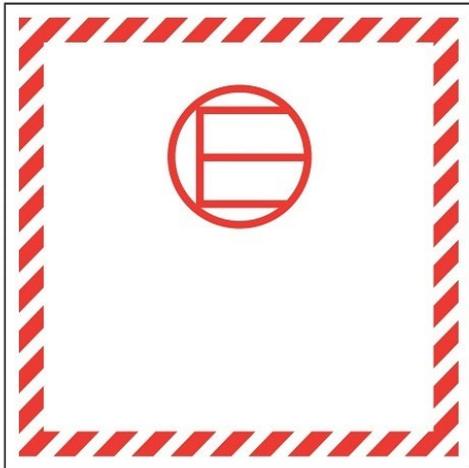
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SHIPPING TICKS IN 85% ETHANOL TO THE INHS MEDICAL ENTOMOLOGY LAB

Ethanol in postal mail is generally considered a “hazardous good”. Natural history specimens (such as ticks for research) are exempt from comprehensive DOT and USPS hazardous goods shipping requirements but must be packed according to them. If the total amount of ethanol to be shipped exceeds 5 liters, split into multiple packages for shipping.

To make a package:

1. Overfill vials with ethanol or pack with tissue before closing them (to minimize the formation of an air bubble and specimen movement in the vial which can damage specimens during shipping).
2. Place vials in a small, sturdy box.
3. Place box inside large Ziploc bag along with some type of absorbent material (in case vials leak during shipping). This may be a small stack of paper towels or similar absorbent material.
4. Place bagged box with absorbent material inside of a second Ziploc bag. Make sure both bags are completely sealed.
5. Place the double bagged box inside of a bubble-wrap lined mailing envelope.
6. If Styrofoam or other packing material is available and there is room in the envelope it may be helpful to insert some around the box to minimize jostling during transit.
7. Seal package and address to: **Illinois Statewide Tick Surveillance Program, c/o Dr. Holly Tuten, INHS Medical Entomology Lab, 1816 S. Oak St., Champaign, IL 61820**
8. Because of shipping restrictions on ethanol, you will need to print out the below label and attach it to the outside of the package (it does NOT have to be printed in color). The UN number for ethanol is 1170 and the class number is 3 - write a large “3” on this label. This will inform workers what hazardous material is in the package. Any further questions should be directed to FedEx at (901) 375-6804 and press 4 to speak to Biohazards.



If you have any questions, please contact Holly Tuten (htuten@illinois.edu)