Ticks and Tick-borne Illnesses of Alabama

Emily Merritt and Dr. Graeme Lockaby
Some Ticks in Alabama

Lone star tick
*Amblyomma americanum*
- Most abundant, woods
- Humans and pets
- Year round, most active spring-fall

Black-legged tick
*Ixodes scapularis*
- AKA “deer tick”
- Common, woods/pine
- Humans and pets
- Active fall-winter

http://tickencounter.org/tick_identification/lone_star_tick#top
http://tickencounter.org/tick_identification/deer_tick#top
Some Ticks in Alabama

American dog tick
*Dermacentor variabilis*
- Common, backyards/woods
- Humans and pets
- Active spring-fall

Gulf Coast tick
*Amblyomma maculatum*
- Common, shrub
- Humans and pets
- Active spring-fall
Some Ticks in Alabama

**Brown dog tick**  
*Rhipicephalus sanguineus*

- Infest homes, animal pens/kennels
  - Controlling infestation difficult
- Prefer dogs, will bite humans
- Active all year

[Image of brown dog tick in different stages: larva, nymph, adult male, and adult female.]
Infected nymphs and adults can transmit during feeding.
Reports have increased
- Greater awareness, better testing
- May continue with climate, habitat change → ticks, hosts, TBDs
- ADPH Lyme endemic Co’s: Calhoun, Chambers, Jefferson, Mobile, Russell, Shelby, Tuscaloosa

AL: Warm winters → Ticks year round → TBDs a constant concern
- Winter hunting, early springs, nice summers → humans active → more tick encounters
Rocky Mountain Spotted Fever

- *Rickettsia rickettsii* and other spp., most commonly reported

- Symptoms a few days to 2 weeks
  - Fever
  - Headache
  - Abdominal or muscle pain
  - Nausea/vomiting
  - Spotted red rash
  - Treated with antibiotics

- Diagnosis difficult → lifelong illness or fatality

- Infects dogs
Lyme Disease – *Borrelia burgdorferi*

- Most commonly reported vector-borne illness in US → ~300,000 cases/yr

- Symptoms a few days to weeks
  - Flu-like: fever, headache, chills
  - Muscle, neck, joint pain
  - Brain fog, depression
  - Expanding red rash, bull’s eye (maybe)
  - Treated with antibiotics

- Diagnosis difficult → lifelong illness/chronic issues

- Infects dogs, horses
Southern Tick-Associated Rash Illness

- STARI - unclear agent, growing problem
- Symptoms within a week
  - Flu-like: fever, headache, fatigue
  - Muscle or joint pain
  - Expanding red rash, bull’s eye (maybe)
  - Treated with antibiotics, not all Docs treat
- Diagnosis difficult → not much known about long-term
- Not reportable, prevalence unknown
Tularemia – *Francisella tularensis*

- Transmitted by ticks or handling infected carcasses (i.e., rabbits)
- Symptoms within 3-5 days
  - Fever, headache, chills, coughing, vomiting, muscle ache
  - Skin ulcers, ~80%
  - May disappear and return
  - Treated with antibiotics
- Fatality can occur
Other Tick-borne Illnesses

Ehrlichiosis – *Ehrlichia* spp.
- Symptoms within 5-10 days
  - Headache, muscle ache, confusion, nausea/vomiting
  - Nonspecific rash, ≤30%
- Lifelong illness or fatality
- Common in Alabama dogs

Anaplasmosis – *Anaplasma phagocytophilium*
- Symptoms within 1-2 weeks
  - Fever, headache, chills, coughing, nausea, abdominal or muscle pain, confusion
  - Rash is rare
- Lifelong illness or fatality

Common in Alabama dogs
Babesiosis – *Babesia divergens*

- Symptoms may or may not present
  - Fever, chills, sweats, headache, muscle ache, confusion, nausea, anemia
  - “Stretch marks” rash
  - Treated with antibiotics
- Lifelong illness or fatality
- Common co-infection
- Infects dogs

Tick paralysis

- Caused by a neurotoxin
- Symptoms within 2-7 days
  - Headache, vomiting, fatigue, loss of muscle function
  - Treatment = remove tick
  - No treatment = death
- Rural children in spring
- Infects dogs
Other Tick-borne Illnesses

- Bartonella
- Alpha-gal/red meat allergy
- Powassan virus
- Q fever
- Boutonneuse fever
- More…
Who is at Risk?

- Hikers
- Campers
- Golfers
- Hunters
- Fishermen
- Gardeners
- Landscapers
- Foresters
- You in your home and backyard!
- Your children!
- Dogs
- Cats
- Horses
- Cattle

Anyone that spends time outdoors for work or play
Keep In Mind…

- Individuals may not develop all symptoms
- Number/combination of symptoms can vary
- Co-infections (having more than one TBD) are possible
- Proper recognition and diagnosis difficult
- Many successfully treated during early stages
- No early diagnosis → treatment difficult, chronic symptoms or death

!!! If you feel sick and tick bite possible, see doctor immediately and insist on treatment !!!
Patient’s Problems

- New problem, little past research, little (but recent) outreach
- “We don’t have that down here. It’s all in your head.”
  - False → scientific and anecdotal evidence
  - AL patients denied testing or treatment
  - Misdiagnosis or improper treatment
    - Unreliable tests → variable sensitivity
    - Due to test timing, genetic markers
  - Many people get very, very sick
From Dr. Ryan McWhorter, Montgomery

“A better test for Lyme disease has made all of the difference in helping several of my patients with their serious illnesses. To learn that Lyme is common and is curable gives them great relief, as they knew all along it wasn’t ‘in their heads.’ Finding answers and then cures has been extremely gratifying...It’s a lot of fun helping those that have been frustrated by current medical misunderstanding. I only wish more physicians had the latest information regarding how Lyme strikes in Alabama.”
Before Going Outside…

- Light-colored, long pants and long-sleeved shirts
- Tuck shirt into pants, tuck pants into socks/boots
- Put long hair in bun or pull up into hat
- Wear close-toed shoes
- ≥20% DEET repellant on skin, clothing
- **Most effective** = 0.5% Permethrin treatment on clothing, gear
Avoid:
- Tall grasses
- Shrubs, brush
- Low lying branches
- Leaf litter/piles
- Rotten logs/stumps
- Stone walls and woodpiles
- Wooded areas and edges
- Lawn adjacent to woods/fields
Immediately After Coming Indoors…

- Examine clothing, gear, pets
  - Ticks ride into home, attach later
- Dryer: high heat 30 min
- Full body check in shower, with partner, or using mirror
  - Check for bumps/scabs
  - Do several days following exposure
  - Make part of daily routine
- Before bed, check sheets, they can wait
Tick Attachment Awareness Dude
Awareness Dude says, “Check…

dark, moist places that bend and fold:

- Hair/scalp
- In and around ears
- Under the arms
- Inside belly button
- Around waist under waistband
- Groin area
- Where bras pull snug to skin
- Inside of thighs
- Around knees, ankles
- In between fingers, toes
For Pets...

- Use brush for checks
  - **Cats**: ears, eyes
  - **Dogs**: face, ears, neck, armpits, thighs, belly, tail, toes
- Look for lethargy/fatigue, arthritis, lameness, fever, change in appetite
- Use tick control products, **year round**

Preventing tick-borne diseases in your pets may also prevent illness in you!
**DO…**

- Remove attached tick with tweezers ASAP

- Longer attachment = increased TBD risk

- Improper removal = increased TBD risk

- Wash, disinfect tweezers and area of attachment

- Dispose of tick:
  - In rubbing alcohol
  - By wrapping in tape, throwing away
  - By flushing down toilet
DO NOT...

- Try to scrape tick off
- Twist or squeeze tick
- Burn tick with hot match while still attached
- Apply substance to tick to kill it while still attached
  - i.e., nail polish remover, nail polish, petroleum jelly, gasoline, soap, etc.
- Touch tick with your fingers
  - Use napkin, tissue, etc.
- Wash tick down drain
Little known about tick/TBD distribution, relationship to wildlife/climate, or TBD infection rates in AL

**Objectives:** Identify vegetation, climatic, and host factors that affect tick and TBD distribution and risk in Alabama

- 3.5-year project...in year 2
- Sample state, university, private lands:
  - Ticks, blood from deer: winter + summer
  - Tick CO$_2$ trapping, flagging: monthly, 1 yr
  - Temperature, relative humidity at forest floor: hourly
  - Trail camera photos of hosts: motion activated
  - Landscape/vegetation survey, foliar and soil analysis: summer ‘16

What Auburn Is Doing

- PCR testing for: Rickettsia spp. Lyme, Ehrlichia spp., STARI
What Auburn Is Doing

- Determine relationship between ticks, TBDs, and wildlife (especially deer=transporter, reservoir)
  - State hunting season, reproductive study deer collections: ‘15 –‘17
    - Tick samples, age, sex, weight, body condition, location
    - Occasional raccoon, coyote, dog, hog collections
- Determine land use change, forest fragmentation effects on ticks/hosts
  - Tick collections, trail cameras, landscape/vegetation survey
- Assess hunter/angler knowledge, experiences related to ticks/TBDs, and estimate economic impact of TBDs in AL
  - Email Qualtrics survey to 10,000 license holders
CO$_2$ trap sites
WMA hunter check stations
Reproductive study counties
Preliminary Results – CO₂ Trapping/Flagging

Monthly Trap Collections:
- American dog, 148
- Blacklegged, 81
- Lone star, 891
- Winter, 0
- Gulf coast, 136

Graph showing trap collections for all sites, 2016-2017:
- Adults
- Nymphs
- Larvae

Graph notes:
- May 2016: 700
- June 2016: 650
- July 2016: 600
- August 2016: 550
- September 2016: 500
- October 2016: 450
- November 2016: 400
- December 2016: 350
- January 2017: 300
- February 2017: 250
- March 2017: 200
- April 2017: 150
- May 2017: 100

Graph indicates seasonal trends and peak collection times.
Preliminary Results – CO$_2$ Trapping/Flagging
Preliminary Results – Pathogen Screening

- ~75% of ticks tested up to December ‘16, no Lyme – remainder in progress
  - *Ehrlichia chaffensis*: causes human monocytic ehrlichiosis
  - *E. ewingii*: emerging pathogen, not yet reportable, causes illness
  - *Rickettsia rickettsia*: causes Rocky Mountain spotted fever
  - *R. parkeri*: emerging pathogen, causes illness
  - *R. amblyommii*: emerging pathogen, role uncertain, possibly symbiont or infectious

- Currently, nothing found in American dog or blacklegged ticks
# Preliminary Results – Pathogen Screening

- Lone star Minimum Infection Rate (\# pos. indivs or pools ÷ total tested):

<table>
<thead>
<tr>
<th>Location</th>
<th>E. chaffeensis</th>
<th>E. ewingii</th>
<th>R. rickettsii</th>
<th>R. parkeri</th>
<th>R. amblyommii</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fayette</td>
<td>0.37%</td>
<td>0.18%</td>
<td></td>
<td></td>
<td>24.64%**</td>
</tr>
<tr>
<td>Camp Hill</td>
<td>0%*</td>
<td>1.71%</td>
<td></td>
<td></td>
<td>30.77%*</td>
</tr>
<tr>
<td>Auburn</td>
<td>0.30%*</td>
<td>0.60%</td>
<td></td>
<td></td>
<td>22.39%*</td>
</tr>
<tr>
<td>Selma</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
<td>16.53%**</td>
</tr>
<tr>
<td>Camden</td>
<td>1.03%</td>
<td>0%</td>
<td></td>
<td></td>
<td>22.68%*</td>
</tr>
<tr>
<td>Clayton</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
<td>16.67%*</td>
</tr>
<tr>
<td>Fairhope</td>
<td>2.56%*</td>
<td>0%</td>
<td></td>
<td></td>
<td>48.72%*</td>
</tr>
<tr>
<td>All sites</td>
<td>0.61%</td>
<td>0.36%</td>
<td></td>
<td></td>
<td>26.06%</td>
</tr>
</tbody>
</table>

*Cases reported in county, ADPH 2007-2015
Preliminary Results – Pathogen Screening

- Gulf coast MIR (# pos. indivs or pools ÷ total tested):

<table>
<thead>
<tr>
<th>Location</th>
<th>E. chaffeensis</th>
<th>E. ewingii</th>
<th>R. rickettsii</th>
<th>R. parkeri</th>
<th>R. amblyommii</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fayette</td>
<td></td>
<td>**</td>
<td></td>
<td>16.67%**</td>
<td>0%**</td>
</tr>
<tr>
<td>Camp Hill</td>
<td></td>
<td>*</td>
<td></td>
<td>N/A*</td>
<td>N/A*</td>
</tr>
<tr>
<td>Auburn</td>
<td></td>
<td>*</td>
<td></td>
<td>0%*</td>
<td>33.33%*</td>
</tr>
<tr>
<td>Selma</td>
<td></td>
<td>*</td>
<td></td>
<td>23.68%**</td>
<td>5.26%**</td>
</tr>
<tr>
<td>Camden</td>
<td></td>
<td>*</td>
<td></td>
<td>14.29%*</td>
<td>0%*</td>
</tr>
<tr>
<td>Clayton</td>
<td></td>
<td>*</td>
<td></td>
<td>35.71%*</td>
<td>0%*</td>
</tr>
<tr>
<td>Fairhope</td>
<td></td>
<td>*</td>
<td></td>
<td>N/A*</td>
<td>N/A*</td>
</tr>
<tr>
<td>All sites</td>
<td></td>
<td></td>
<td></td>
<td>18.07%</td>
<td>7.72%</td>
</tr>
</tbody>
</table>

*Cases reported in county, ADPH 2007-2015
Preliminary Results – Photos of Wildlife

- Complete results pending
- Captured predators, rodents, birds, pets, game
- No apparent trends by location

![Species Richness and Frequency by Cover Type](image)

Photo source: Emily Merritt
### Preliminary Results – State Deer Collections

<table>
<thead>
<tr>
<th>ADCNR Deer</th>
<th>Summer ’15</th>
<th>Winter ‘15/’16</th>
<th>Summer ’16</th>
<th>Winter ‘16/’17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ticks</td>
<td>141</td>
<td>1,848</td>
<td>337</td>
<td>1,454</td>
</tr>
<tr>
<td>Deer</td>
<td>24</td>
<td>412</td>
<td>65</td>
<td>397</td>
</tr>
<tr>
<td>Counties/WMAs</td>
<td>6</td>
<td>11</td>
<td>9</td>
<td>12</td>
</tr>
</tbody>
</table>

#### Summer Collections
- Blacklegged
- Gulf Coast
- Winter
- American dog

#### Winter Collections
- American dog
- Gulf Coast
- Winter
- Lone star

- Lone star

- Blacklegged
Preliminary Results - Survey

- Most “moderately knowledgeable” about Lyme disease, “slightly knowledgeable” about Rickettsiosis, and “not knowledgeable at all” about ehrlichiosis, STARI, tularemia, or the alpha-gal allergy

- Most never use Permethrin to treat clothing/gear

- 54% pull attached ticks off with fingers or by burning off with match (25%)

- 6% have or had a TBD → sick at 38 yrs, recovery took 1.72 yrs
  - Suffer from “mild or residual symptoms” (14%) or “long term or chronic illness” (12%)
  - While seeking diagnosis, spent $2,467 out-of-pocket and $332 in transportation costs, on average
  - 45% took time off work/school because of TBD
Have you found at least one tick attached to you in the last year (12 months)?

- Yes
- No
Next Steps

 Summer 2017 reproductive study tick collections
 In-depth game camera data analysis
 Tick-borne illness testing and results
 In-depth survey analysis and economic impact estimation
 In-depth tick and deer data analysis, distribution mapping, and predictive modeling
Products

- Factors affecting distribution and risk in relation to humans, wildlife, environment
- Hotspot maps → locations, densities of ticks/TBDs
- Predictive model for disease risk as a function of geographic region, short-term climate, hosts, extent/distribution of forests, etc.
- Identify outreach need, estimate TBD economic impact in State
- Public outreach → events, seminars, publications, radio shows
Many Thanks To…

Center for Environmental Studies at the Urban-Rural Interface

U.S. Forest Service

Alabama Department of Conservation and Natural Resources

Alabama Agricultural Experiment Station
Contact Information

Emily Merritt
Research Associate
School of Forestry and Wildlife Sciences
Auburn University
ezm0017@auburn.edu
334-750-6308
Thank You!