Tick-borne Illnesses of Alabama: Relationships among Hosts, Habitats, and Ticks throughout the State

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Some Ticks in the Southeast

Lone star tick
Amblyomma americanum

Black-legged tick
Ixodes scapularis

American dog tick
Dermacentor variabilis

Gulf Coast tick
Amblyomma maculatum
Some Tick-borne Illnesses

- Rocky Mountain Spotted Fever, etc.
- Lyme disease, STARI
- Tularemia
- Ehrlichiosis
- Anaplasmosis
- Babesiosis
- Tick paralysis
- Alpha-gal/red meat allergy
- Powassan virus
- More…

Infected ticks can transmit during feeding
Reports have increased in US and Southeast
- Greater awareness, better testing
- May continue with climate, habitat change → hosts, ticks, TBIs

Southeast: Warm winters → Ticks year round → TBIs a constant concern
- Winter hunting, early springs, mild summers → humans active → more tick encounters
Little known about tick/TBI distribution or relationship to wildlife/climate

**Objective**: Identify land use, climatic, and wildlife effects on tick/TBI distribution and risk in Alabama → broad- and fine-scales

- 3.5 year project...1 year left
- Sample state, university, private lands:
  - Ticks from deer: winters + summers
  - Tick CO$_2$ trapping, flagging: monthly, 1 yr
  - Temperature, 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
Many Thanks To…

Alabama Department of Conservation and Natural Resources
U.S. Forest Service
Alabama Agricultural Experiment Station
Center for Environmental Studies at the Urban-Rural Interface
Overview

From summer 2015 - 2017 (ongoing):

- 9,786 ticks, CO$_2$ trap & wildlife
  - 1,248 traps
  - 745 white-tailed deer
  - 51 raccoons
  - 19 feral hogs
- 34 AL counties (51%)
Monthly Tick Trapping

- CO$_2$ trap sites, 105 plots
Preliminary Results – Tick Trapping

<table>
<thead>
<tr>
<th>Adults</th>
<th>Nymphs</th>
<th>Larvae</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,257</td>
<td>2,006</td>
<td>2,226</td>
<td>5,489</td>
</tr>
</tbody>
</table>

Trap Collections - Adults

Deciduous: 11%
Coniferous: 4%
Shrub: 0%
Pasture: 1%
Residential: 3%
Preliminary Results – Pathogen Screening

- ~75% tested up to December ’16, Lyme and remainders in progress
- Currently, nothing in American dog (Ixodes scapularis) or blacklegged (Ixodes pacificus) ticks
- Minimum infection rates (# pos. indivs or pools ÷ total tested), all sites:

<table>
<thead>
<tr>
<th>Tick</th>
<th>E. chaffeensis</th>
<th>E. ewingii</th>
<th>R. parkeri</th>
<th>R. amblyommii</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lone star</td>
<td>0.61% (0–2.56%)</td>
<td>0.36% (0–1.71%)</td>
<td></td>
<td>26.06% (16.53–48.72%)</td>
</tr>
<tr>
<td>Gulf coast</td>
<td></td>
<td></td>
<td>18.07% (0–35.71%)</td>
<td>7.72% (0–33.33%)</td>
</tr>
</tbody>
</table>
Preliminary Results – Habitat Analysis

- Negative binomial regression with zero-inflated model, all sites

**Variables Considered**
- Average temperature, month
- Minimum temperature, month
- Maximum temperature, month
- Range temperature, month
- Average humidity, month
- Minimum humidity, month
- Maximum humidity, month
- Median humidity, month
- Range humidity, month
- Forest floor depth
- Forest floor weight
- Forest floor moisture
- Soil-sand
- Soil-clay
- Soil-pH
- Soil-base saturation

**Adult Females-All Sites**
- Minimum temp.
- Range temp.
- Range humidity
- Soil-sand
- Soil-clay

**Adult Males-All Sites**
- Minimum temp.
- Range temp.
- Minimum humidity
- Range humidity
- FF depth
- FF weight
- Soil-sand

**Nymphs-All Sites**
- Minimum temp.
- Range temp.
- Minimum humidity
- Range humidity
- FF depth
- FF weight
- Soil-sand
Wildlife Sampling

- WMA hunter check stations, 12
- Deer reproductive study co’s, 17
- Raccoon collection co’s, 8
- Feral hog collection co’s, 3

Source: E. Meritt, ESRI ArcMap 10.2, 10/2017
Preliminary Results – Wildlife Sampling

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Deer</td>
<td>119</td>
<td>626</td>
</tr>
<tr>
<td>Ticks</td>
<td>744</td>
<td>3,302</td>
</tr>
<tr>
<td>Counties/WMAs*</td>
<td>6, 9, 11</td>
<td>11*, 12*</td>
</tr>
<tr>
<td>Infestation</td>
<td>~6 per deer</td>
<td>~5 per deer</td>
</tr>
</tbody>
</table>

Summer ‘16
- 19 hogs
- 91 ticks
~5 each

Winter ‘16/’17
- 51 raccoons
- 145 ticks
~3 each
Next Steps

- Evaluation of tick infestation ~ deer health, age, weight, sex
- In-depth game camera data analysis → host associations
- Further pathogen testing → distribution, risk, host effects
- In-depth tick data analysis
  - By physiographic region, land use type, within sites
  - Foliar, vegetation structure, weekly temp/humidity, TBI data
- Tick/TBI distribution mapping, predictive modeling
Factors affecting distribution and risk ~ environment, wildlife, humans

Hotspot maps → locations, densities of ticks/TBIs

Predictive model: disease risk ~ hosts, physiographic region, short-term climate, extent/distribution of forests, etc.

Identify outreach need, estimate TBI economic impact in State

Public outreach → seminars, radio shows, publications
Thank You!