Looking Out For Lyme: Identifying Areas of Disease Risk in Ohio

Lyme Disease in the United States

Lyme disease is a zoonotic tick-borne disease, commonly characterized by a bullseye-shaped skin rash. This disease was first described in the 1970s in the United States, and in the early 1980s it was linked to *Borrelia burgdorferi*, the blacklegged tick or deer tick. The tick acts as a vector for the causative agent; a bacterium called *Borrelia burgdorferi* that is transmitted when an infected tick bites a suitable host. The CDC estimates that more than 300,000 new human cases occur each year, concentrated in the Northeast and Upper Midwest states.

Currently, a vaccine against Lyme disease exists for dogs but there is no vaccine for humans.

In order to understand the persistence and growing number of cases of Lyme disease each year, the life cycle of blacklegged ticks must be understood. Adult blacklegged ticks lay eggs in the spring that hatch in the summer. These larval ticks must find a meal—typically birds or small mammals such as white-footed mice (*Peromyscus leucopus*). White-footed mice are considered the principal reservoir for Lyme disease, meaning they can be natural carriers of the disease-causing bacteria. Ticks become infected when they feed on an infected individual. In the spring, the nymphal ticks search for a second blood meal. Finally in the fall, the nymphs become adults that seek larger hosts, such as white-tailed deer (*Odocoileus virginianus*).

Occasionally, humans become the unlucky host for nymph or adult ticks. Because of their small size, nymphal ticks often go unnoticed when attached to a human.

Alexandra Lombard
M.S. in Conservation Medicine Candidate
GIS for Conservation Medicine
December 2017

THANK YOU to Carolyn Talmage for her wealth of knowledge and continued support throughout this project. Many thanks also to Clint McCoy from the Ohio Division of Wildlife for deer harvest data.

Lyme Disease Risk Analysis

Ohio has seen very few cases of reported Lyme disease compared to neighboring Pennsylvania, though the number grows each year. In 2010, 44 cases were reported compared to 2015’s 34 reported cases. These numbers will likely continue to grow, and about half of the counties in Ohio have already seen an increase in the reported number of Lyme disease cases from 2010-2015.

The purpose of this analysis was to determine areas in Ohio that are at most risk for Lyme disease. There are many factors that contribute to the spread of Lyme disease, including increased blacklegged tick habitat, white-tailed deer density, white-footed mouse density, and human population density. Climate change may be a factor driving the increase in suitable habitat for blacklegged ticks as temperatures rise and they may allow the ticks to spread northward and remain active for a longer period of time.

Unfortunately, due to data limitations, climate changes were unable to be incorporated into this analysis. The final risk analysis shows that the Appalachian Plateau region of eastern Ohio is at the greatest risk for Lyme disease, while the northwestern part of the state has very little risk.

What does this mean for you?

Lyme disease is one of many tick-borne diseases. Take necessary precautions when outdoors to avoid tick bites. Use insect repellent and thoroughly check for the presence of ticks on your clothing and body. For pets, be sure to regularly use tick prevention. Consider vaccinating your dog for Lyme disease, especially if you live in

Methods

A risk analysis was performed by converting each factor layer into a raster and ranking the values from 1-5 (5 being the highest risk). Raster calculator was used to develop a final risk map incorporating each of the four factors.

<table>
<thead>
<tr>
<th>ANALYSIS FACTORS</th>
<th>RISK SCORE 1 (Lowest Risk)</th>
<th>RISK SCORE 2</th>
<th>RISK SCORE 3</th>
<th>RISK SCORE 4</th>
<th>RISK SCORE 5 (Highest Risk)</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>White-tailed deer density</td>
<td>0-2</td>
<td>3-4</td>
<td>4-6</td>
<td>6-8</td>
<td>8-12</td>
<td>30%</td>
</tr>
<tr>
<td>Blacklegged tick range</td>
<td>&gt;50</td>
<td>25-50</td>
<td>10-25</td>
<td>5-10</td>
<td>Within5</td>
<td>20%</td>
</tr>
<tr>
<td>White-footed mouse habitat</td>
<td>Water, Perennial line/ Swamplands, Wetlands</td>
<td>Developed (Open Space and Low Intensity)</td>
<td>Developed (Medium and High Intensity)</td>
<td>Barren Land</td>
<td>Open Space and Low Intensity, Pasture, Scrub</td>
<td>30%</td>
</tr>
<tr>
<td>Human population density</td>
<td>0-1,000</td>
<td>1,001-3,000</td>
<td>3,001-10,000</td>
<td>10,001-20,000</td>
<td>20,001-40,000</td>
<td>20%</td>
</tr>
</tbody>
</table>

White-tailed Deer Density

White-footed Mouse Habitat

Blacklegged Tick Range

Human Population Density

Areas of greater deer density (evaluated based on number of bucks harvested per square mile) are likely to have a greater number of blacklegged ticks as they are a suitable host for the adult ticks. The possibility for increased presence of ticks means increased risk for Lyme disease.

Suitable habitat for white-footed mice was determined based on land cover. White-footed mice prefer dry, forested areas, but can adapt to live in various other habitats. Due to their ability to be a reservoir for Lyme disease, areas with suitable habitat are more likely at risk.

The range of blacklegged ticks spans from the southwest corner of Ohio to the northeast corner. Much of this region is considered the Appalachian Plateau, as depicted by the higher elevations. Areas within the range are most at risk for Lyme disease, and the risk decreases further from the range.

Human population density was obtained from the 2010 U.S. census and is based on the number of people per square mile in each block group. For larger towns and cities, areas of higher density have a greater chance of coming in contact with an infected tick and therefore are most at risk.

Data Sources: U.S. Census, ESRI, CDC, Ohio Division of Wildlife
Projection: NAD 1983 State Plane Ohio North FIPS 3401