STRATEGIC CONSERVATION THROUGH GREEN INFRASTRUCTURE PLANNING

Implications for Lyme disease

Matt Nicholson, PhD, EPA Region 3
A Changing Landscape

- Since European settlement we have lost more than 50% of our wetland acreage.
- Since 1992 Region 3 has lost approximately 80,000 acres of forest annually.
- Projecting to 2020, we will have lost over 2 million acres of forest and 150,000 acres of wetland.
- Developed land area is projected to increase to 5.2 million acres from 2.9 million acres.
Ecological Impacts of Landscape Change

- Degradation remaining natural landscape components:
  - fragmentation of forests,
  - encroachment into riparian buffers,
  - air quality impacts leading to further natural loss

- Loss of ecosystem services
  - carbon and nutrient cycling,
  - sediment trapping,
  - biodiversity,
  - flood mitigation, etc.
Economic and Social Impacts of Landscape Change

- Loss of Services Provided by Natural Systems = Increased Costs for Services to Dispersed Development
- Loss of Productive Farm and Forest Land, tourism revenue
- Decreased Sense of Community: “Anywhere USA”
- Human Health; Quality of Life
Epiphanies lead to new approaches!

Headline: We are discovering polluted streams faster than we can clean them!

Region III Rivers and Streams Trend Analysis

Graph showing the increase in miles of waters impaired by pollutants and the completion of TMDLs and delisting of 303(d) impaired waters over the years 1998 to 2006.
State Green Infrastructure Efforts

- Highlands
- State Boundary
- DE Green_Infrastructure
- VaNLA_Cores_Lite
- Ecological Integrity
  - C1: Outstanding
  - C2: Very High
  - C3: High
  - C4: Moderate
  - C5: General
- MD Hubs
  - Rank
  - Best
- MD Corridors
  - Rank
  - Best
  - General
Green Infrastructure

“Strategically planned and managed networks of natural lands, working landscapes and other open spaces that conserve ecosystem values & functions and provide associated benefits to human populations.”
FROM THE DIRECTOR OF HELLBOUND: HELLRAISER II

TICKS

SOMETHING HUNGRY IS ABOUT TO HATCH.

ROSALIND ALLEN AMI DOLenz PETER SCOLARI
Lyme Disease Risk and Land Conservation
Year One
Spring    Summer    Autumn    Winter

Year Two
Spring    Summer    Autumn    Winter

eggs

larvae

nymphs

adults

Meal 1

Meal 2

Meal 3

Adults mate, produce eggs & die
Potential Human Risk Factors

• **Entomological Risk**
  + Density of nymphal *I. scapularis*
  + Infection of tick populations with *B. burgdorferi*

• **Ecological Risk**
  + Habitat composition
  + Distance to “conducive tick habitat” edges
  + Landscape structure
What about Scale?

1 m  100s m  1000s m  ?
SEASONAL PATTERN OF LYME DISEASE RISK

HIGH

LOW

Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec

SEASONAL ACTIVITY OF DEER TICK LIFE STAGES
Sampling Locations

- Type of Habitat
- Amount of Habitat
- Accessibility of Habitat
Tick Abundance

- No ticks observed
- < 10 nymphs / hr
- 10 - 50 nymphs / hr
- > 50 nymphs / hr
1993

Nymphal Deer Tick Densities

Low
Moderate
High
Nymphal Deer Tick Densities

Low  Moderate  High
Distribution of Lyme Disease

Lyme Disease Cases

Control Population
## Logistic Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter estimate</th>
<th>S.E.</th>
<th>Wald $\chi^2$</th>
<th>$P$</th>
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<tbody>
<tr>
<td>Interceptor</td>
<td>-0.61</td>
<td>0.33</td>
<td>3.4</td>
<td>0.064</td>
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<tr>
<td>Nymphs per hour</td>
<td>0.0068</td>
<td>0.00087</td>
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<td>Distance to roads (km)</td>
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<tr>
<td>Distance to coast (km)</td>
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<td>Total edge (km)</td>
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<td>Urban/Built-up</td>
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<td>0.31</td>
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<td>Agriculture</td>
<td>1.14</td>
<td>0.69</td>
<td>2.7</td>
<td>0.097</td>
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<td>Brush Land</td>
<td>-4.24</td>
<td>1.90</td>
<td>5.0</td>
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</table>

concordant responses = 84.6%
Sensitivity = 75.3% , Specificity = 80.0%
Lyme Disease Risk
Green Infrastructure Approach
Providing Strategic “Context”

Source: Green Infrastructure Center
Implications

<table>
<thead>
<tr>
<th>Variable</th>
<th>To Reduce Lyme Disease Risk</th>
<th>Goals of GI PLANING</th>
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<tr>
<td>Nymphs per hour</td>
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<tr>
<td>Distance to roads (km)</td>
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<tr>
<td>Urban/Built-up</td>
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<tr>
<td>Total edge (km)</td>
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<td>yes</td>
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</tbody>
</table>
Lyme Disease Risk and Land Conservation
Projecting the Future

Laura Jackson, U. S. EPA
Peter Claggett, U.S.G.S.
Conclusions

- The Goal of the Green Infrastructure approach is to strategically plan for conservation across a landscape.
- Ticks populations are synchronous at large scales suggesting management should be done at the landscape scale.
- Managing for Green Infrastructure appears to be compatible with managing to reduce Lyme disease risk.
- How do we plan Green Infrastructure to specifically reduce risk?
ASK ME ABOUT MAGICoP