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.

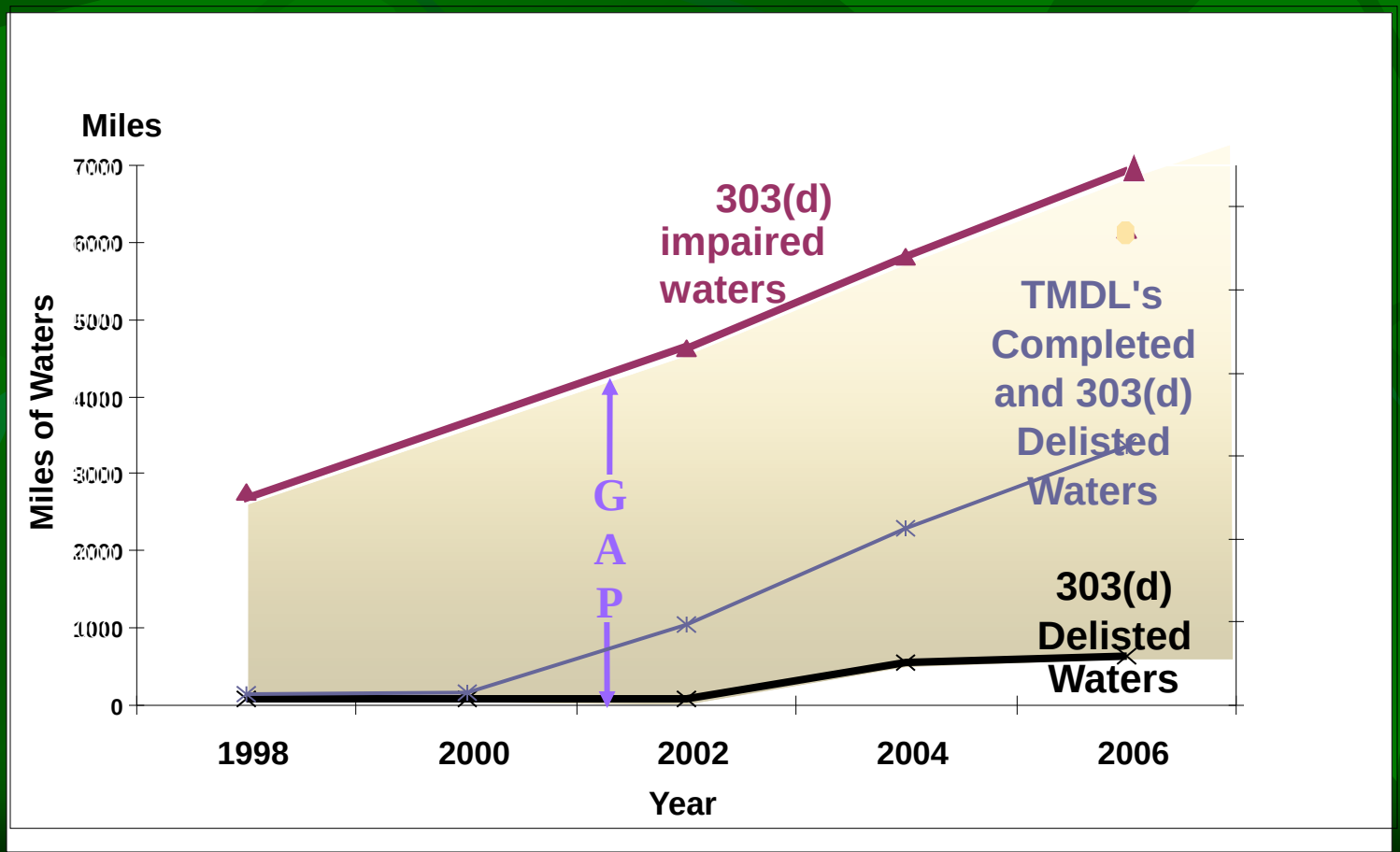
Economic and Social Impacts of Landscape Change

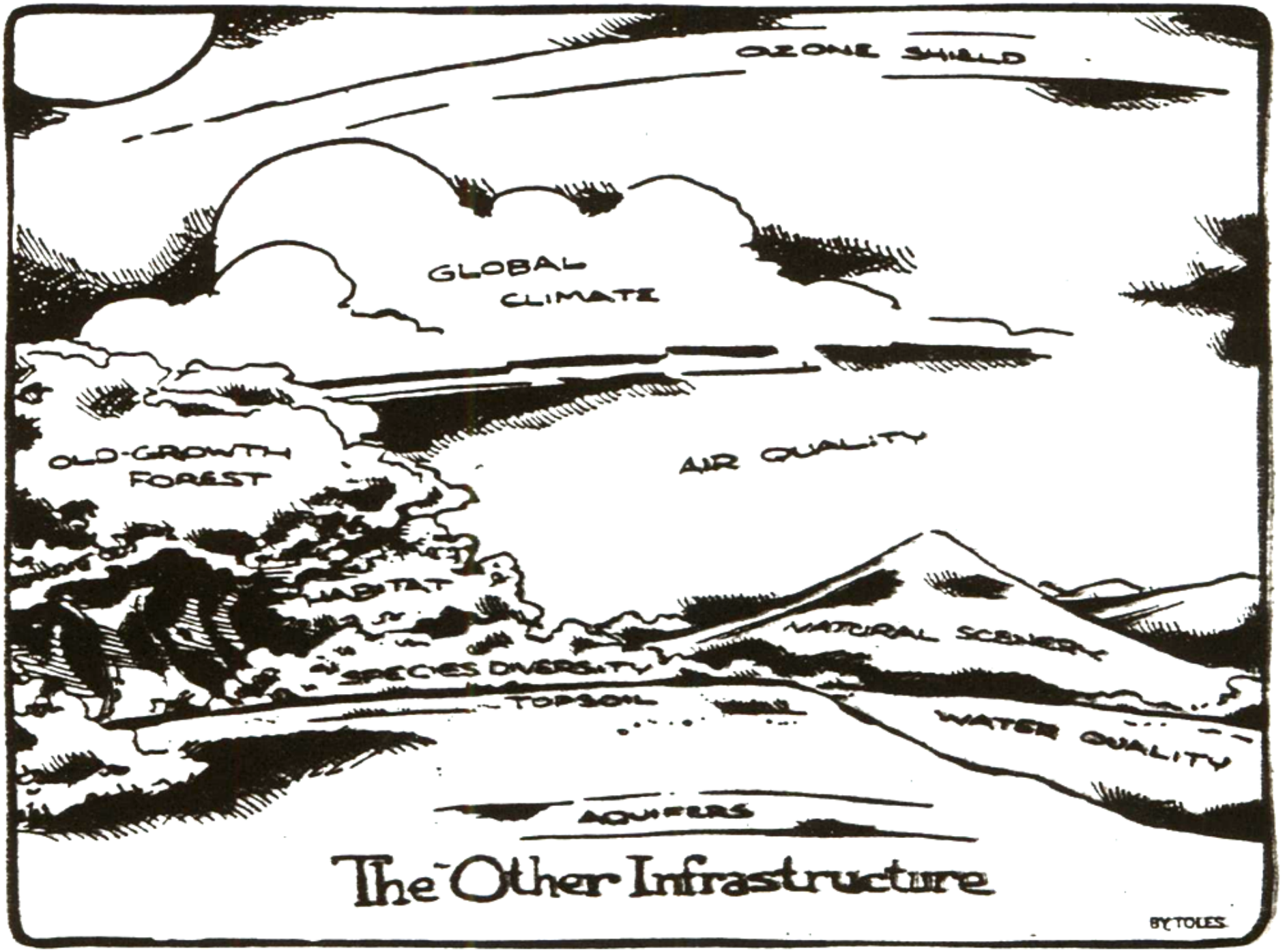
- Loss of Services Provided by Natural Systems = Increased Costs for Services to Dispersed Development
- Loss of Productive Farm and Forest Land, tourism revenue
- Decreased Sense of Community: “Anywhere USA”
- Human Health; Quality of Life

Epiphanies lead to new approaches!

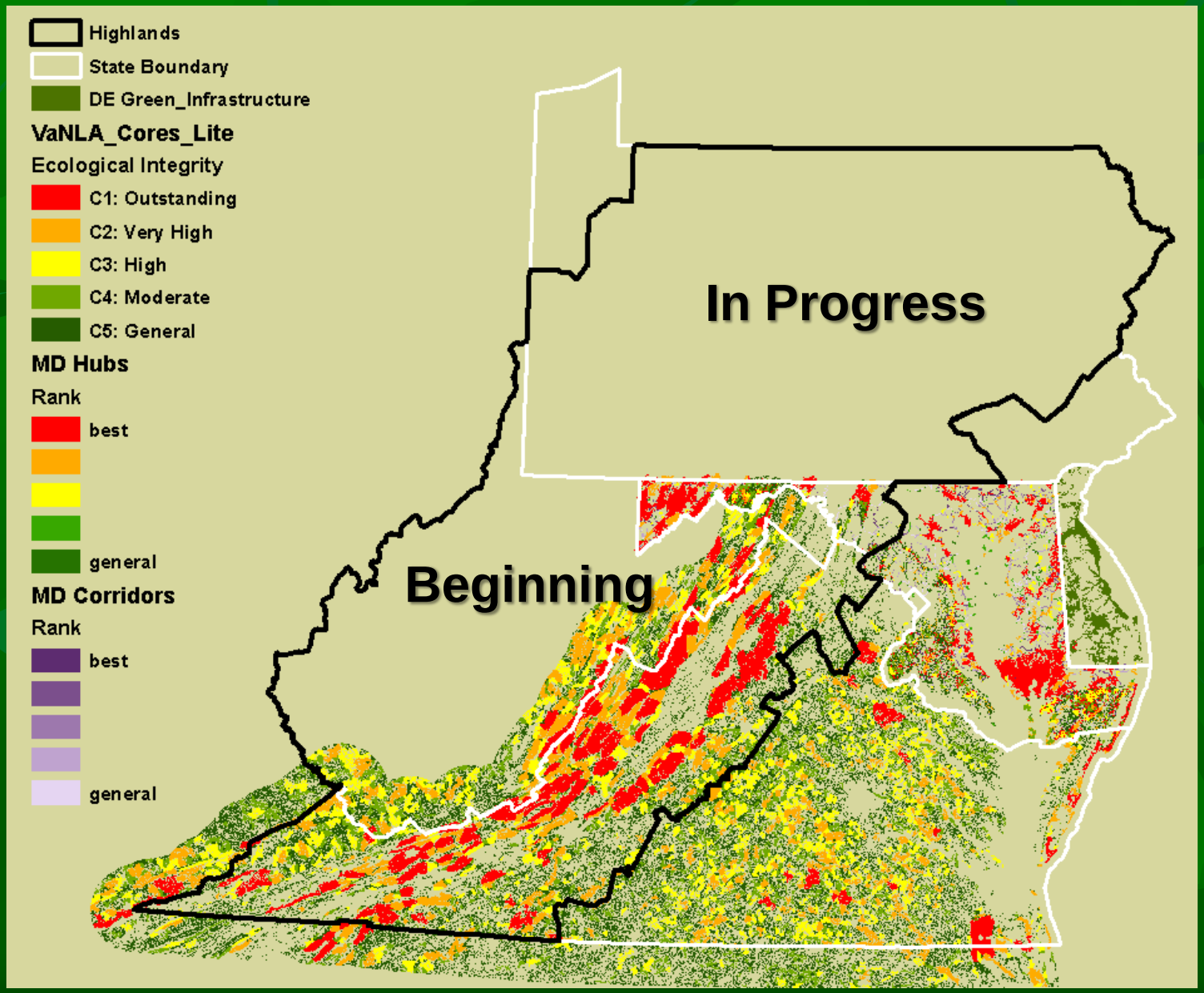
Headline: We are discovering polluted streams faster than we can clean them!

Region III Rivers and Streams Trend Analysis




OZONE SHIELD
GLOBAL CLIMATE
OLD-GROWTH FOREST
AIR QUALITY
HABITAT
NATURAL SCENERY
SPECIES DIVERSITY
TOPSOIL
WATER QUALITY
AQUIFERS
The Other Infrastructure
BY TOLES

State Green Infrastructure Efforts



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
ROSALIND ALLEN
AMI DOLENZ
IN
PETER SCOLARI
TICKS
SOMETHING
HUNGRY
IS ABOUT
TO HATCH.
REPUBLIC PICTURES

Lyme Disease Risk and Land Conservation

Year One **Year Two**

Spring Summer Autumn Winter Spring Summer Autumn Winter

eggs

larvae

nymphs

adults

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?

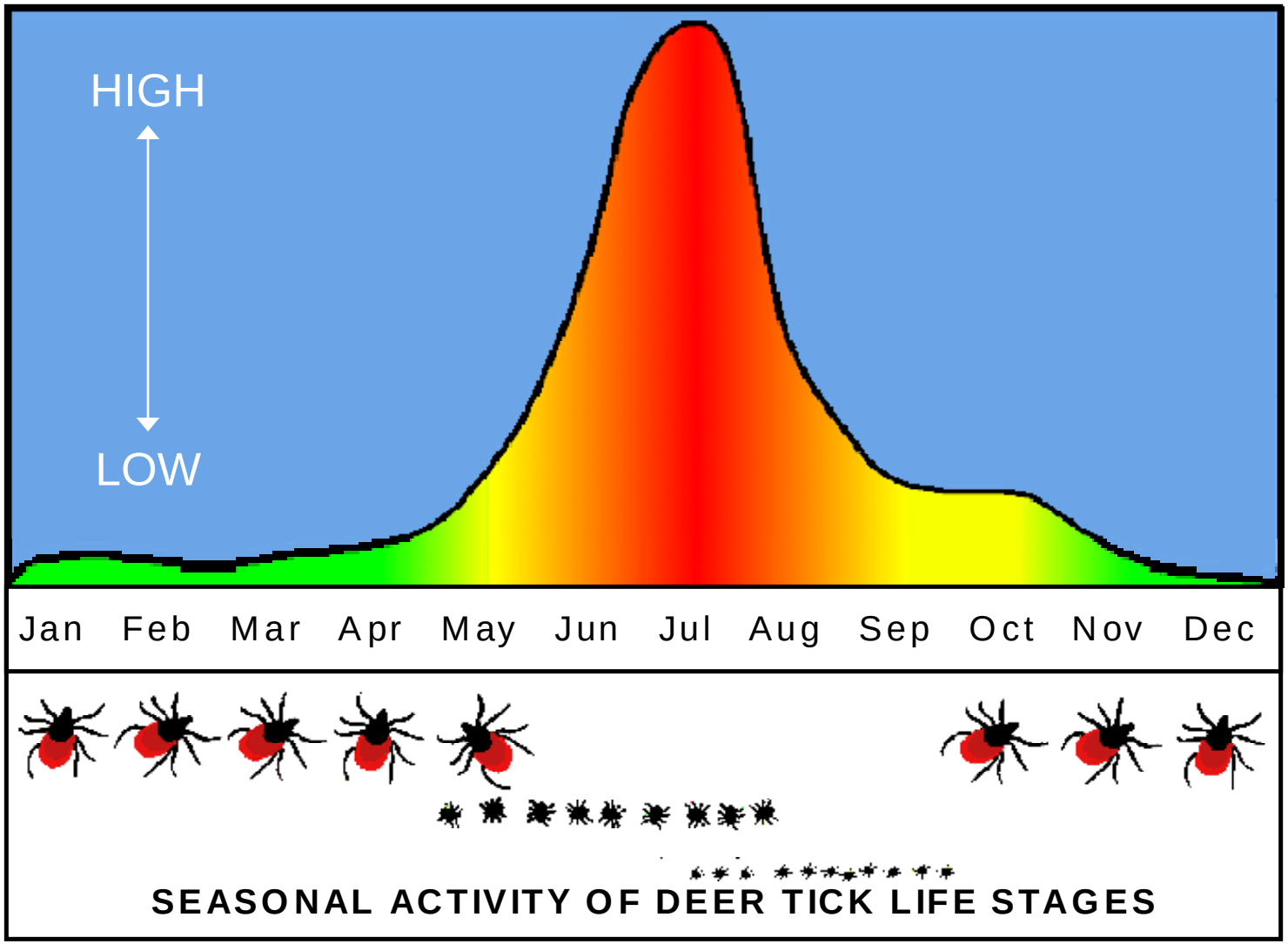
1 m

100s m

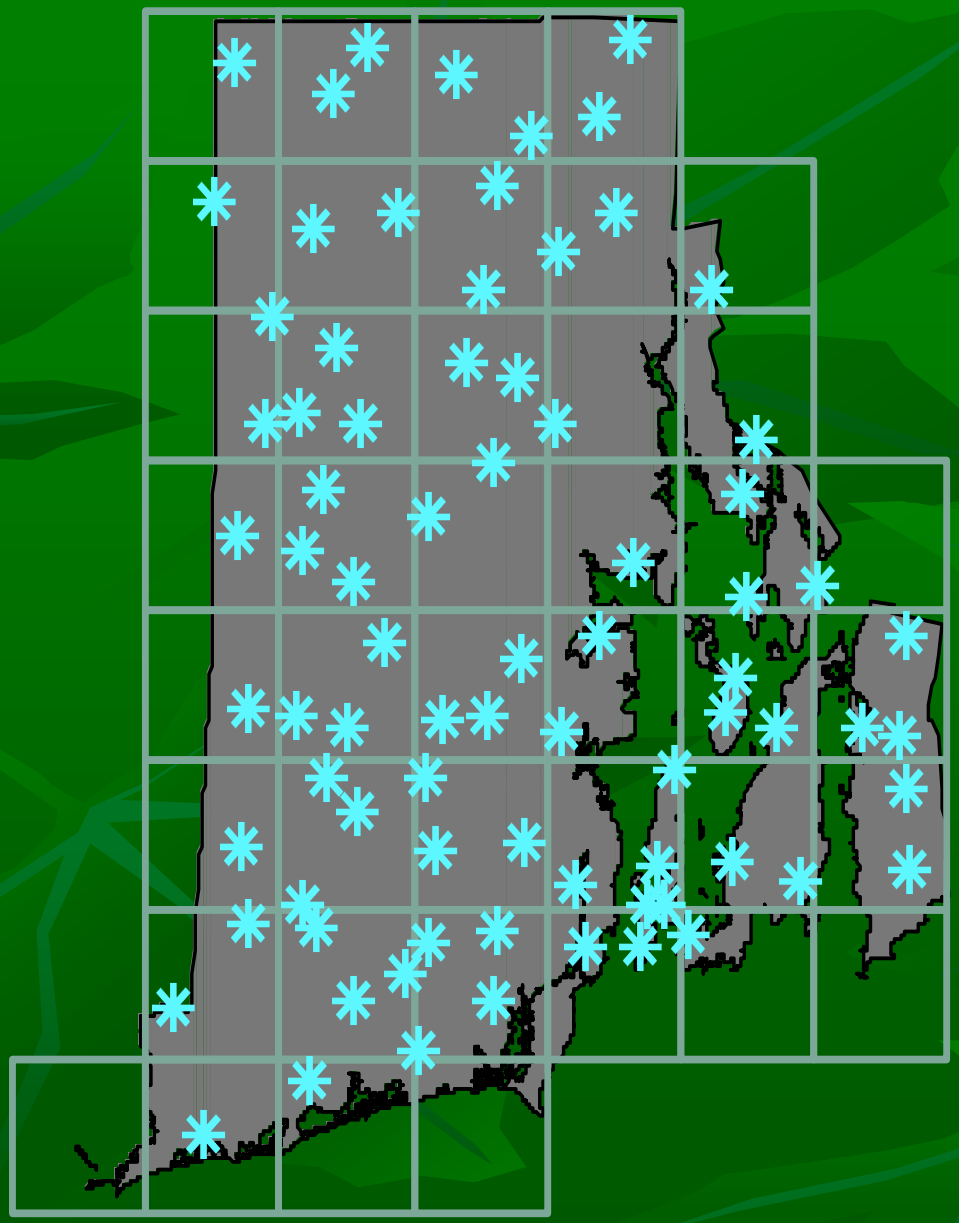
1000s m

?

SEASONAL PATTERN OF LYME DISEASE RISK

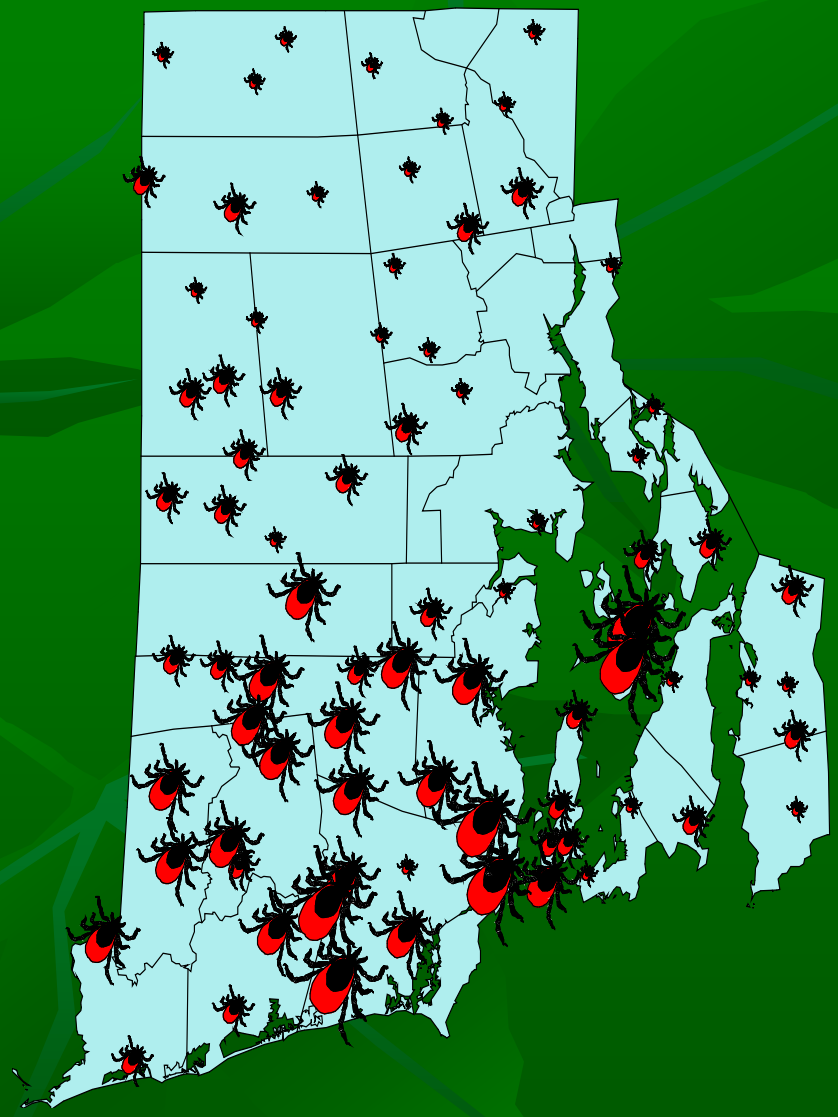


SEASONAL ACTIVITY OF DEER TICK LIFE STAGES



Sampling Locations

- Type of Habitat
- Amount of Habitat
- Accessibility of Habitat



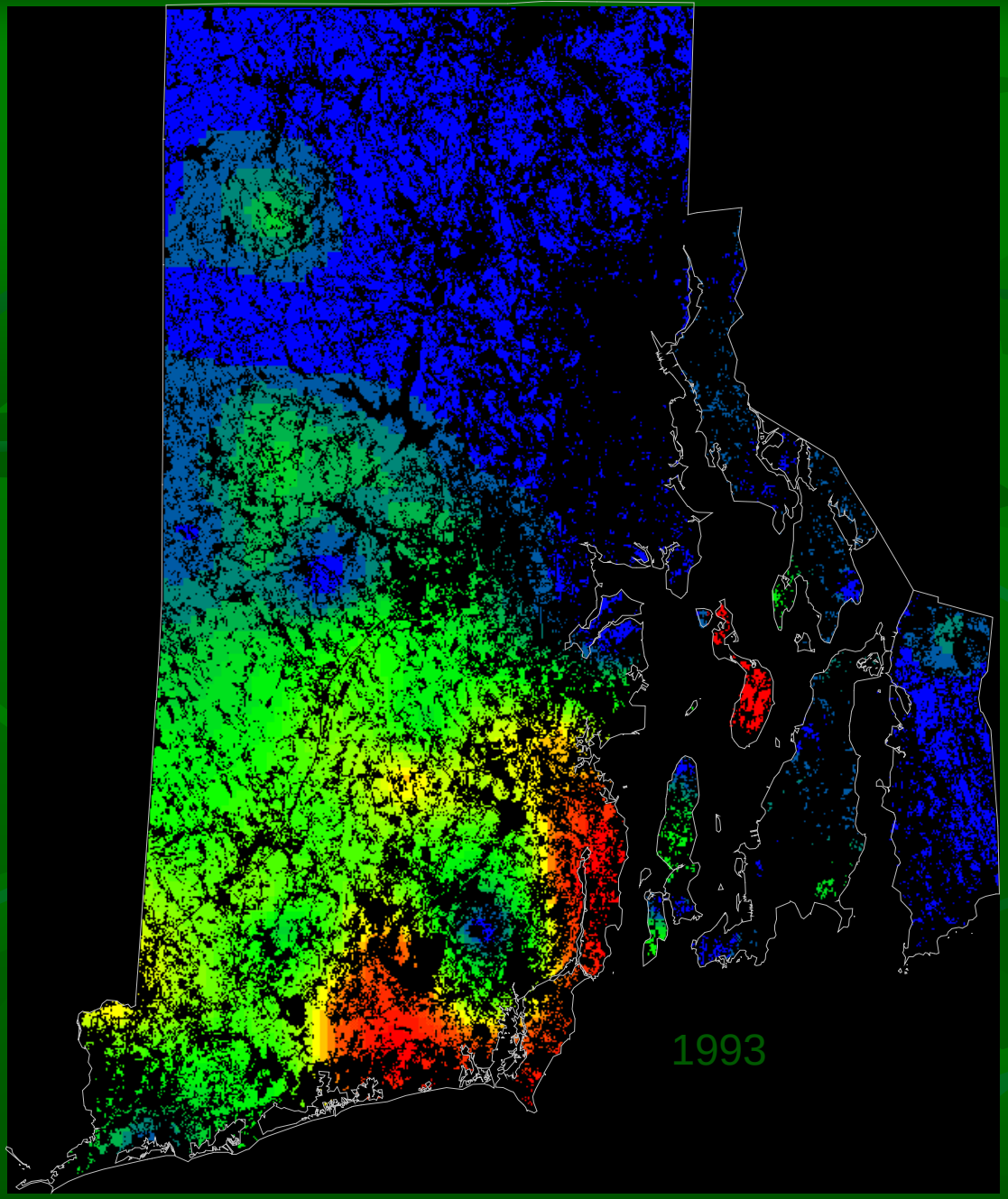
Tick Abundance

No ticks observed

< 10 nymphs / hr

10 - 50 nymphs / hr

> 50 nymphs / hr

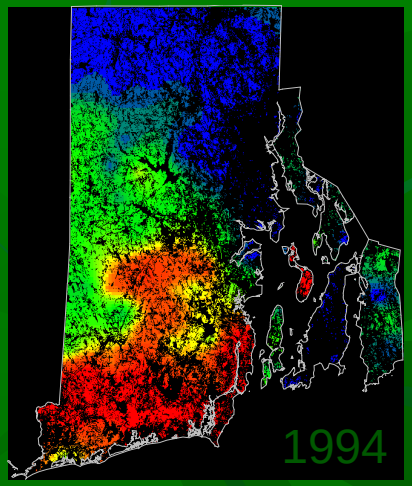


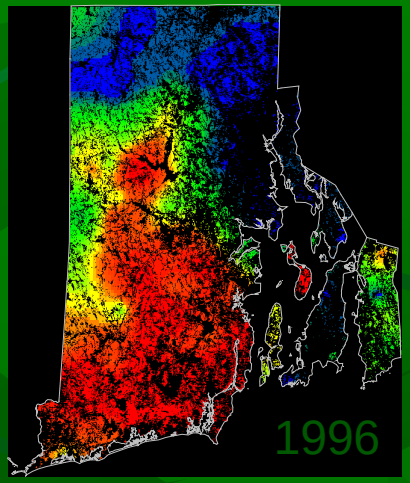
Nymphal Deer Tick Densities

Low

Moderate

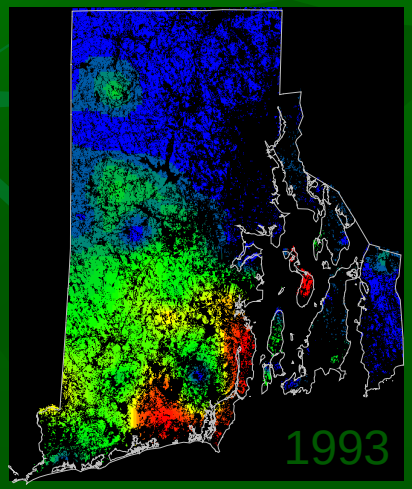
High

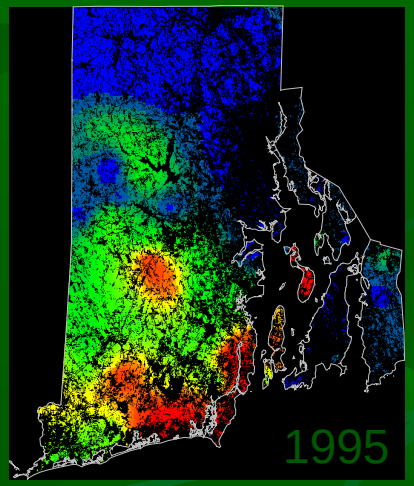


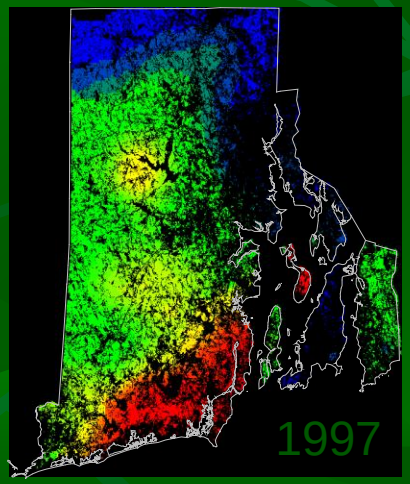


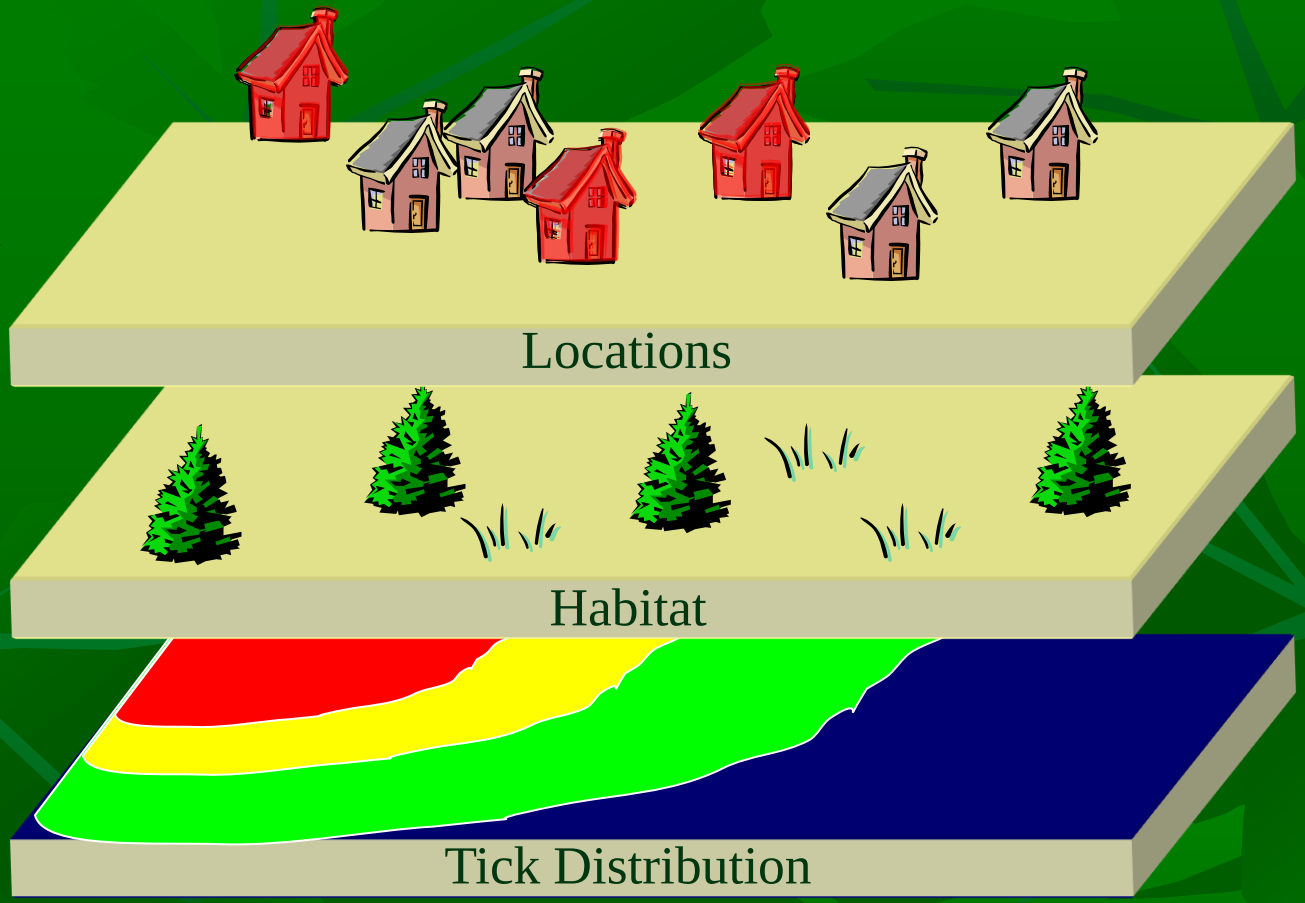
Nymphal Deer Tick Densities

Low Moderate High

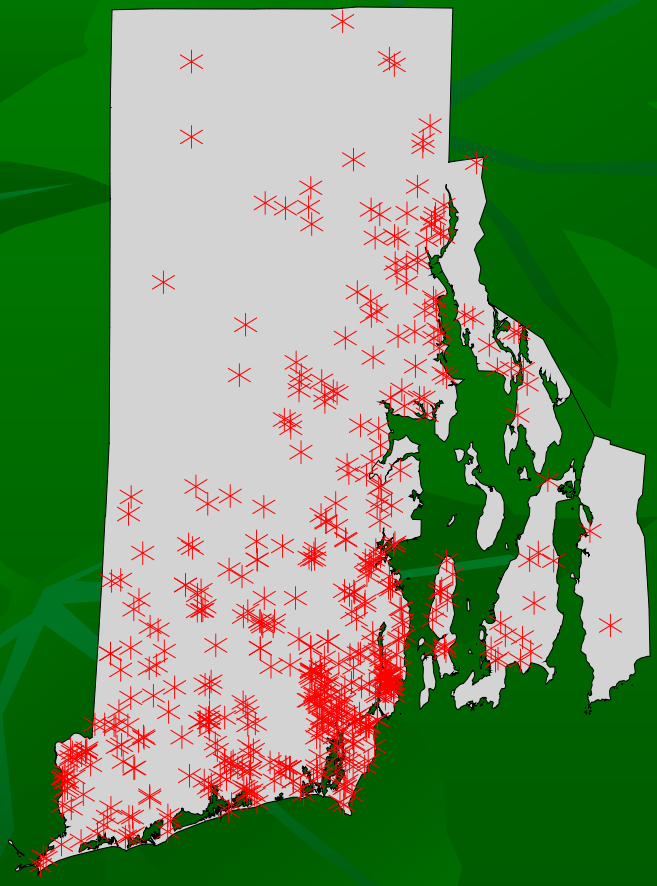







Locations
Habitat
Tick Distribution

Distribution of Lyme Disease



Lyme Disease Cases

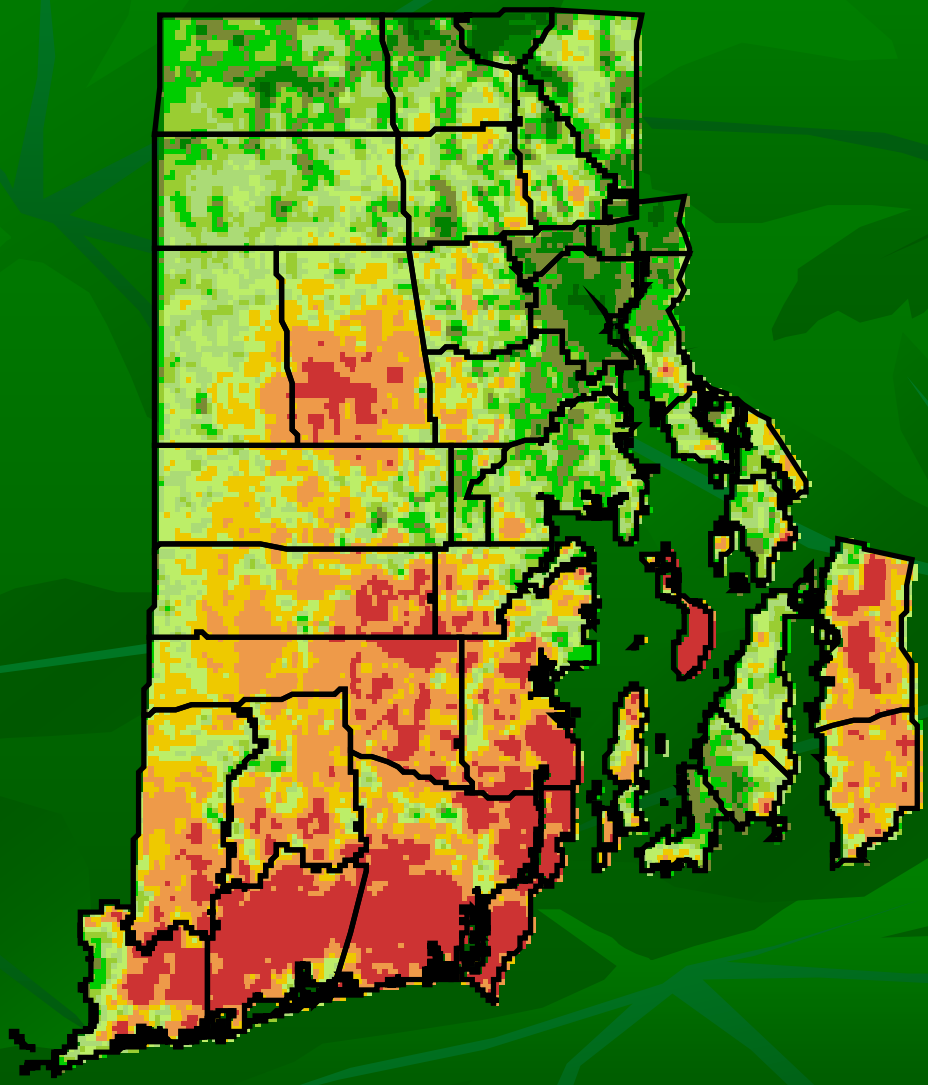
Control Population

Logistic Model

Variable	Parameter estimate	S.E.	Wald χ^2	*P*
Intercept	-0.61	0.33	3.4	0.064
Nymphs per hour	0.0068	0.00087	61.2	0.0001
Distance to roads (km)	0.42	0.14	9.1	0.0025
Distance to coast (km)	-0.085	0.0083	106.0	0.0001
Total edge (km)	1.38	0.098	197.9	0.0001
Urban/Built-up	-1.04	0.31	11.4	0.0007
Agriculture	1.14	0.69	2.7	0.097
Brush Land	-4.24	1.90	5.0	0.025

concordant responses = 84.6%
Sensitivity = 75.3% , Specificity = 80.0%

Lyme Disease Risk



Green Infrastructure Approach Providing Strategic "Context"

Source: Green Infrastructure Center

Implications

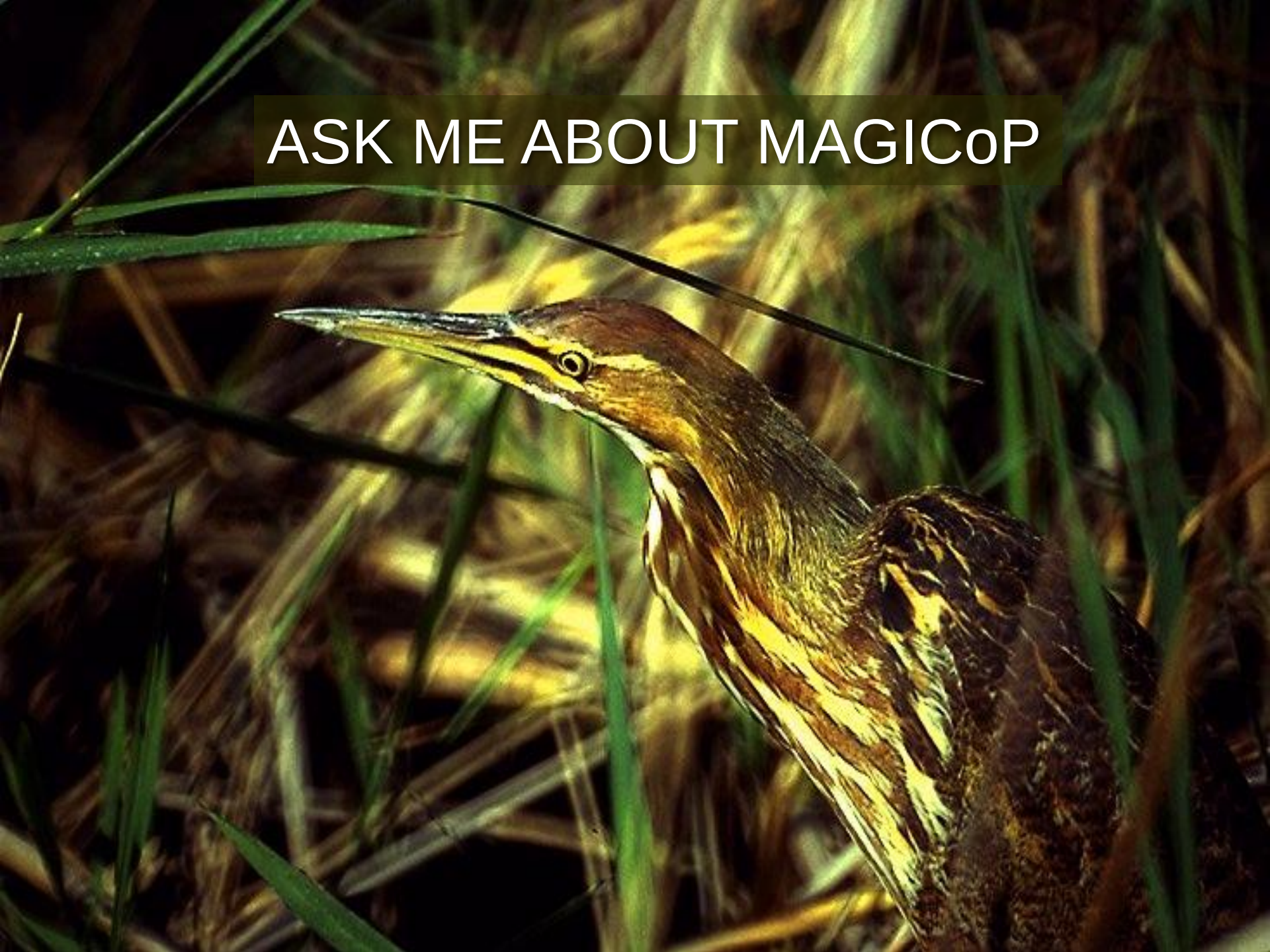
Variable	To Reduce Lyme Disease Risk	Goals of GI PLANING
Nymphs per hour	-----	
Distance to roads (km)	-----	yes
Urban/Built-up	+++++	yes
Total edge (km)	-----	yes

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