

DO WE HAVE METHODS TO
FIGHT THE LYME DISEASE
EPIDEMIC VIA TICK CONTROL-

In the post-vaccine era?

“Tick control represents a small but growing part of the [pest management] professional’s business. The application of acaricides for the control of *I. scapularis* is a relatively recent service [which corresponds] to an increase in tick abundance and and increase in the number of Lyme disease cases.”

J. Med. Entomol. 1997

Pesticide Use by Licensed Applicators for the Control of *Ixodes scapularis* (Acari: Ixodidae) in Connecticut

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ABSTRACT To assess the use of insecticides for tick control by Connecticut, a questionnaire was mailed to 897 individuals and both lawn and turf pesticide applicator licenses. In total, 348 completed surveys. The majority of the respondents considered themselves lawn care (n = 186) or tree care (13.8%) providers. Tick control services were offered by 103 respondents, all of whom apply insecticides for tick control, mainly for the American dog tick, *Dermacentor variabilis*. Over half (n = 33) also treat for the American dog tick. *D. variabilis* respondents (86.7%) began applying pesticides for the control of ticks from 1990 to 1996. The principal acaricide used for tick control was chlorpyrifos 2nd (n = 18), carbaryl 3rd (n = 12), and fluazacarb 1st (n = 10). When asked about what other pesticides were used for tick control, the principal alternatives, Past success with a product was the dominant factor, but information provided by the Connecticut Agricultural Experiment Station (University of Connecticut, Storrs), was also important. Half of the respondents (49.1%) indicated that their tick control business increased slightly or dramatically since 1991, although tick control represented overall business for 63.1% of these applicators. Residential property was the primary business for half of those treating for ticks, and the median charge for tick control was \$43.88. Respondents (43.8%) also indicated that they planned to expand their tick control business. Tick control represents a small but growing business in Connecticut.

KEY WORDS *Ixodes scapularis*, control, insecticides, Lyme disease



Photograph: Kirby Stafford

Area-wide acaricides

- Chemicals like carbaryl, cyfluthrin, fulvalinate, permethrin, deltamethrin etc. can give 68-100% control of nymphal *I. scapularis*, BUT
- Surveys in CT, MA, NJ, NY show most homeowners not willing to use them
- Need other options to offer

KAB Surveys

- Community Prevention Projects
- NJ, NY, CT, MA (Hyperendemic Areas)
- Total of 5 Surveys Conduct
- Max # Respondents 3,812

Approval of Prevention Measures

- Clear brush 80.7%
- Control deer pop 73.0%
- Pesticide on mice-community 66.1%
- Pesticide on deer 62.2%
- Woodchip/gravel barrier 58.9%
- Pesticide public property 54.7%
- Pesticide on own property 45.8%
- Pesticide on mice-home 41.7%
- Fence property 40.5%

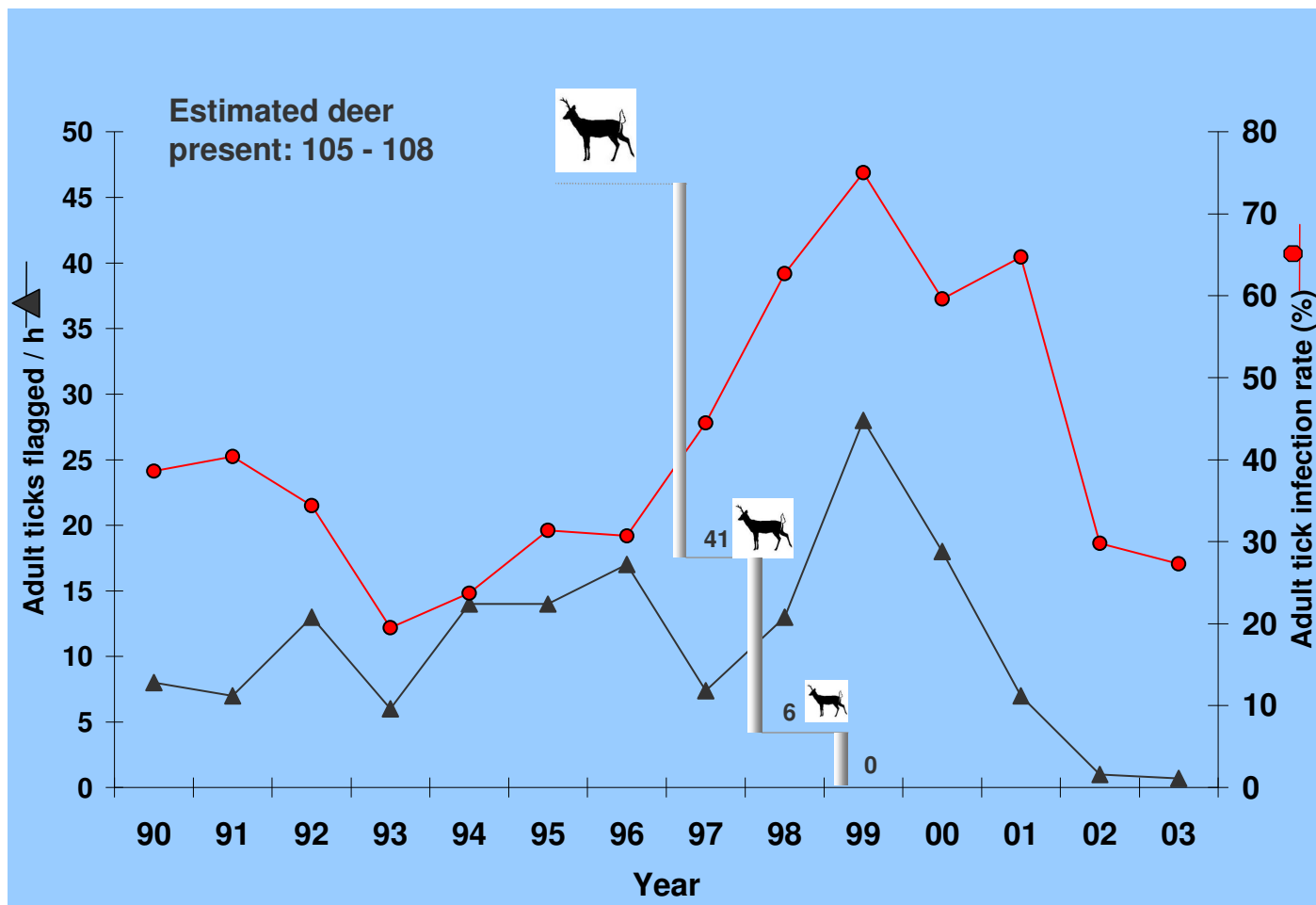
Prevention Measures Taken

- Long pants 49.8%
- Cleared Brush 48.6%
- Tick checks 45.7%
- Avoid woods 35.1%
- Pesticide on ground 24.4%
- Fenced property 23.1%
- Tucked pants/sock 18.3%
- Repellents/clothes 14.2%
- Used woodchip/gravel barrier 11.4%
- Vaccine 10.1%
- Pesticide on Rodents 9.0%

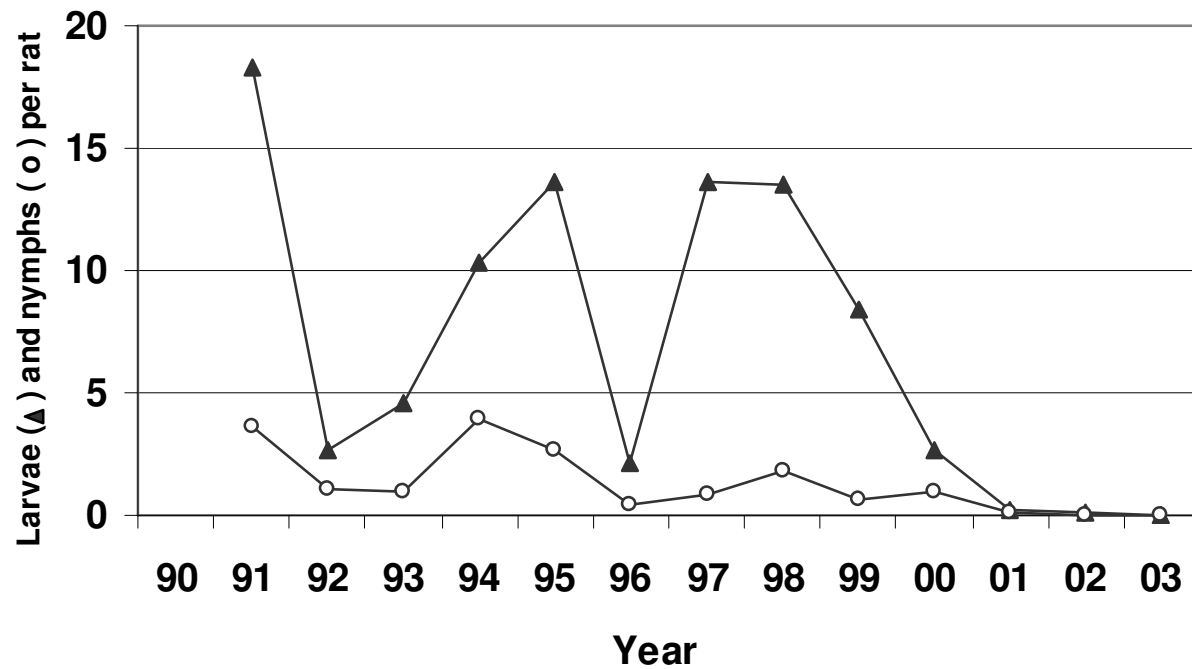
ALTERNATIVES TO AREA-WIDE ACARICIDES

- Host Removal
- Host Targeted Treatments (Deer & Rodents)
- Least Toxic (Soaps, Desiccants, Tree Extracts)
- Fungal Agents
- Landscape Management

Abundance and infection rate of *I. scapularis*, before and after deer removal on Monhegan Island, ME. 1990-2003.



I. scapularis on Norway rats

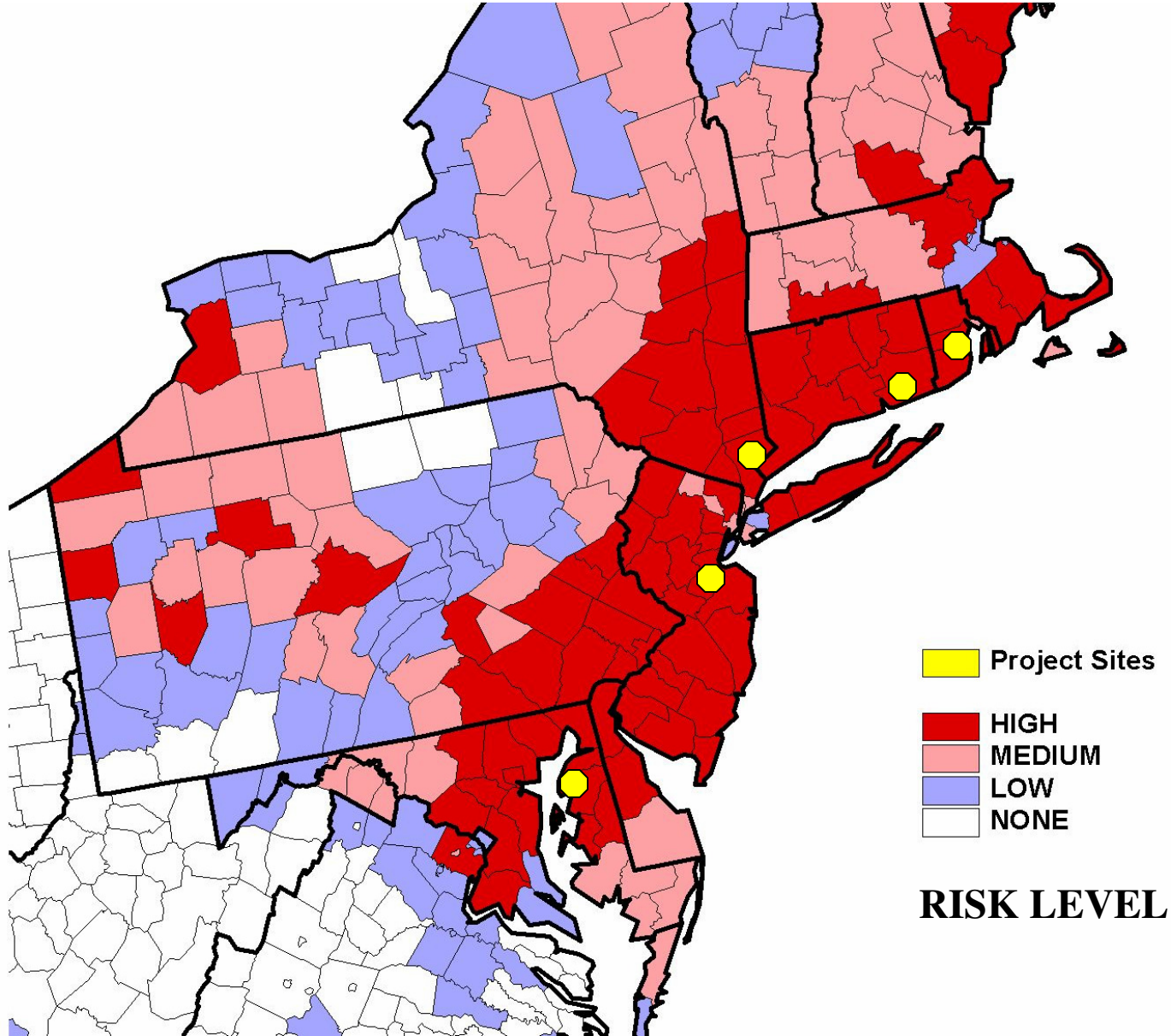


USDA “4-POSTER” DEVICE



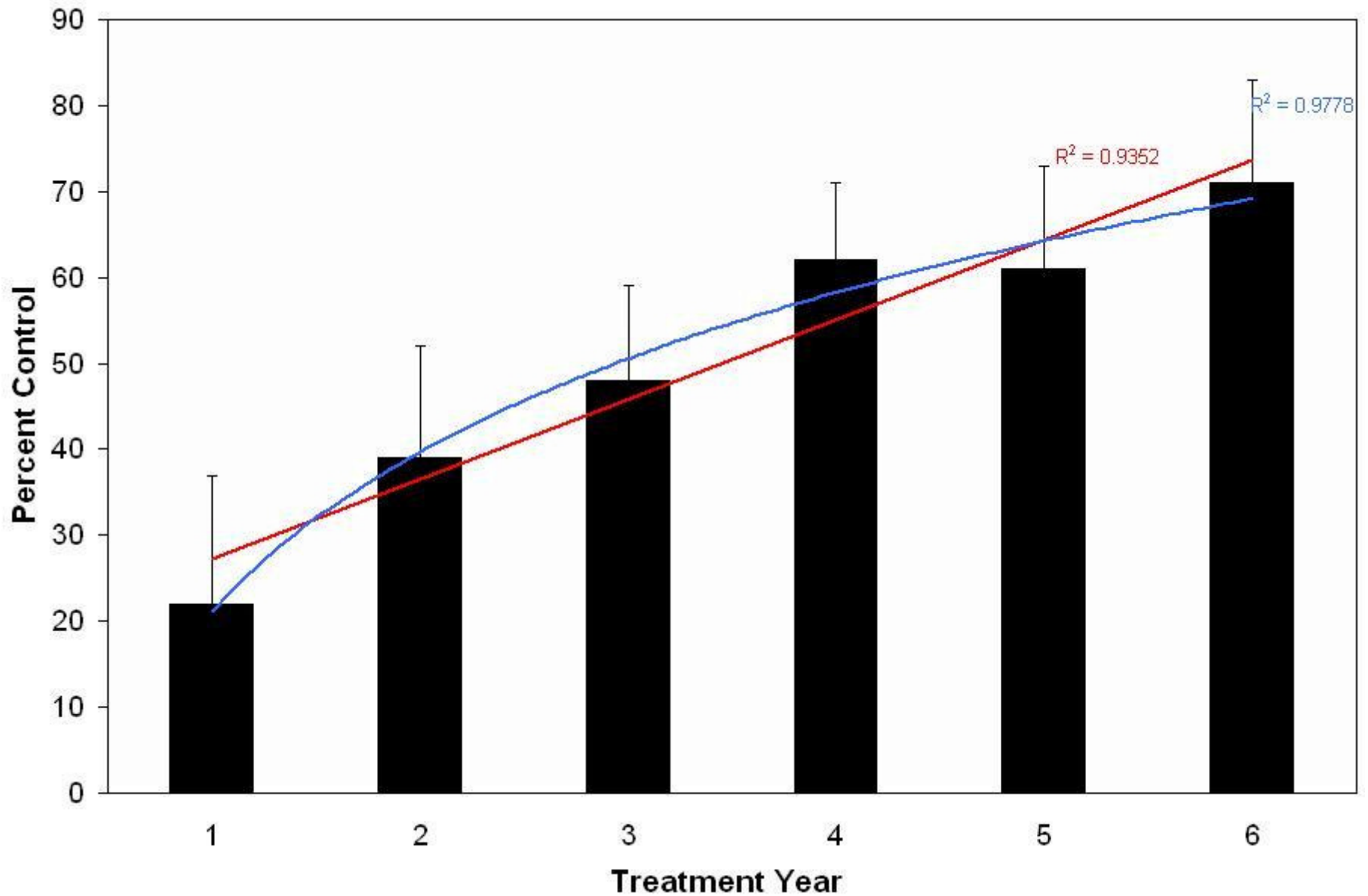
CORN BAITED SELF-APPLICATION WITH AMITRAZ

NATIONAL LYME DISEASE RISK MAP*



* Fish and Howard 1999. *MMWR* 48(RR07): 21-28

META-ANALYSIS OF EFFICACY DATA FOR 5 STUDY SITES



MAXFORCE
TICK
MANAGEMENT
SYSTEM

MAXFORCE
TICK
MANAGEMENT
SYSTEM

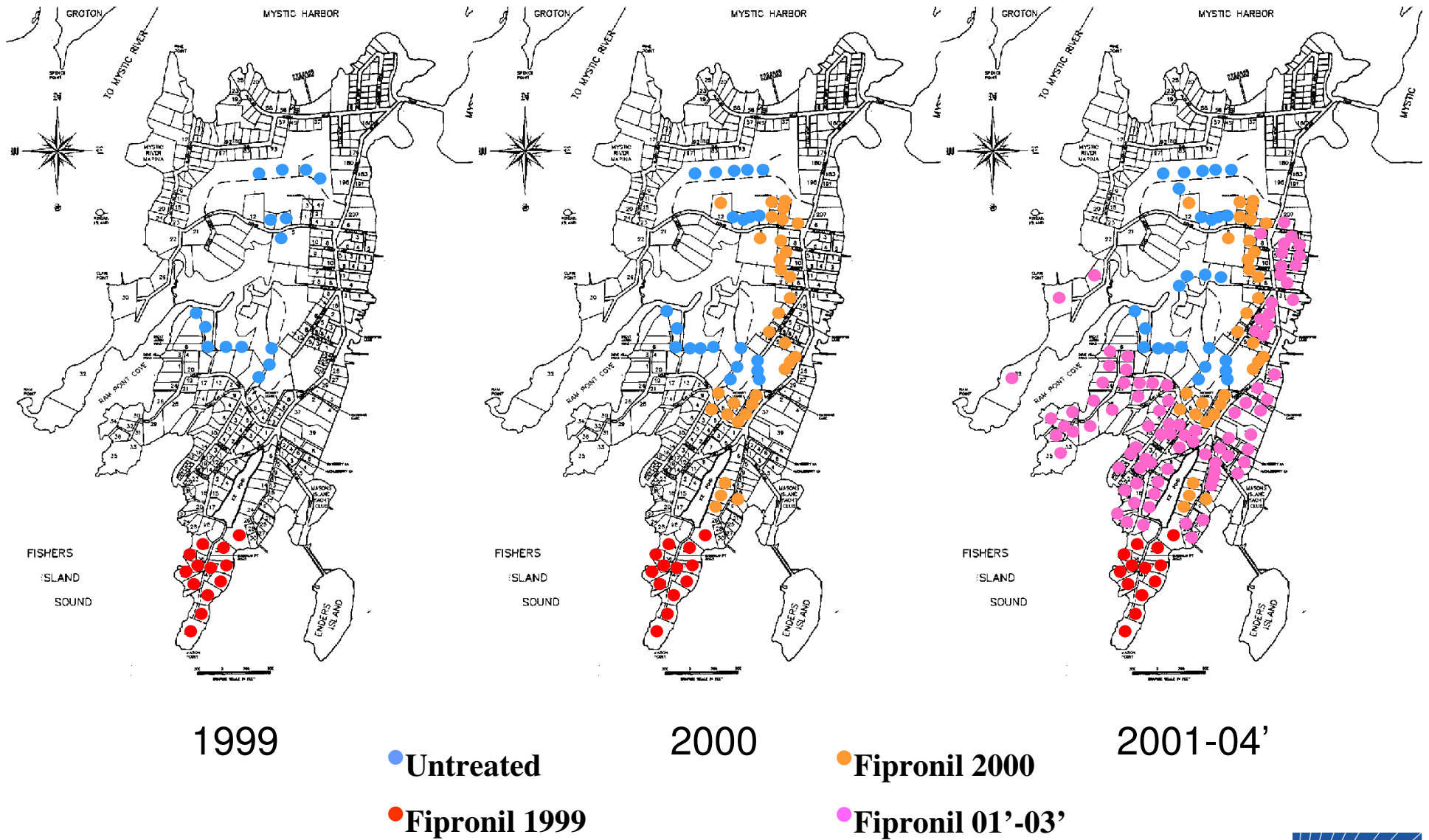




Photo courtesy of Dr. Kirby C Stafford III, CAES.



Location of Fipronil-Treated Properties, Mason's Is., Mystic, CT



Bait Box Trials, CT

Mason's Island 1999-2001*

% control ticks on mice: >80%
Infection in mice; reduced 53%
Questing nymphs; reduced 50%
Infection in questing nymphs; reduced 67%

Westport & Weston 2003-2005

% control of ticks on mice: 99%
Questing nymphs; reduced 78%

Torrington Health District 2003-2005

Less effective in this area (larger lots)
Reduction in % infested mice

*Published J Med Entomol 2004, 41:1043-1054



MAXIMIZE TICK SYSTEM
CAUTION
9.28.03

THE TERMINATOR





In trials at homes in Old Lyme, CT, removing leaf litter at yard edges reduced nymphal ticks on the lawn by an average of 49.1-69.5%

Stafford, K.C., 1995-1998. unpubl. data

Removing leaf litter from wooded areas in a forested NJ residential community reduced nymphal ticks by an average of 74.9-77.3%.

Schulze et.al. 1995. J. Medical Entomology 32:730-733.

In trials at homes in Old Lyme, CT, from 1995-1998 (n = 5), a wood chip barrier reduced nymphal ticks on yards by an average of 35.3-76.6%.

Stafford, K.C., 1995-1998. unpubl. data

Tick Management Handbook

A integrated guide for homeowners, pest control operators, and public health officials for the prevention of tick-associated disease

Prepared by:

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Produced as part of the Connecticut community-based Lyme disease prevention projects in cooperation with the following Connecticut health agencies:

The Connecticut Department of Public Health
The Westport Weston Health District
The Torrington Area Health District
The Ledge Light Health District



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The Connecticut Agricultural Experiment Station

BIOLOGICAL CONTROL

- FUNGAL PREPARATIONS
- Some are approved for use against ticks
- Problems with mass production, consistency in spore quality between batches, conditions for use
- NATURAL FOREST PRODUCTS: CCD/OSU. Extracts from trees highly effective acaricides. Repellents?

Potential Entomopathogenic Hypomycetes Fungi for Tick Control

- Fungus *Beauveria bassiana*
- Fungus *Metarhizium anisopliae*

Wide host range.

Produce conidia (asexual spores)

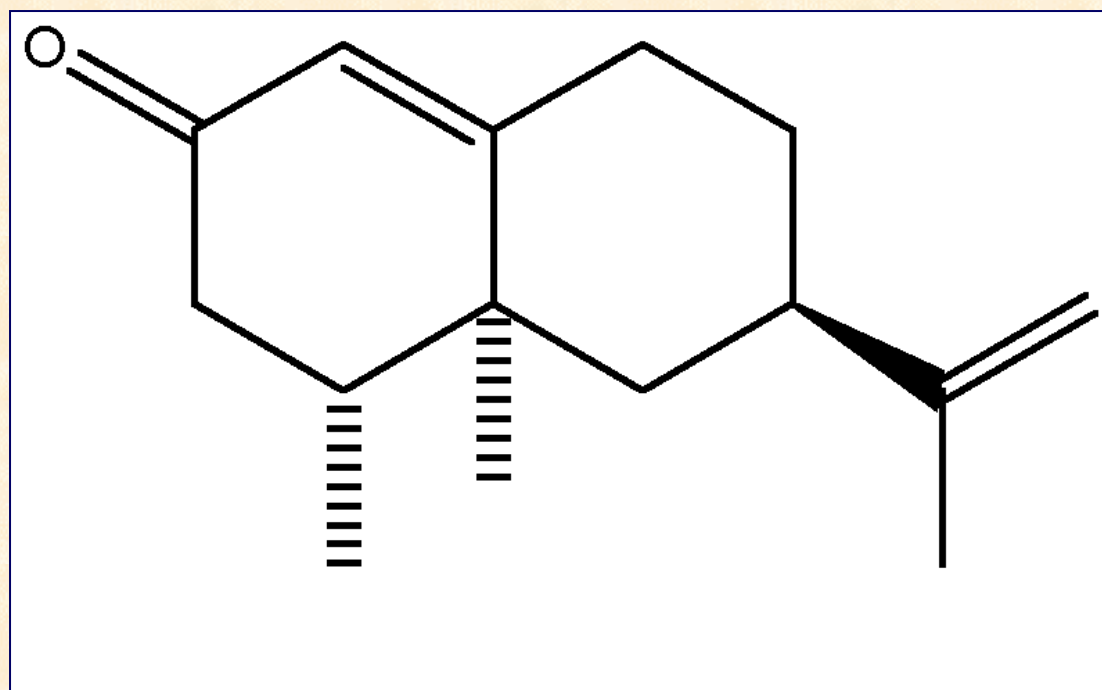
Conidia adhere to cuticle, germinate, penetrate and produce hyphae and toxins.



M. anisopliae on female
I. scapularis (Photo: Stafford)



Natural Products with Biocidal Activity Against Arthropods



***Nootkatone* :**
Alaska Cedar, Grapefruit

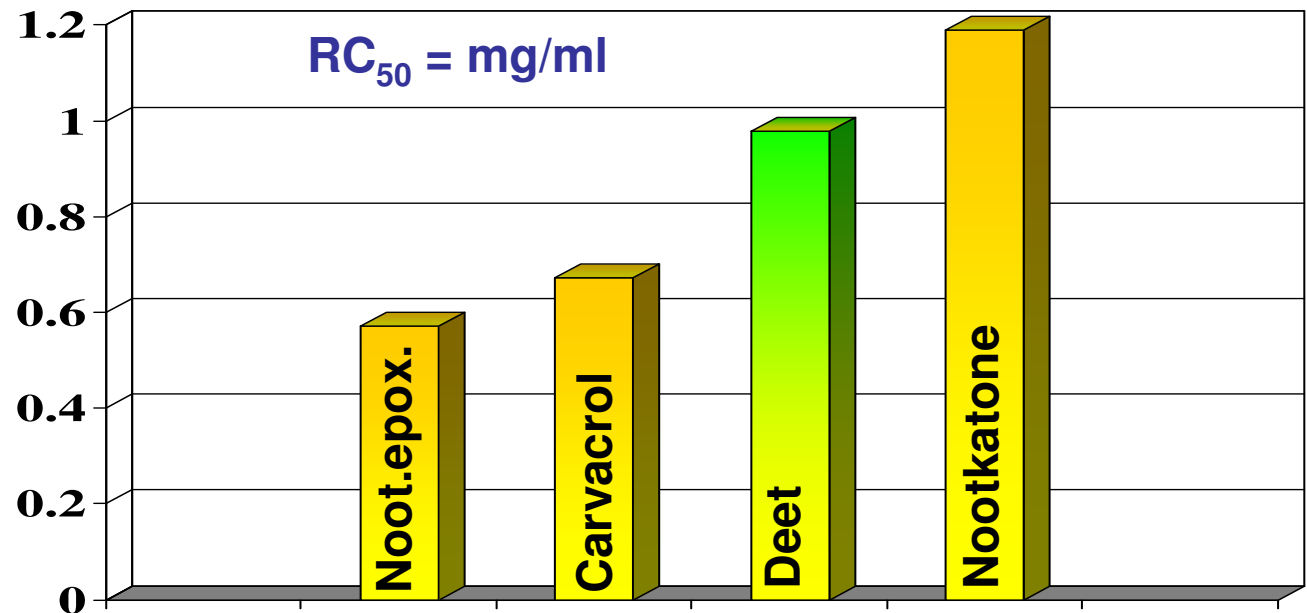
Biocidal & Repellent Activity of AYC Compounds


<u>COMPOUND</u>	<u>LD50 mg/ml</u>
AYC Essential Oil	1.51
Nootkatone	0.029
Carbaryl	0.007
Permethrin	0.003

Comparison of biocidal activity against *I. scap* nymphs.



Repellent efficacy of AYC compounds and Deet vs. nymphal ticks. →





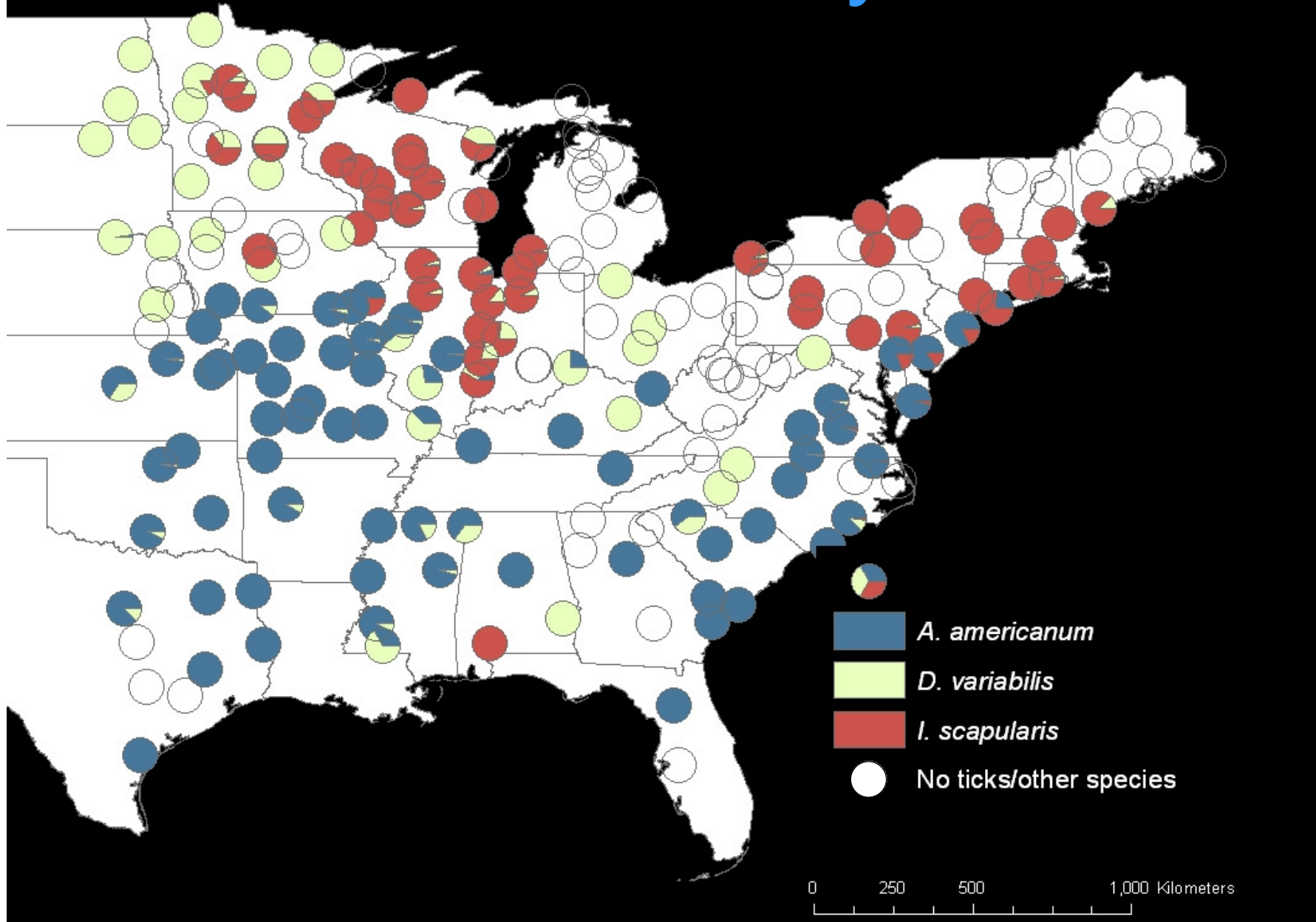
Spatial Patterns of *Ixodes scapularis*-borne *Borrelia* in the United States

Toward a Spatial Risk Model

Anne Gatewood, Maria Diuk-Wasser, Sarah Yaremych-Hamer, Roberto Cortiñas, Jonas Bunikis, Jean Tsao, Graham Hickling, Ned Walker, Joe Piesman, Alan Barbour, and Durland Fish

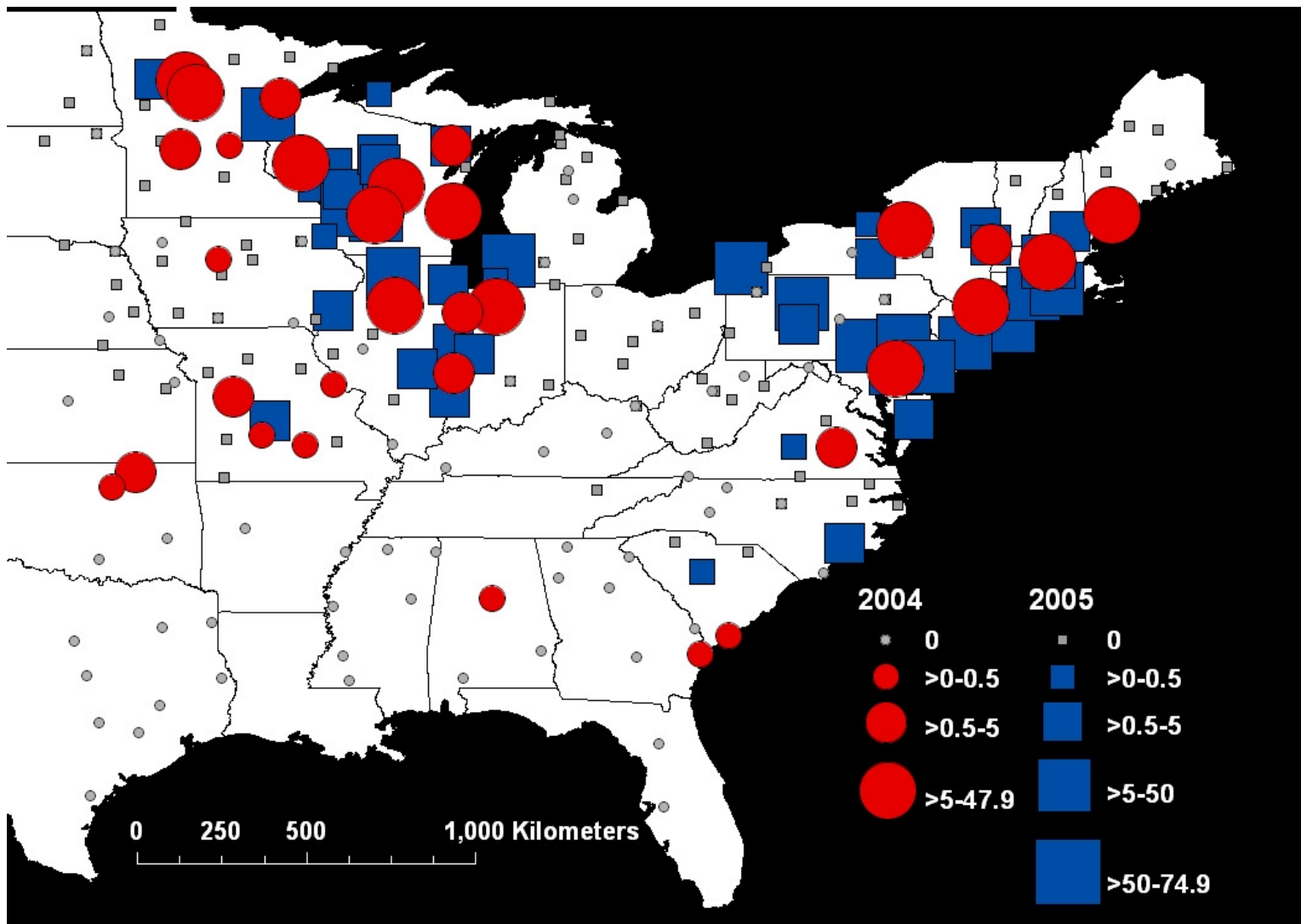
PROJECT UPDATE NOVEMBER 2005

Collection Summary



Nymphal *I. scapularis*

distribution and density 2004-2005



Outcome of Risk Mapping Project

- Predictive risk model for Lyme disease spirochete transmission
- Focus our prevention efforts for new approaches like:
- Oral vaccine for wildlife
- Integrated natural control methods (forest products + fungi)
- New human vaccine?