THE TICK PROJECT

Testing environmental interventions to prevent Lyme and other tick-borne diseases in our communities

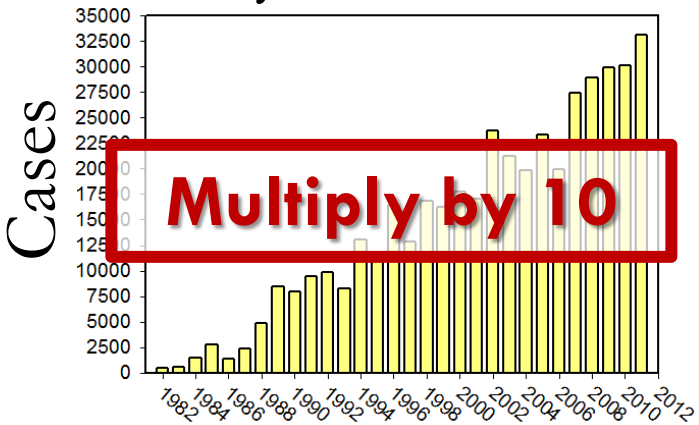
Principal Investigators: Richard S. Ostfeld and Felicia Keesing

Cary Institute of Ecosystem Studies • Bard College • Centers for Disease Control & Prevention • New York State Department of Health • Dutchess County Department of Behavioral & Community Health

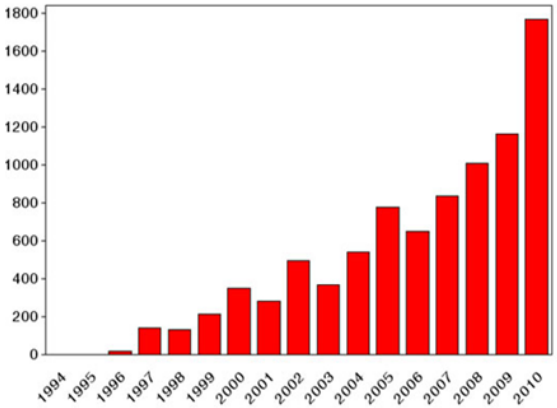
www.tickproject.org

THREE TICK-BORNE DISEASES

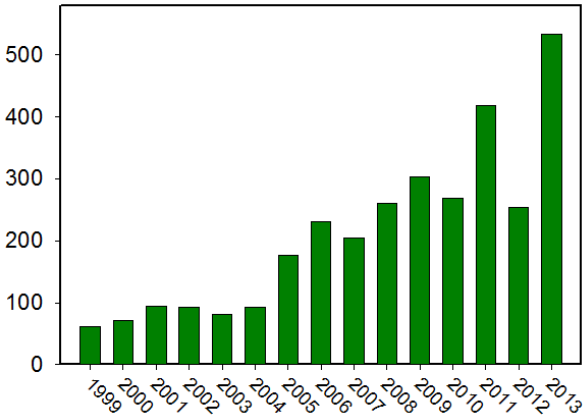
Lyme disease



Anaplasmosis



Babesiosis



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LYME DISEASE 2001

1 dot placed randomly within county of residence for each reported case

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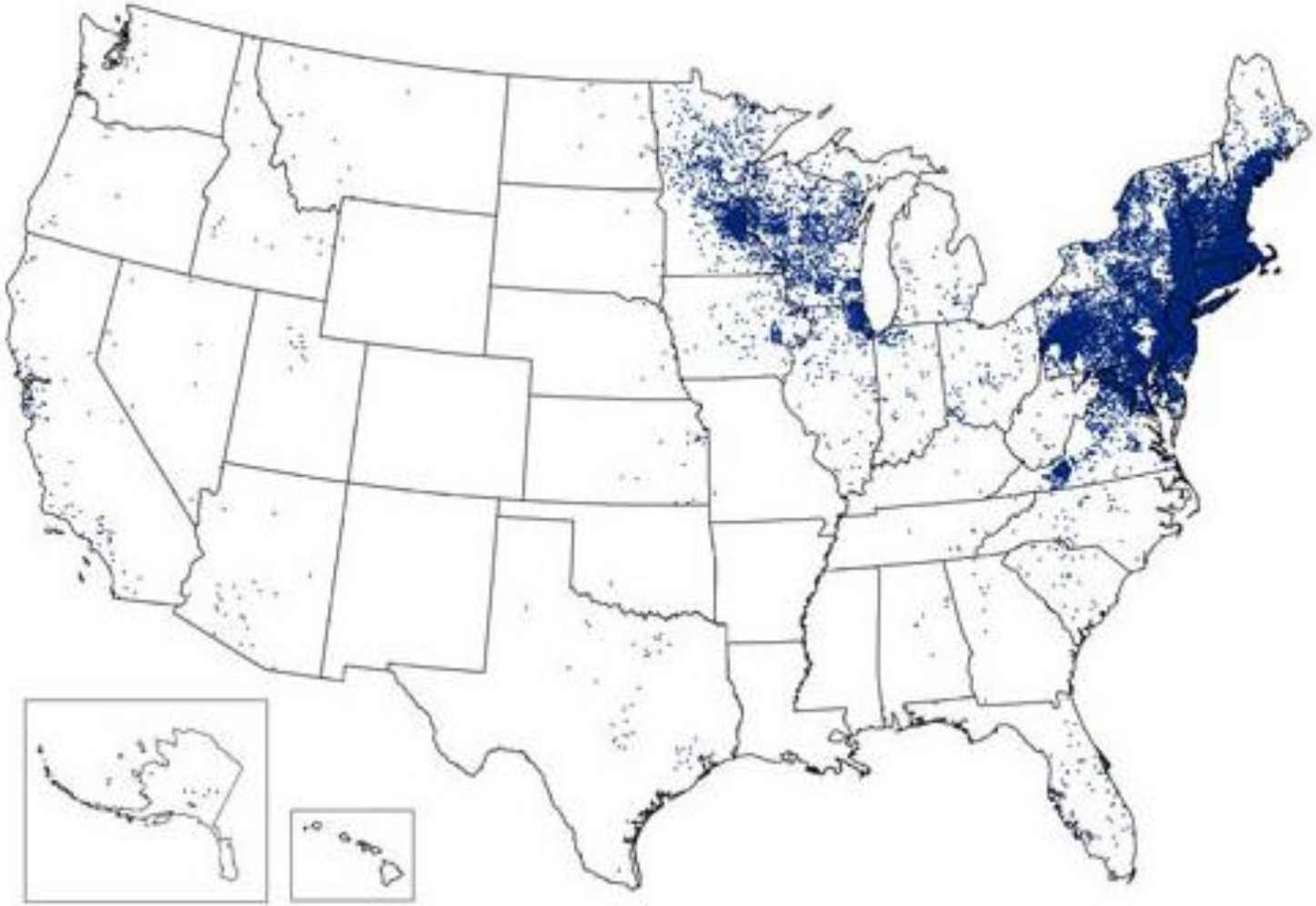
LYME DISEASE 2013



1 dot placed randomly within county of residence for each confirmed case

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LYME DISEASE IN THE 21ST CENTURY

- Rapidly increasing in incidence and range
- No vaccines available
- Diagnosis and treatment problematic
- Estimated cost: $712M to $1.3B/year
- Effective tick management poorly developed
  - Small scale, poor replication, poor control

The Journal of Infectious Diseases
Journal of Infectious Diseases Advance Access published February 3, 2016
MAJOR ARTICLE
IDSA Infectious Diseases Society of America
hivma hiv medicine association
OXFORD

Effectiveness of Residential Acaricides to Prevent Lyme and Other Tick-borne Diseases in Humans

Alison F. Hinckley,[1] James I. Meek,[2] Julie A. E. Ray,[2,a] Sara A. Niesobecki,[2] Neeta P. Connally,[3] Katherine A. Feldman,[4] Erin H. Jones,[4,a] P. Bryon Backenson,[5] Jennifer L. White,[5] Gary Lukacik,[5] Ashley B. Kay,[1,a] Wilson P. Miranda,[5] and Paul S. Mead[1]

[1]Division of Vector-Borne Diseases, Centers for Disease Control and Prevention, Fort Collins, Colorado; [2]Connecticut Emerging Infections Program, Yale School of Public Health, New Haven, and [3]Western Connecticut State University, Danbury; [4]Maryland Department of Health and Mental Hygiene, Baltimore; and [5]New York State Department of Health, Albany

2-year, 3-state, 2727-household, double-blind, randomized, placebo-controlled study.

One annual springtime Bifenthrin spray.

Effects on ticks and cases of TBDs

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63% reduction in questing nymphal blacklegged ticks

But……

Table 2. Proportion of Participating Households Reporting Tick Encounters or Physician-Diagnosed Tick-borne Disease, by Treatment Group, Study Year, and Study Site

Outcome, Year(s), Site	Acaricide	Placebo	*P* Value
Ticks crawling			
2011	185/762 (24.3)	209/769 (27.2)	.19
2012	139/541 (25.7)	150/518 (29.0)	.23
Overall	324/1303 (24.9)	359/1287 (27.9)	.08
CT	133/474 (28.1)	157/491 (32.0)	
MD	68/319 (21.3)	60/289 (20.8)	
NY	123/510 (24.1)	142/507 (28.0)	
Ticks attached			
2011	127/762 (16.7)	145/769 (18.9)	.26
2012	86/541 (15.9)	84/518 (16.2)	.89
Overall	213/1303 (16.3)	229/1287 (17.8)	.33
CT	78/474 (16.5)	103/491 (21.0)	
MD	35/319 (11.0)	30/289 (10.4)	
NY	100/510 (19.6)	96/507 (18.9)	
Self-reported illness			
2011	27/739 (3.7)	25/755 (3.3)	.72
2012	14/534 (2.6)	14/513 (2.7)	.91
Overall	41/1273 (3.2)	39/1268 (3.0)	.78
Verified illness			
2011	13/739 (1.8)	14/755 (1.9)	.89
2012	6/534 (1.1)	6/513 (1.2)	.94
Overall	19/1273 (1.5)	20/1268 (1.6)	.90

Data are no. (%) of households with specified characteristics.

Why?

- 63% reduction in tick abundance is too modest?
- Treating individual yards too restricted?

GOAL

Develop and test a safe, effective, and affordable means of preventing tick-borne disease at the scale of whole neighborhoods

TWO INTERVENTIONS

Metarhizium anisopliae

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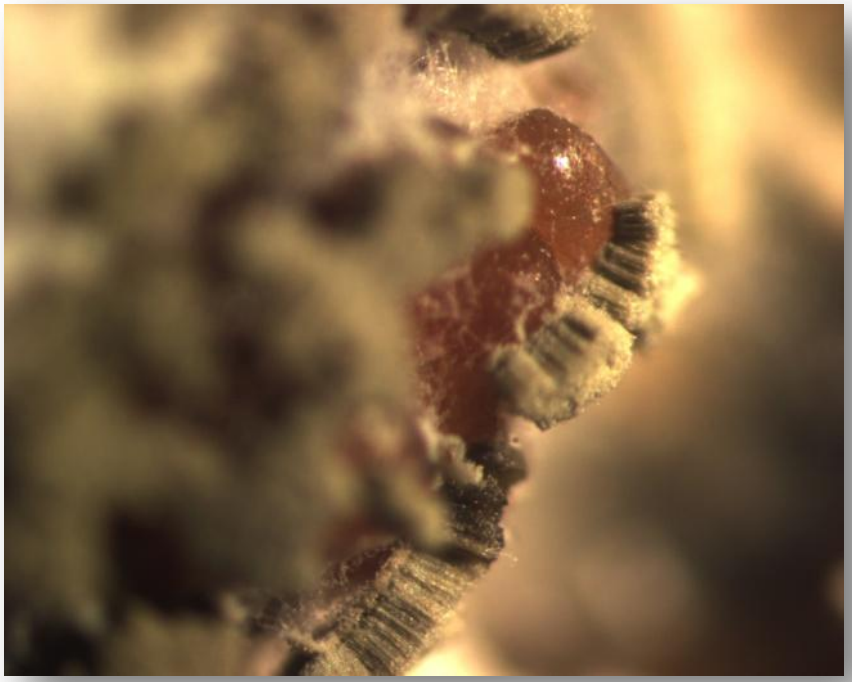
TWO INTERVENTIONS

Metarhizium anisopliae



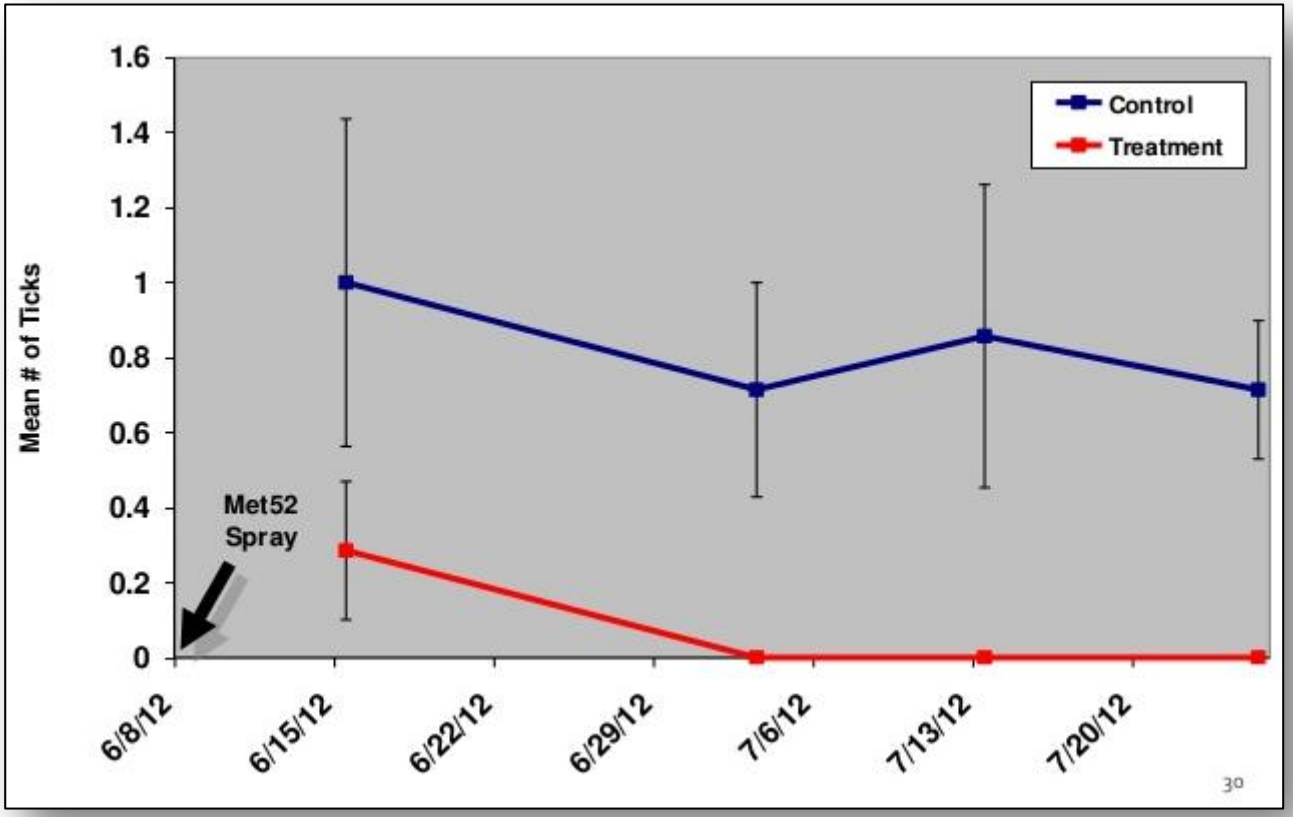
TWO INTERVENTIONS

Metarhizium anisopliae

Photos: Ray Young, Novozymes

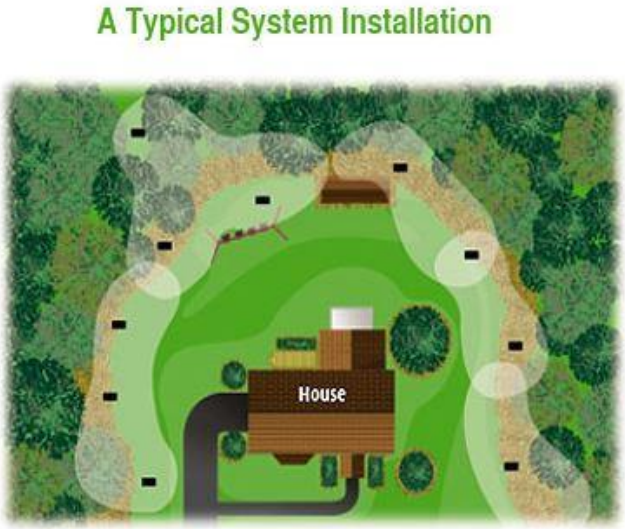
TWO INTERVENTIONS

Metarhizium anisopliae



TWO INTERVENTIONS

TCS Bait boxes



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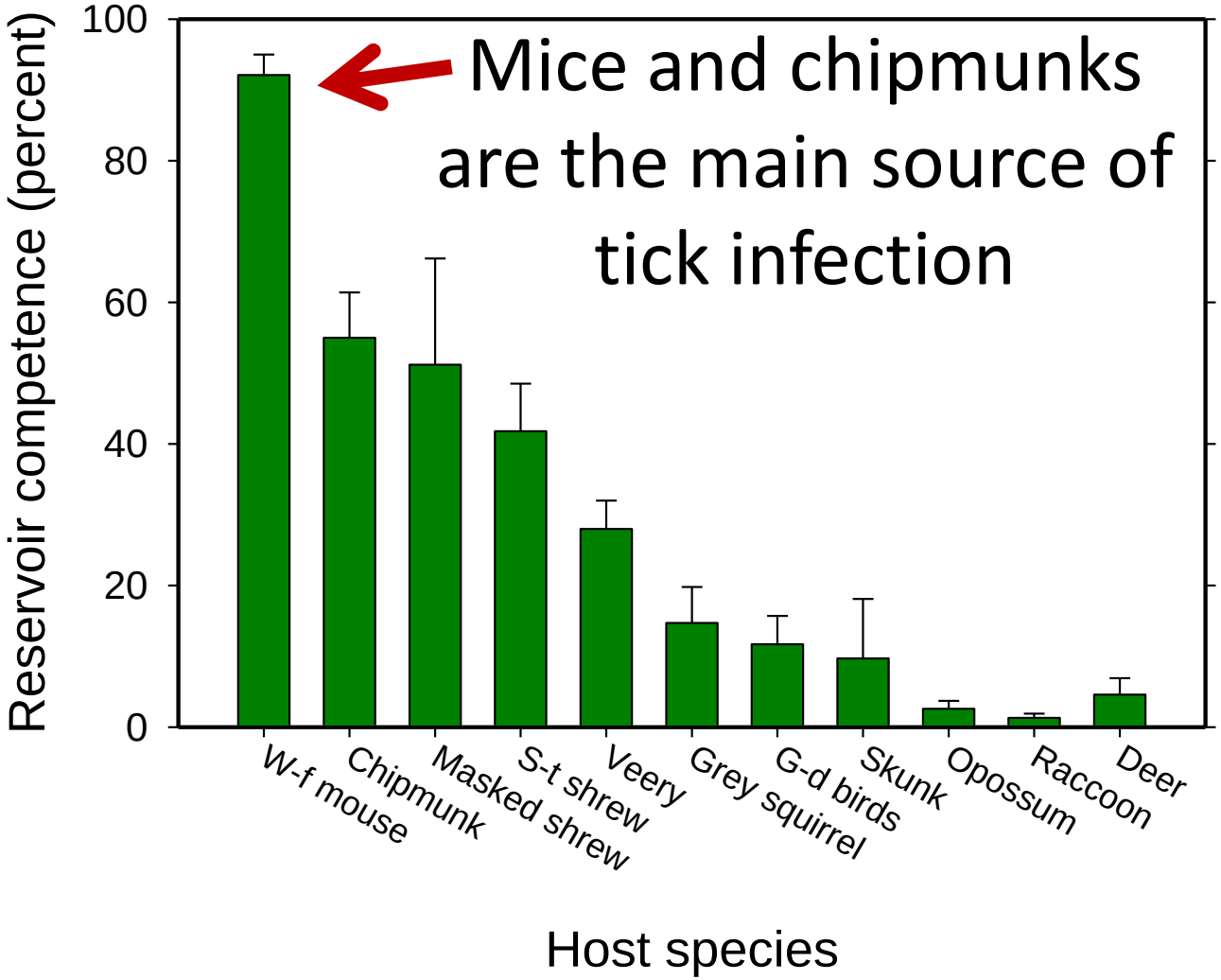

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TWO INTERVENTIONS

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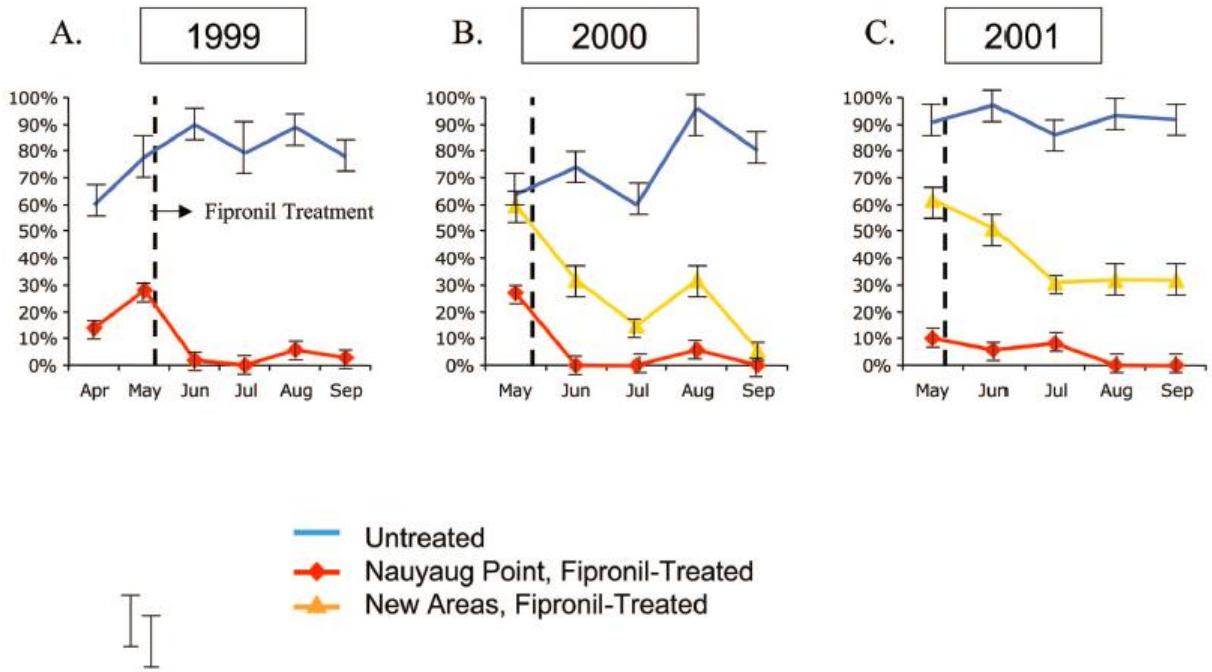


Fig. 3. (A) Infestation rates of *P. leucopus* on Nauyaug Pt. compared with untreated areas. Pretreatment collections were performed in April and May, posttreatment in June to September. Fipronil-treated bait boxes were in place by 15 May all 3 yr. (B) Infestation rates of mice including New Areas. (C) Infestation rates during 2001. 15 May–July, properties received Prototype 2 bait boxes; modified Protecta Jr. boxes were used August and September.

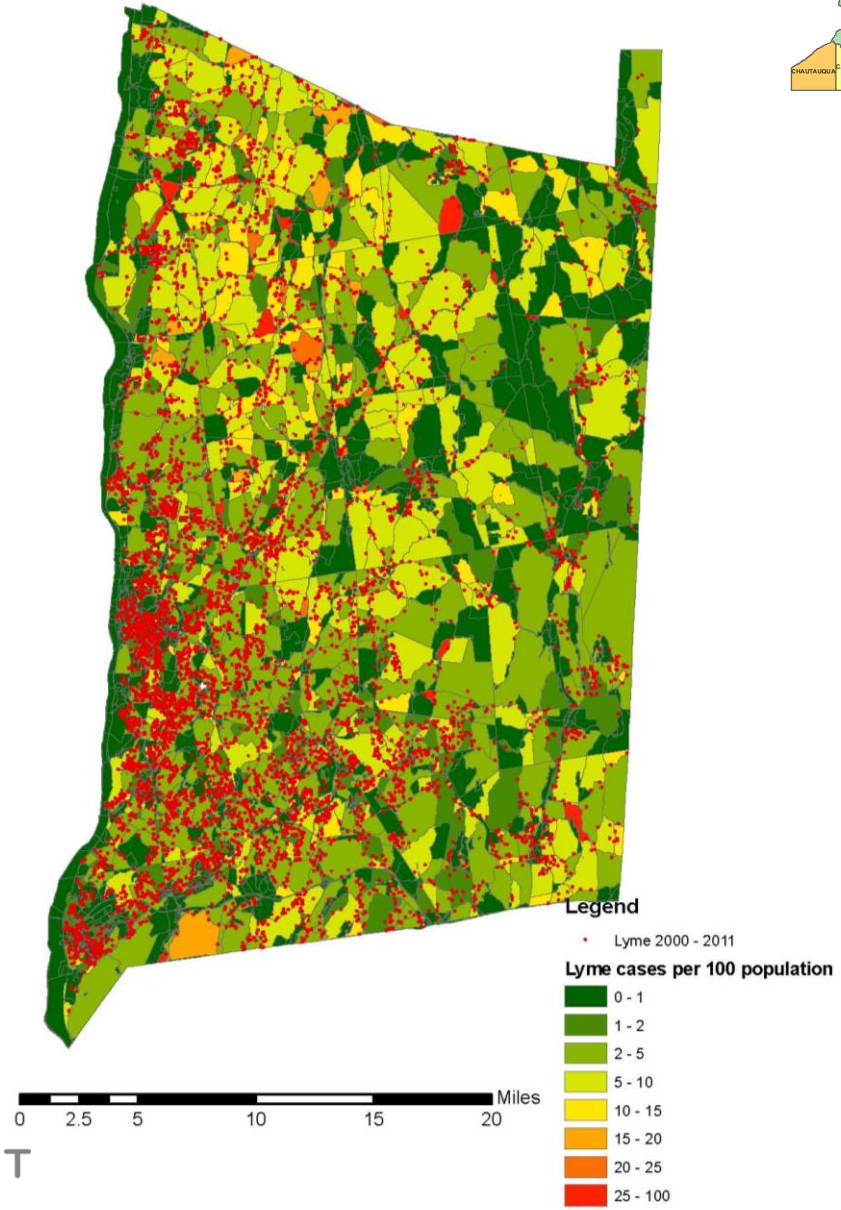
TWO INTERVENTIONS

Met52 kills ticks in the environment

TCS Bait boxes kill ticks on “reservoir hosts” responsible for feeding and infecting many ticks

STUDY DESIGN

Location



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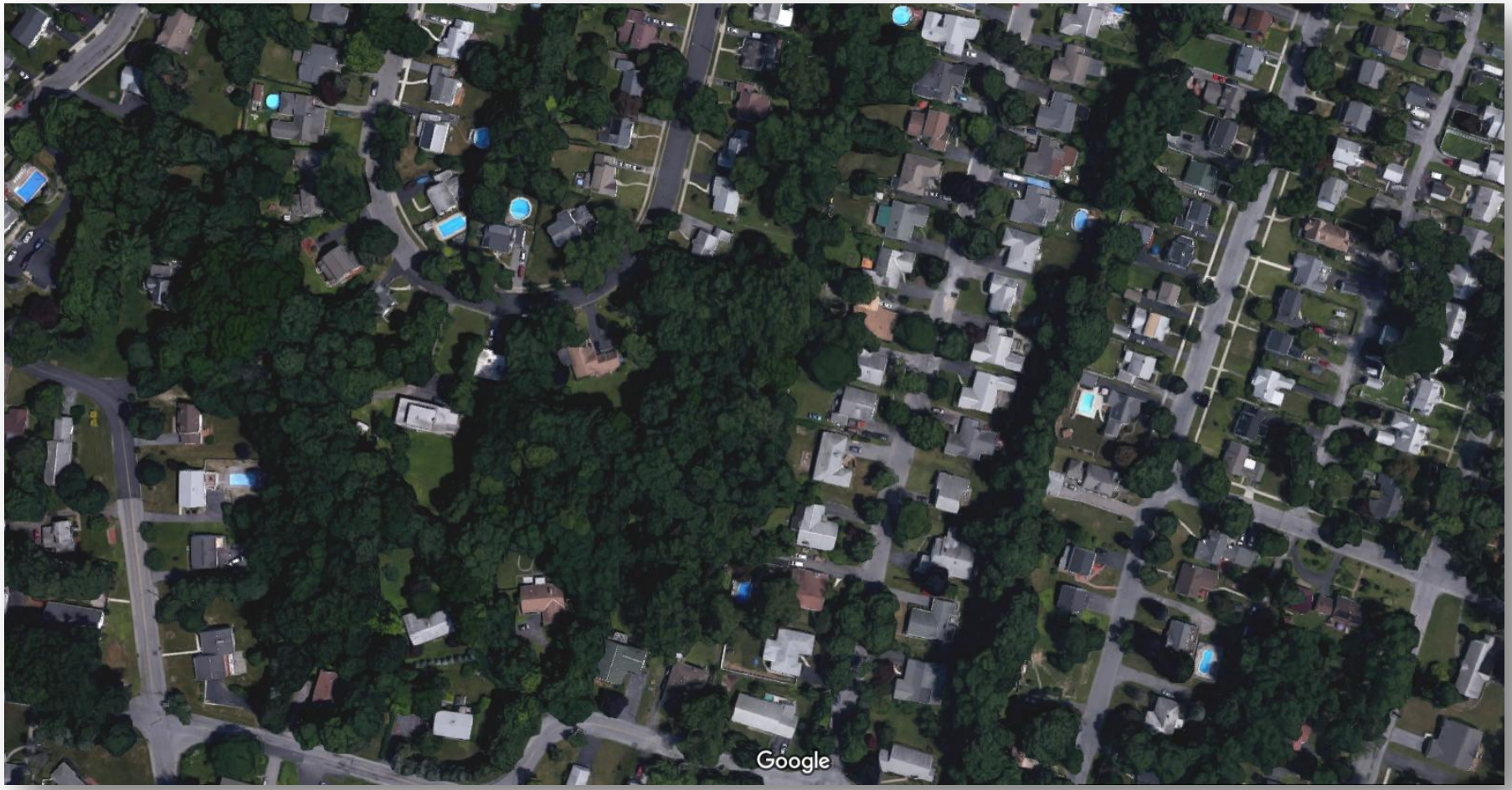
STUDY DESIGN

Neighborhoods



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STUDY DESIGN

Interventions, imposed on neighborhoods

(~100 homes)

	Bait boxes	Inactive bait boxes
Fungus	6 replicates	6 replicates
Inactive fungus	6 replicates	6 replicates

Real controls

Scientific gold standard: randomized, placebo-controlled, double-blind

STUDY DESIGN

Measurements

- Per capita cases of tick-borne disease
- Numbers of encounters with ticks
- Tick abundance and infection prevalence

- Covariates (wildlife diversity, deer abundance, percent of properties participating)
- Non-target effects

STUDY DESIGN

Expectations

- Two interventions will be more powerful than one
- Longer duration (spray twice, boxes all season) more effective
- TCS bait boxes will reduce infection prevalence as well as abundance of ticks
- Treatment of neighborhoods more effective than single yards

STUDY DESIGN

Logistics

- Five year project, 2016 through 2021
- Collaboration between the Cary Institute of Ecosystem Studies, Bard College, CDC, NYSDOH, DCDOBCH
- Funding from the Steven & Alexandra Cohen Foundation
- Additional funding from several smaller donations

STUDY DESIGN

Current status

- 24 neighborhoods have been selected
- At present, ~1000 households have agreed to participate, others being contacted
- In pre-intervention year (2016) sampled mammals at 229, and ticks at 192 properties
- Interventions started April 2017, to continue through 2020
- Conduct "biweekly surveys" of all participants

FOR MORE INFORMATION

www.tickproject.org