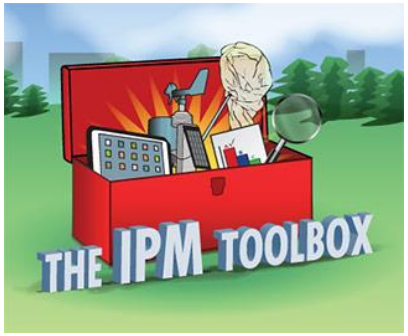
Northeastern IPM Center

Tick IPM Series

Part 4: Impacts of Forest Management on Tick-Borne Disease Transmission and Exposure Risk

August 10, 2020



USDA United States Department of Agriculture National Institute of Food and Agriculture

Welcome

A recording of this webinar will be available within a week at

http://www.neipmc.org/go/ipmtoolbox

We Welcome Your Questions

- Please submit a question at any time using the Q&A feature to your right at any time

- If you'd like to ask a question anonymously, please indicate that at the beginning of your query.

Presenter

Allison (Allie) Gardner
University of Maine

Some Questions for You

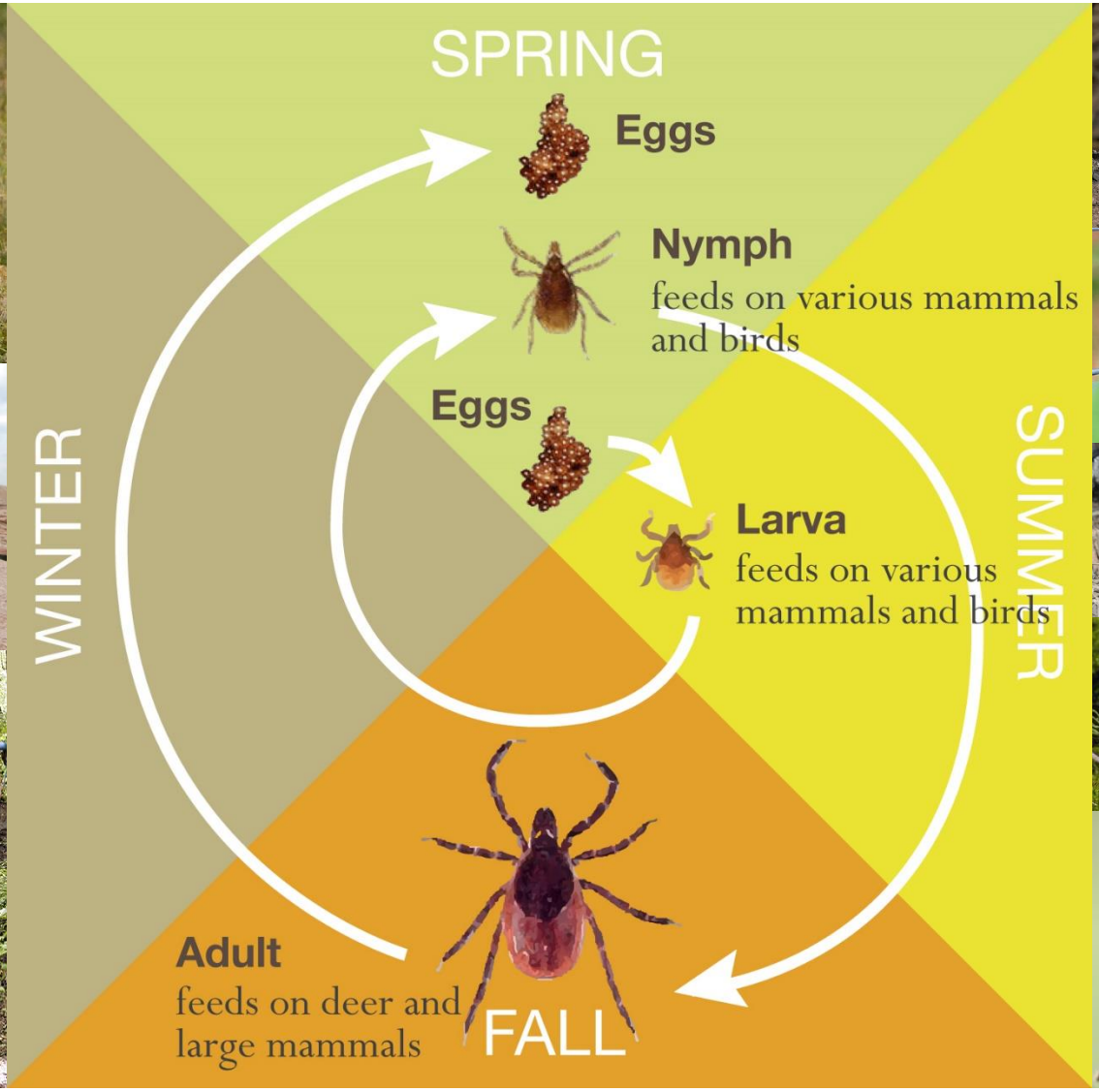



Impacts of Forest Management on Tick-Borne Disease Transmission and Exposure Risk

Allison (Allie) Gardner ▪ University of Maine ▪ 10 August 2020




Ecology of Tick-Borne Disease Transmission



Forest Management and the Tick Life Cycle

Forest management may impact tick-host encounter frequencies and off-host abiotic conditions for ticks throughout the life cycle…

White-tailed deer (↑DON)

Rodents (↑NIP) and their predators (↓NIP)

Insulation during winter (↑ off-host tick survival)

Humidity during summer (↑ off-host tick survival)

Forest Management and Landowner Goals

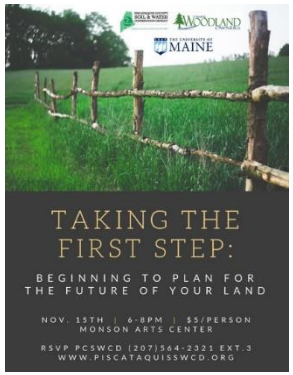
Forest management to control tick-borne disease may complement landowners' other objectives for their woodland…

Urquhart & Courtney 2011, *For Pol & Econ* 13: 535-544

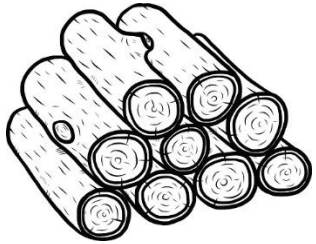
Table 2
Characteristics of six woodland owner types derived from cluster analysis.

Factors	Owner groups							
	I	Ind	PC	AmO	MfO	C	F	Sig.
X1: Financially-oriented	*0.758*	−0.253	−0.373	−0.521	*1.093*	−0.491	59.552	<.0001
X2: Conservation	−0.825	−0.491	0.282	*0.541*	0.140	*0.599*	27.157	<.0001
X3: Private consumption	−0.184	−0.13	*0.716*	−0.461	*0.389*	−0.827	28.830	<.0001
X4: Public Amenity	−0.483	−0.134	−0.361	*1.561*	*0.459*	−0.882	81.528	<.0001
X5: Personal enjoyment	−1.353	*0.494*	*0.340*	−0.723	*0.345*	0.011	48.746	<.0001
X6: Environmental	−0.327	−0.187	−0.463	−0.07	*0.544*	*0.625*	19.805	<.0001
X7: Constrained	−0.060	*0.582*	−0.809	−0.089	0.008	0.218	22.332	<.0001
X8: Grant dependent	−0.098	−0.736	*0.323*	0.251	0.059	*0.448*	18.577	<.0001
Numbers of cases ($n = 399$)	38	96	78	50	79	58		

I = Investor; Ind = Individualist; PC = Private Consumer; AmO = Amenity Owner; MfO = Multifunctional Owner; C = Conservationist.
Significant factor loadings (0.450 or above) are shown in italics.



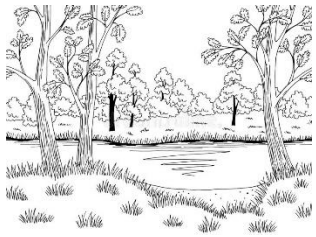
Outline for This Presentation



1. Highlight my lab's research concerning the impacts of timber harvesting on tick-borne disease transmission dynamics

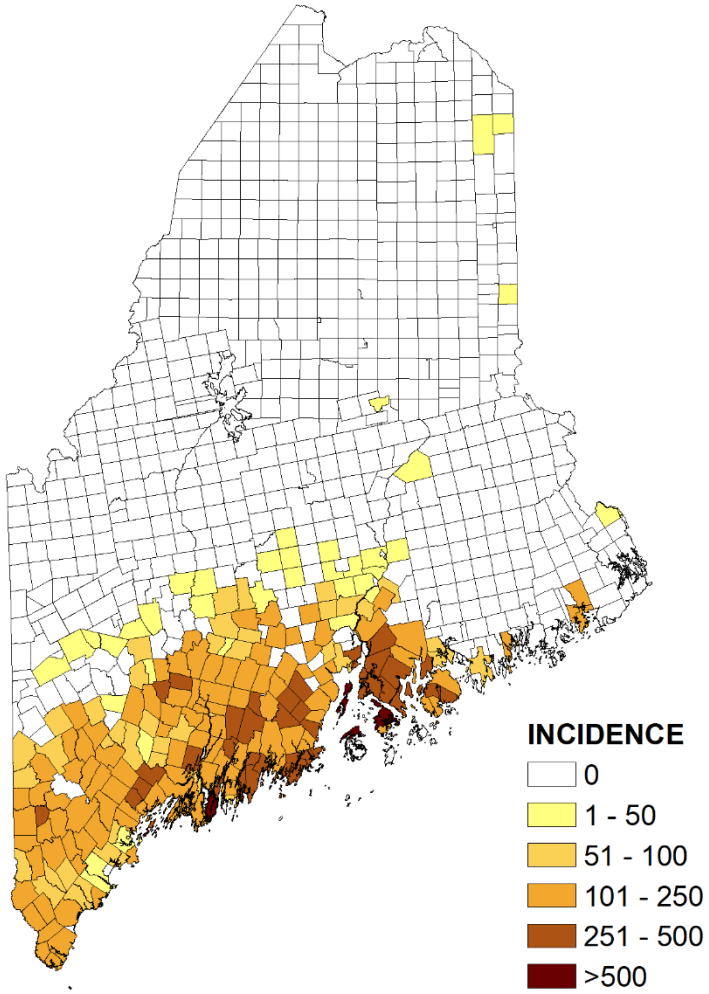
2. Discuss other examples of the impacts of active forest management on human risk of exposure to tick-borne disease

3. Place these management strategies in the context of forest landowner objectives and decision-making processes

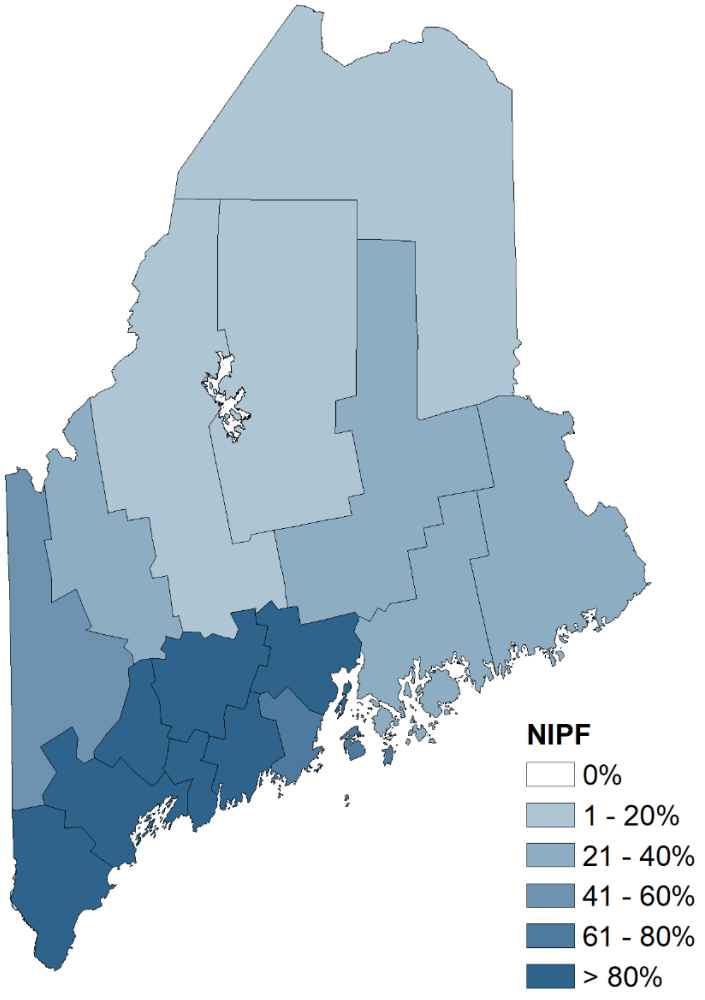


4. Discuss the impacts of forest management on tick-borne disease transmission at the landscape scale

The Spread of Lyme Disease in Maine



Lyme cases/100,000, 2010-2020



Percent non-industrial private forest landownership

Forest Ownership and Management in Maine

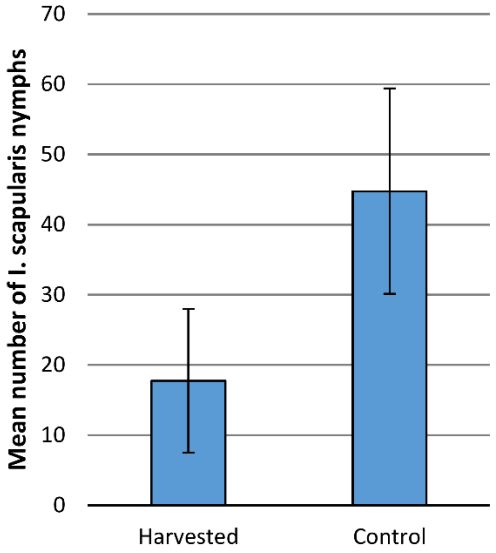
Table 3. Typology cluster titles, grouped into six categories.

Silver et al. 2015, *J Forestry* 113(5): 490-499

Category	Cluster titles	Citations
Production	Timber Agriculturalist, Forest Utilitarian, Investor, Timber Manager, Timber Producer, Classic Owner, Economically Interested, Self-interested, Farmer Forest Owner, Income from Forestry, Economist	22
Protection	Timber Conservationist, Resource Conservationist, Self-employed, Resident Conservationist, John Muir, Nontimber, Naturalists, Preservationist	15
Consumption/Amenity	Forest Environmentalist, Poor Rural Residents, Amenities, Small Towners, Henry David Thoreau, Consumptive, Retreat	12
Recreationists	Range Pragmatist, Forest Recreationist, Affluent Weekenders, Utilities, Hobby Owner, Conceptually Interested Owner, Urban Forest Owner, Free Time and Hobbies, Traditionalist, Woodland Retreat, Nontimber, Private Consumer, Enthusiasts	21
Passive	Passive Owner, Indifferent Farmer, Disinterested Owner, Jane Doe, Ready to Sell, Individualists	13
Multiobjective	Multiobjective Owner, Multifunctional, Part-time/Previous Farmers, Working the Land	15

Categories are from Boon et al. (2004) and Urquhart and Courtney (2011); $n = 25$. Two articles were excluded for relevance only to cross-boundary cooperation and not land management objectives or timber harvesting.

Christine Conte



Preliminary field season suggests that nymphal *I. scapularis* abundance is lower at sites harvested recently (0-5 yrs ago) compared to a control site harvested >20 yrs ago

Questions?

Effects of Silviculture on Lyme Dynamics

1A. Clearcutting
1B. Shelterwood
1C. Groups
1D. Thinning
1E. Unmanaged

2A. Temperature
2B. Humidity
2C. Leaf litter cover

1. Silviculture treatment

2. Microhabitat Features

3. Wildlife Communities

4. Tick Abundance

5. TBD Prevalence

6. TBD Exposure Risk

H1

H2

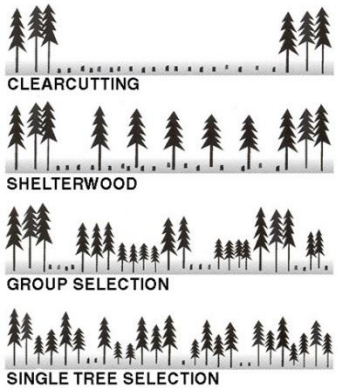
H3

H4

H5

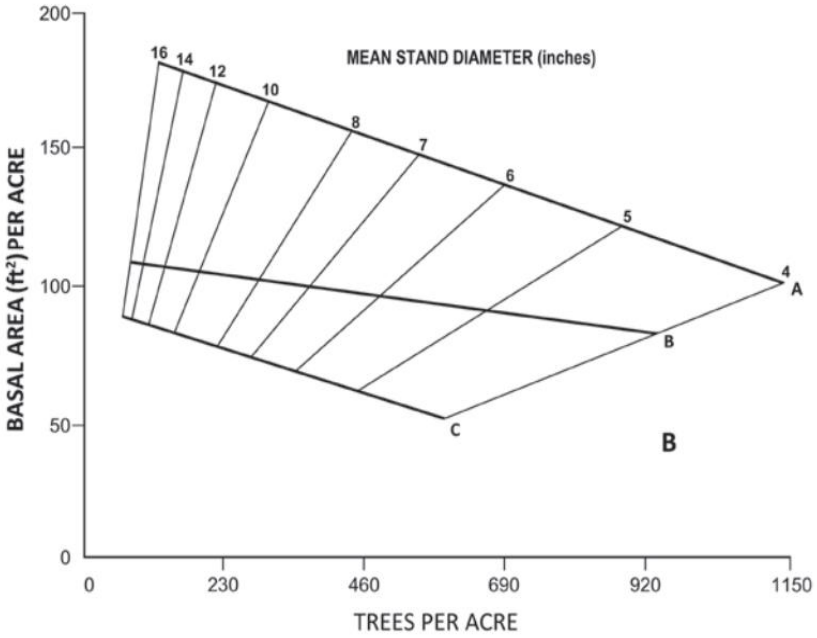
H6

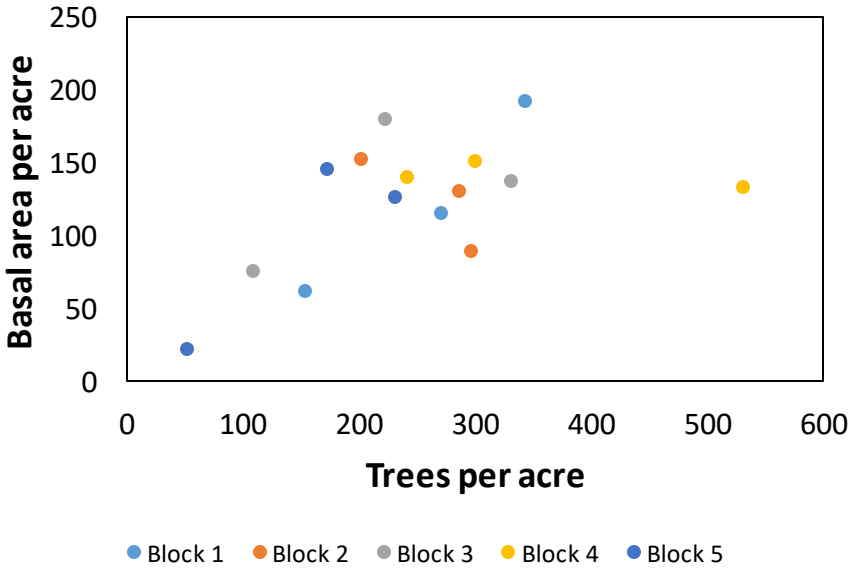
H7



3A. Vertebrate host diversity
3B. White-footed mouse density
3C. White-tailed deer density

Timber Harvesting and Ticks

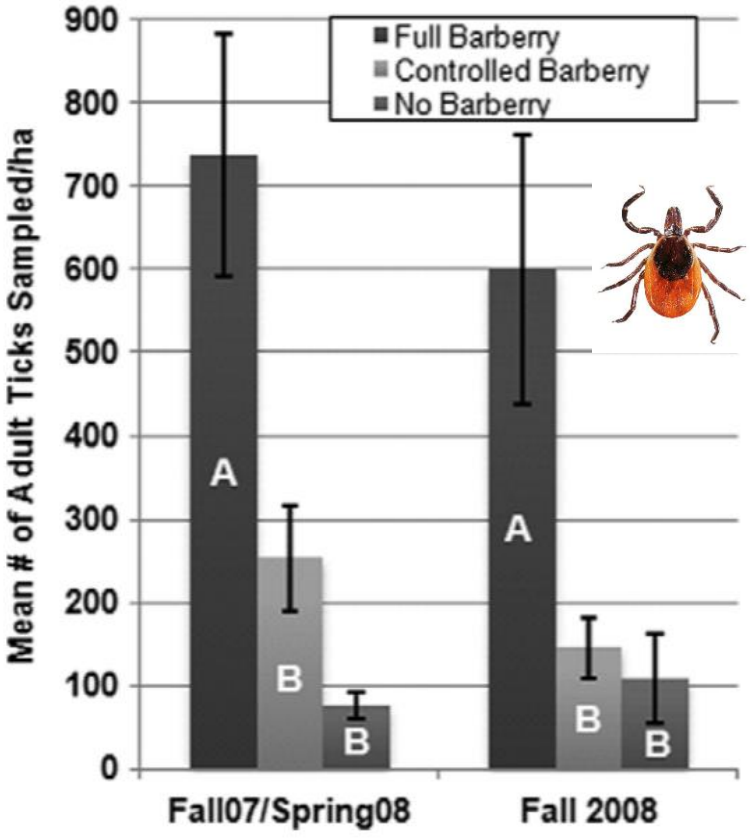




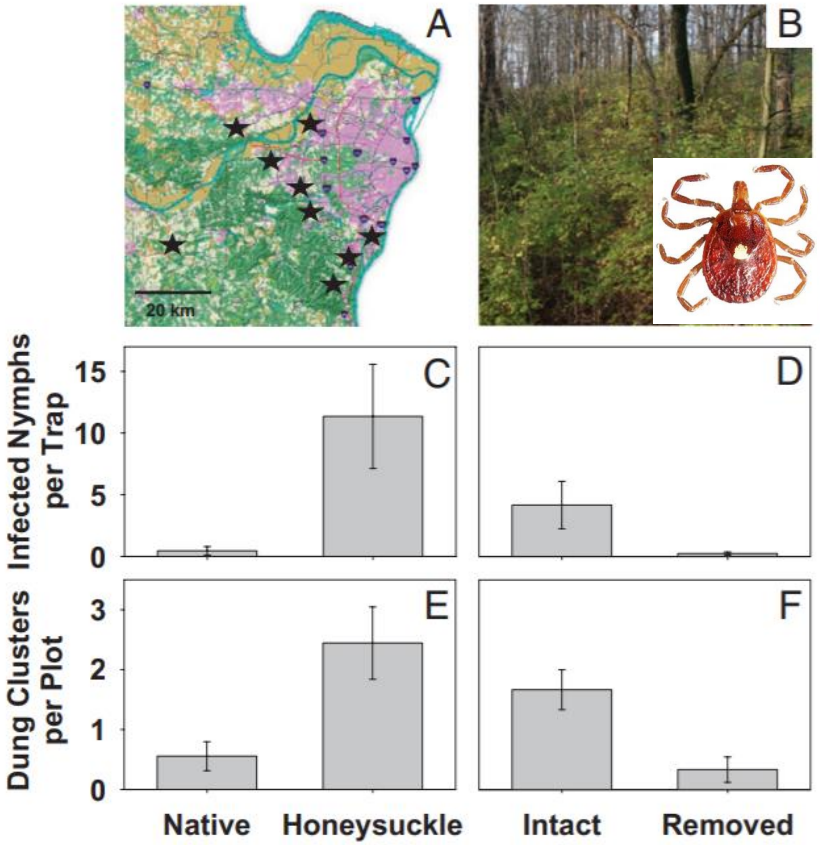
--Vegetation measurements
--Off-host tick dragging
--Small mammal trapping
--Trail camera surveys for wildlife
--Temp/humidity monitoring
--Tick-borne pathogen assays

Invasive Plant Removal and Tick Ecology

Numerous previous studies that demonstrate that invasive plant removal reduces tick-borne disease risk by various pathways…



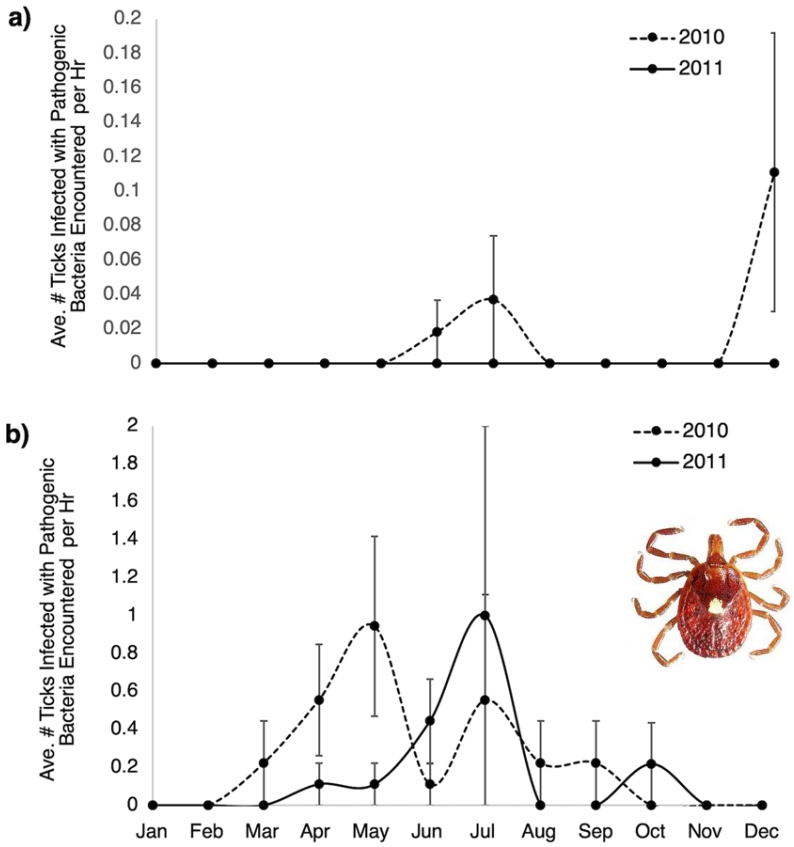
Williams et al. 2009, *Environ Entomol* 38: 977-84



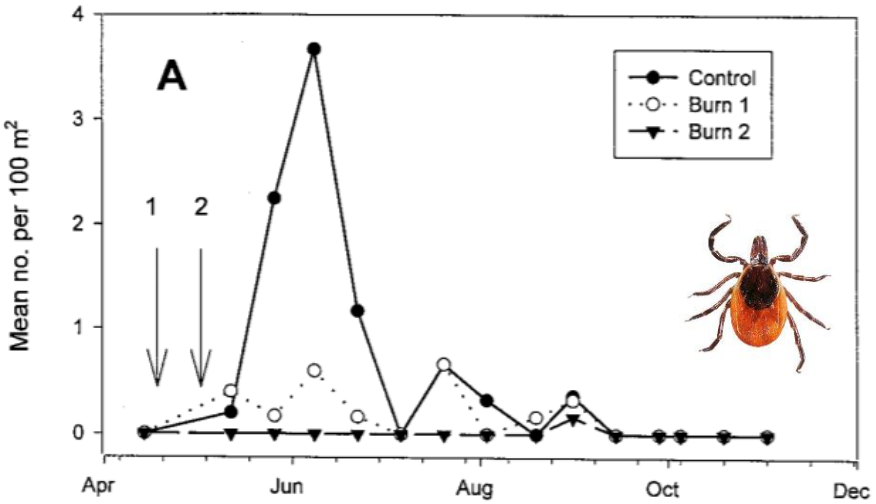
Allan et al. 2010, *PNAS* 107: 18523-27

Prescribed Burns and Tick Ecology

Tick densities also are reduced in the immediate aftermath of prescribed burns, although they may rebound…



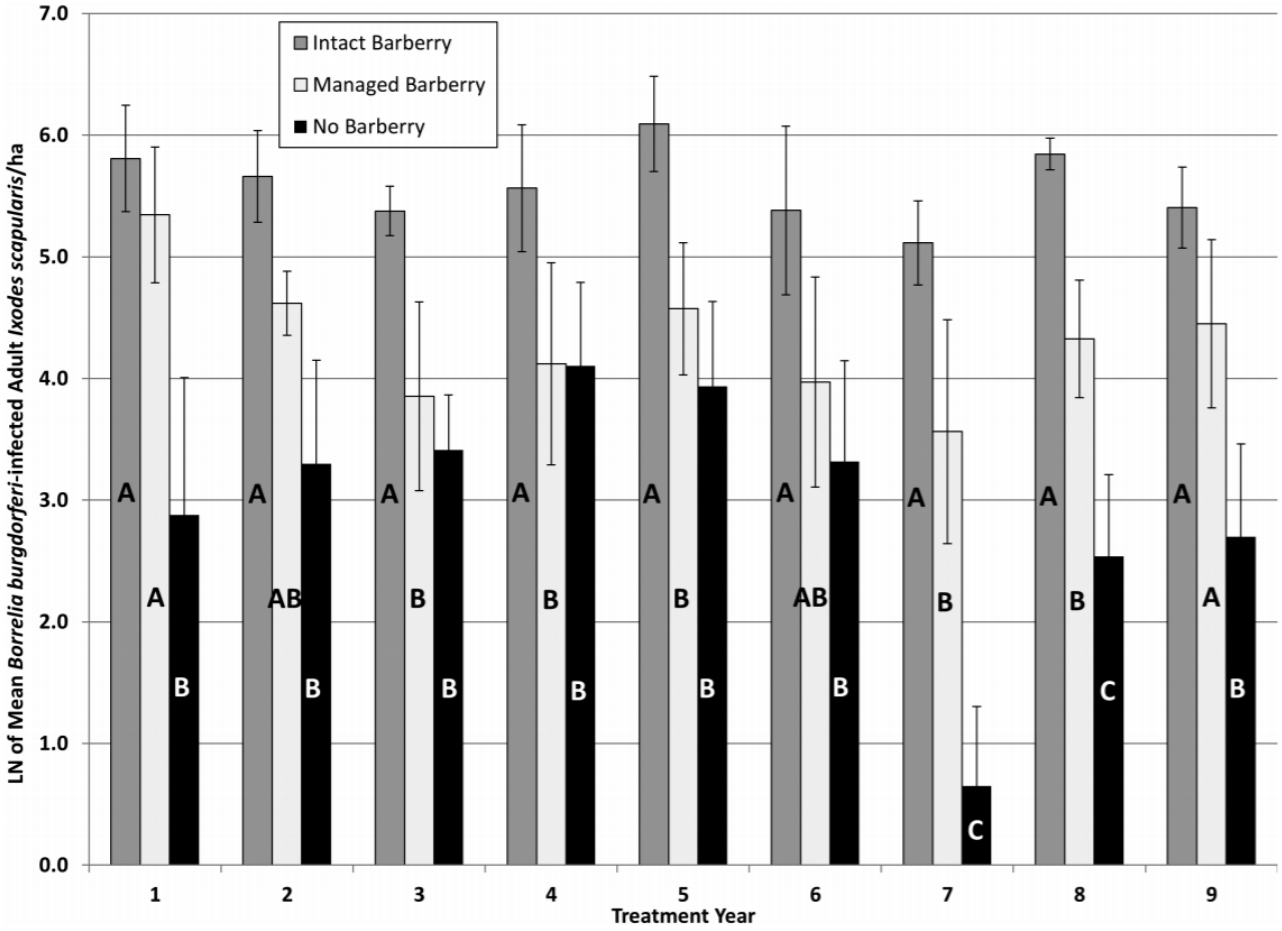
Gleim et al. 2019, *Sci Rep* 9: 9974



Stafford et al. 1998, *J Med Entomol* 35: 510-13

Temporal Dimensions of Management

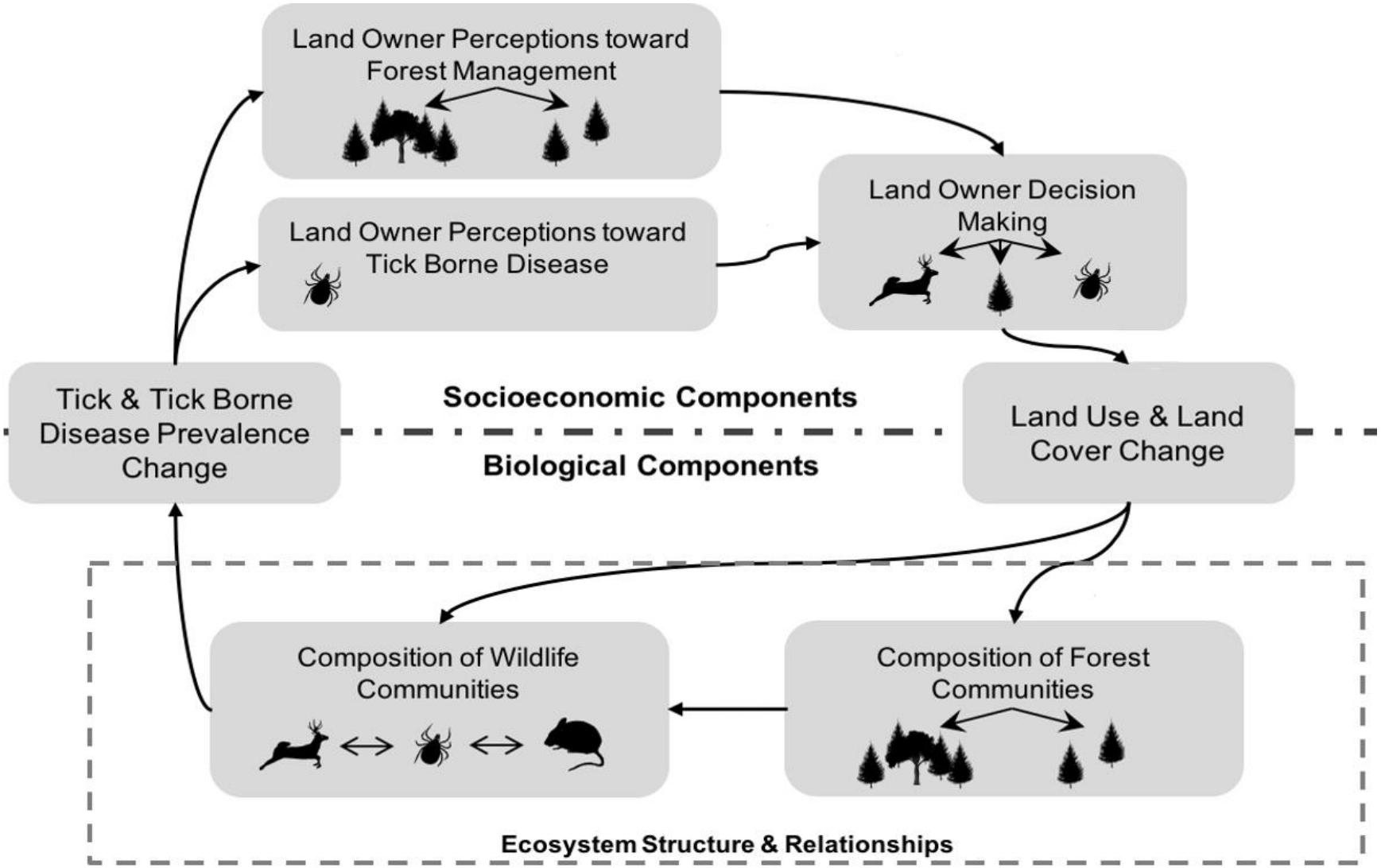
- There is a strong temporal dimension to the impacts of active forest management on tick-borne disease transmission
- Management must occur regularly for benefits to be maintained



Williams et al. 2017, *Environ Entomol* 46: 1329-38

Questions?

Lyme Disease as a Socio-Ecological System



Landowner Attitudes and Practices

Goal: Characterize the ways in which private woodlot owners incorporate tick-borne disease prevention into their woodlot management decisions currently, and how willing they would be to adapt their management behavior to reduce the risk of tick-borne disease exposure in the future

Please indicate the frequency of your past and future tick bite prevention practices. *Circle one number for each statement.*

Last month, when I visited nature I…	Never	Occasionally	Sometimes	Usually	Always
Dressed in protective clothing.	1	2	3	4	5
Used insect repellent.	1	2	3	4	5
Performed a tick check.	1	2	3	4	5

LOCATION	METHOD	SAMPLE SIZE	RESPONDENTS	RESPONSE RATE
NEW GLOUCESTER	DOPU	86	55	69%
	Mailing	104	34	33%
	Total:	**190**	**89**	**47%**


Lyme Disease and Land Management Study

USDA

THE UNIVERSITY OF MAINE

Citizen Science: Maine Forest Tick Survey

MAINE FOREST TICK SURVEY

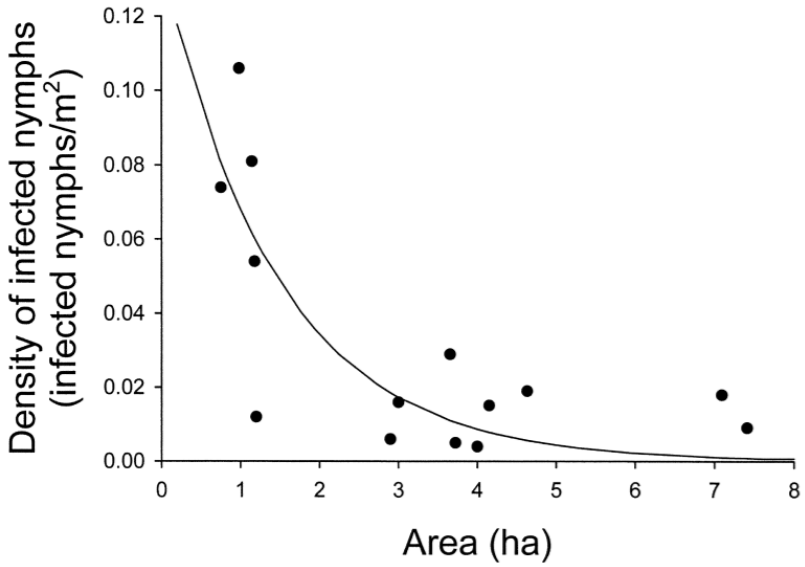

Elissa Ballman

- Active tick surveillance citizen science project
- 125 citizen scientist participants enrolled in Summer 2020 and an additional 125 will be enrolled in Summer 2021
- All citizen scientists located in southern and coastal Maine and own woodlots >10 acres
- Participants drag for ticks on their own land at least four times throughout the summer
- Participants also fill out questionnaires about their property management history and forest management decision-making
- UMaine students identify ticks to species and conduct pathogen testing

Behind the Scenes and in the Field . . .

MAINE FOREST TICK SURVEY

Ticks and Forests at the Landscape Scale



Allan et al. 2003, *Cons Biol* 17: 267-72

- Much of landscape-scale research concerning human management of forests focuses on forest fragmentation in suburban environments
- Future research should address how mosaics of management practices on individual forested properties alter tick-borne disease risk at landscape scales
- As well, how social networks among landowners influence adoption of practices that benefit human health

Questions?

Some Questions for You

Find a Colleague

- To post a profile about yourself and your work:
- http://neipmc.org/go/APra
- “Find a Colleague” site
- http://neipmc.org/go/colleagues

Upcoming Webinars

- **Tick IPM #5: Pathogens Found in Ticks Collected on School Grounds and Public Parks**

  Drs. Jody Gangloff-Kaufmann, Joellen Lampman, Matt Frye, NYS IPM Program. Dr. Laura Goodman, College of Veterinary Medicine, Cornell University. September 14, 2020, 1:00 p.m.

- **Tick IPM #6: Host-Targeted Tick Control – What Works, What Doesn't, and What's New**

  Dr. Andrew Li, Research Entomologist, USDA-ARS Invasive Insects Biocontrol and Behavior Laboratory, Beltsville, MD. September 30, 2020, 11:00 a.m.

- **Tick IPM #7: Leaf Litter/Snow Removal for Tick Reduction**

  Dr. Kirby C. Stafford III, Connecticut Agricultural Experiment Station, October 7, 2020, 11:00 a.m.

For Updates: https://www.northeastipm.org/ipm-in-action/the-ipm-toolbox/

Recording of Tick IPM Webinar Series

- Past recordings and today's Webinar will be available to view **on demand** in a few business days.
- http://www.neipmc.org/go/ipmtoolbox
- You can watch as often as you like.

Acknowledgments

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