



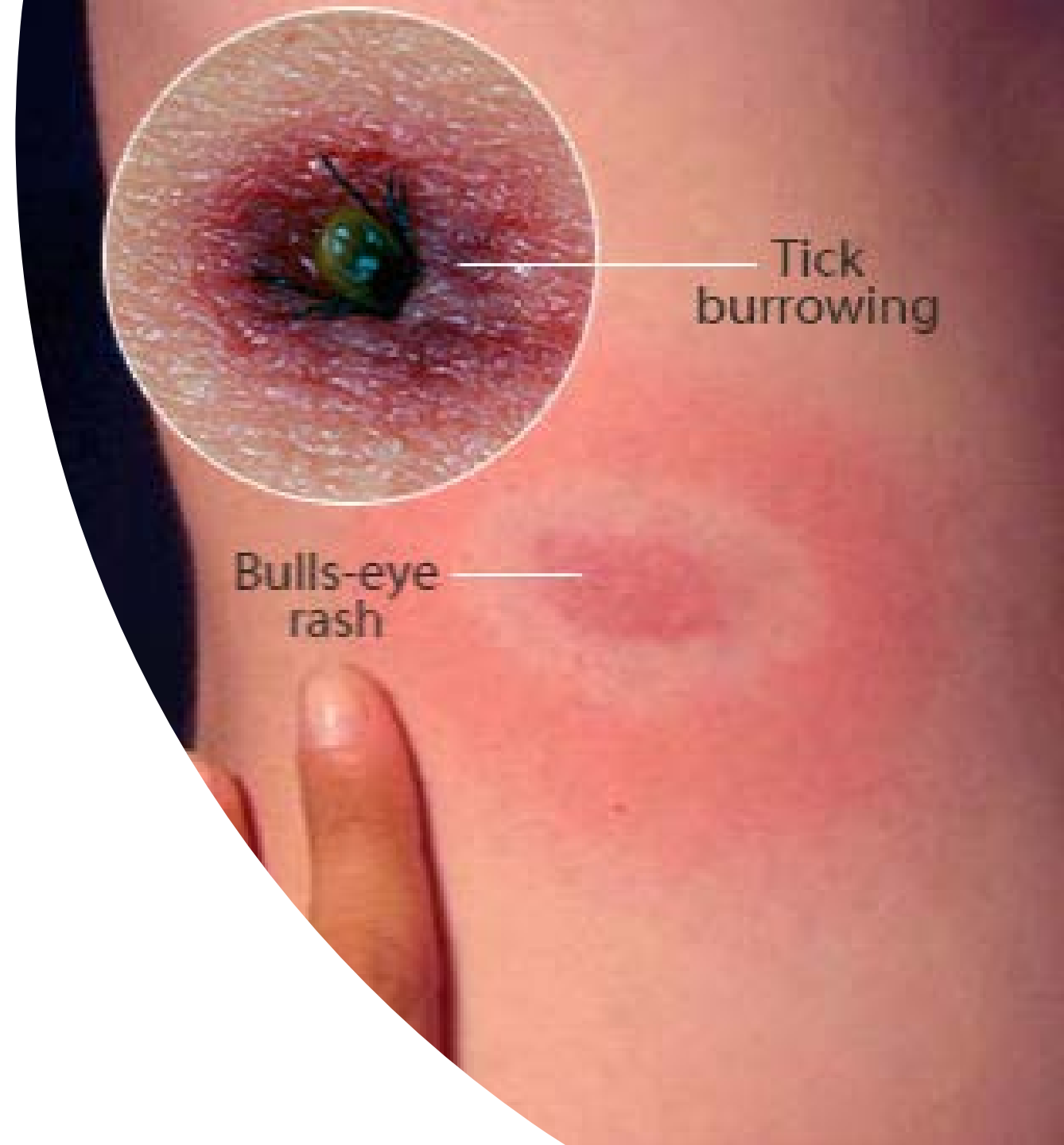
Spread of Lyme disease into NC from VA: Tick survey along the VA/NC border

Presented by : Jimmie Teague

Advisor: Dr. Gideon Wasserberg

Committee Members: Dr. Olav Rueppell, Dr. Brian Byrd,
Dr. Lorenza Beati

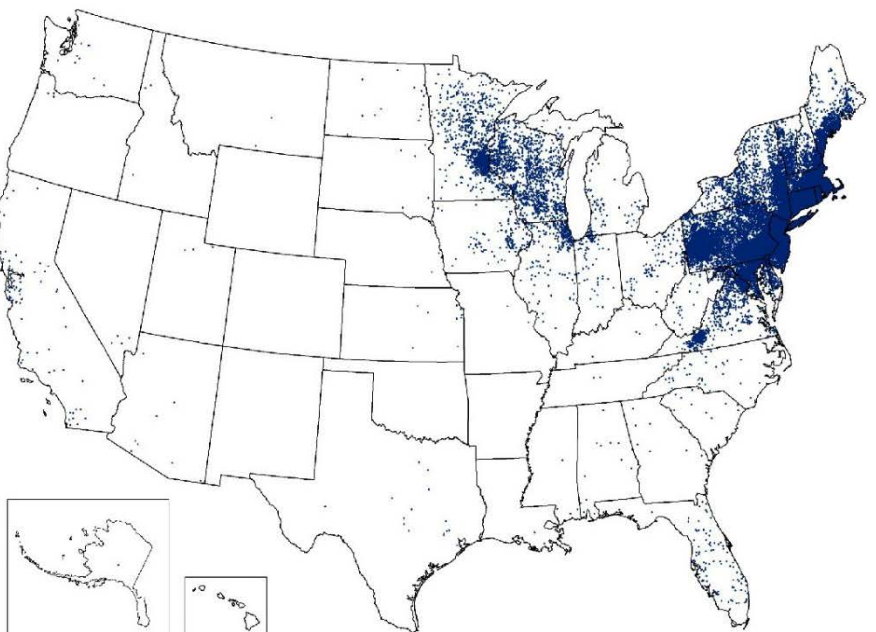
Lyme Disease



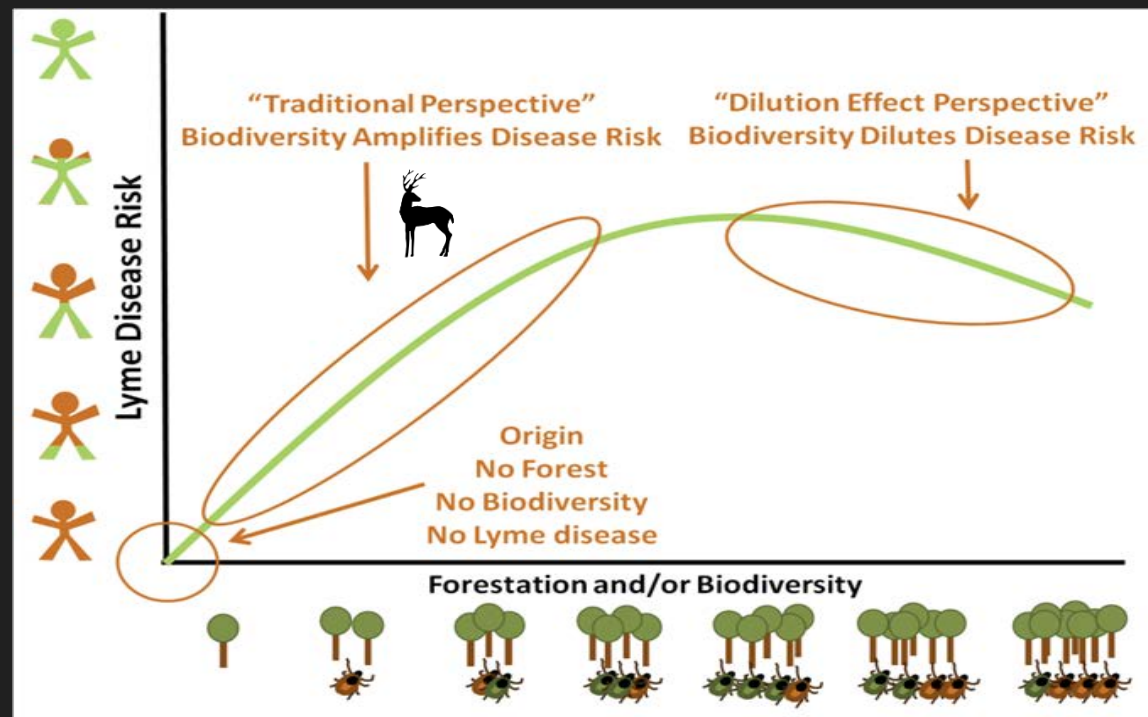
Reported Cases of Lyme Disease—United States, 2001



Reported Cases of Lyme Disease—United States, 2015




LD Emergence:



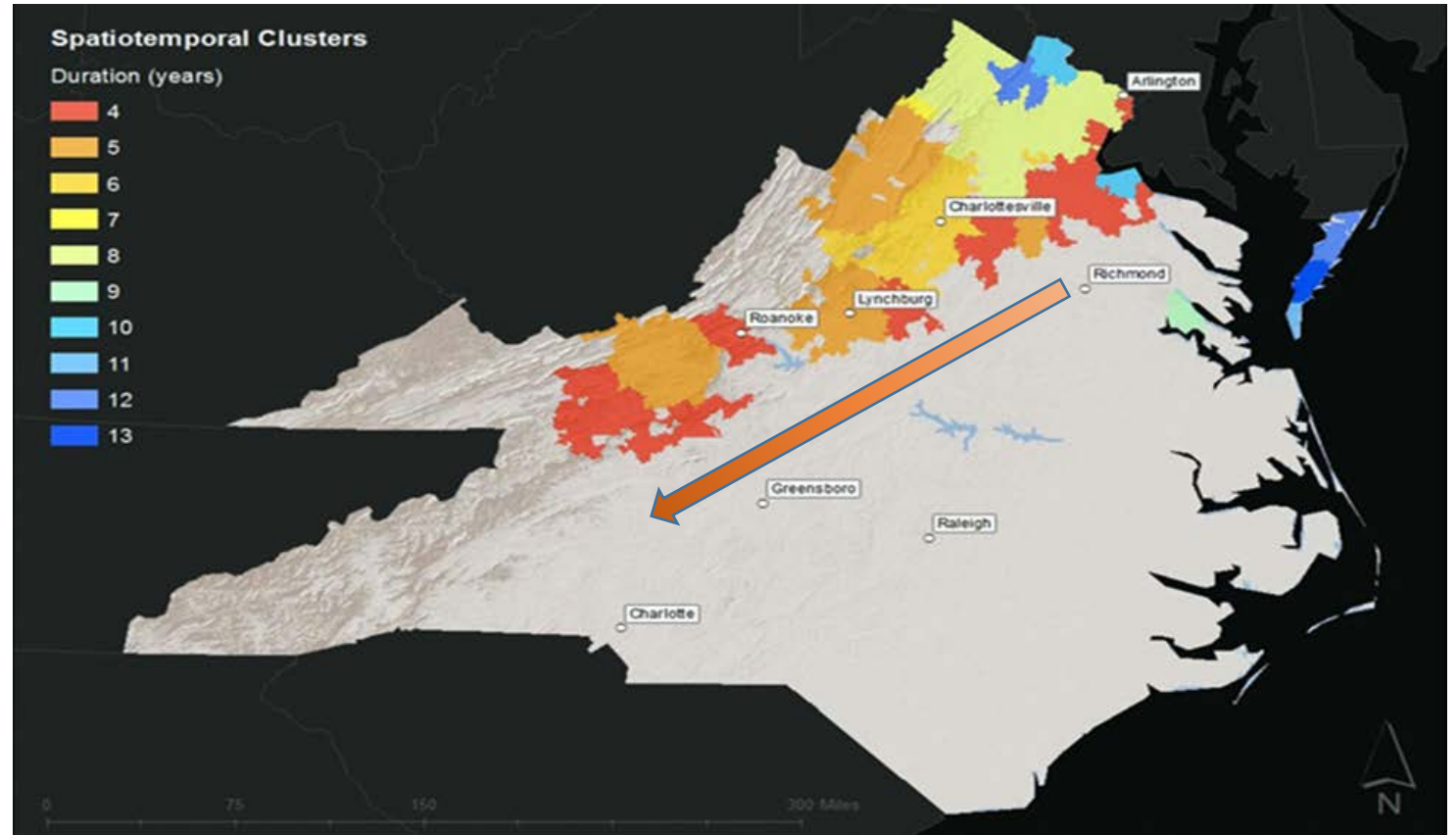
- Reforestation
- Fragmented Forested Landscape
- Habitat Generalist White-footed Mouse
- Deer Populations Thrive



Geographical LD Spread

- Highest Vector-Borne and Fifth Nationally Notifiable Disease in the Country
 - Herrin and Brinkerhoff (2014) suggest LD spread is linked to expansion of vector
- 

Possible Route of LD Expansion



- Lantos et al. 2015
 - Cluster analysis of Reported LD Cases in Virginia
 - Years Covered 2000 – 2014
- Disease cluster shows Northeast to Southwest spread pattern

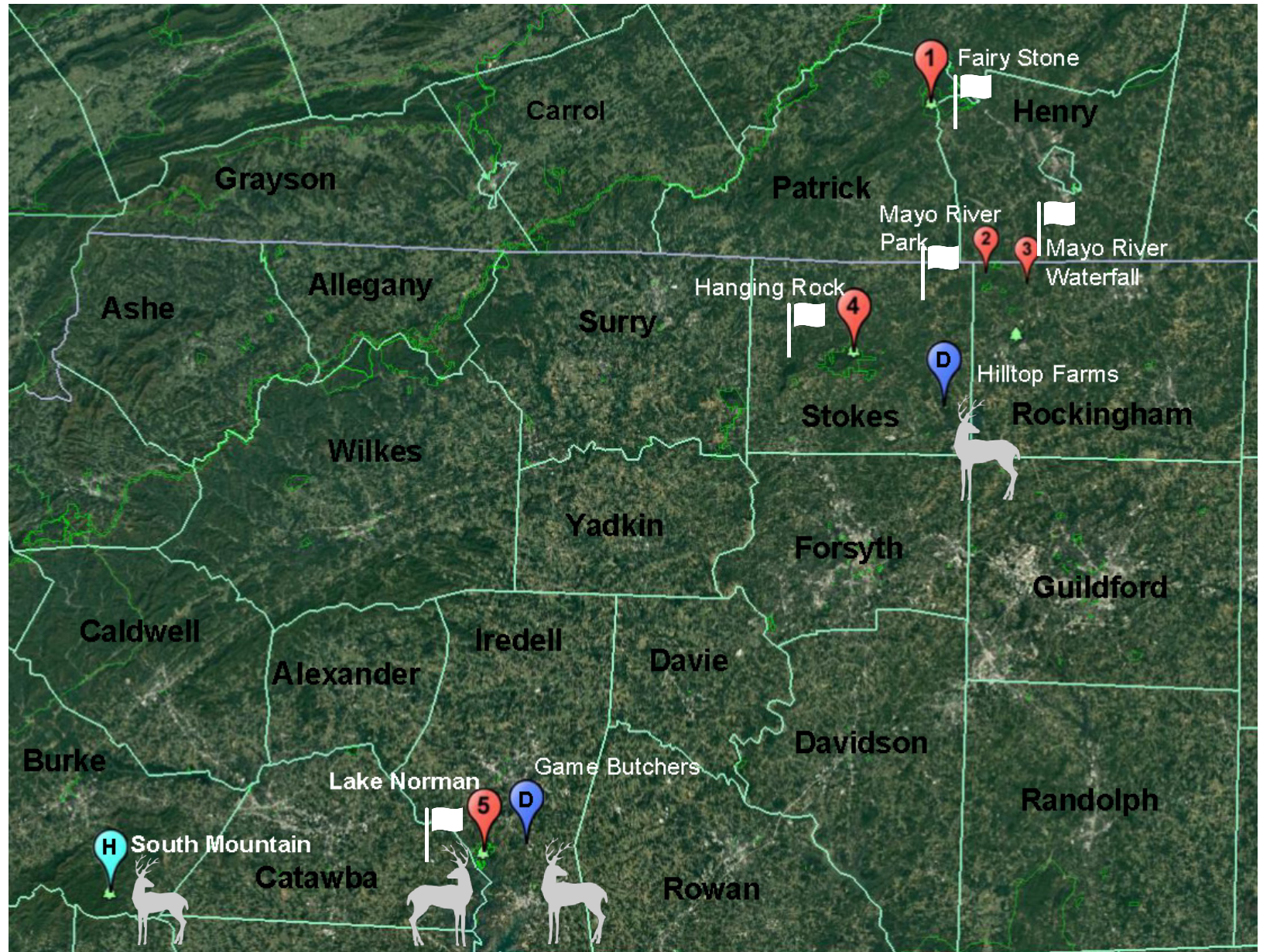
Current Knowledge

- LD Expanding
- Number of Human Cases Increasing
- No entomological information is available regarding the distribution and abundance of the vector – *I. scapularis*

Study Goal

Characterize the entomological risk of LD spread from VA into NC.

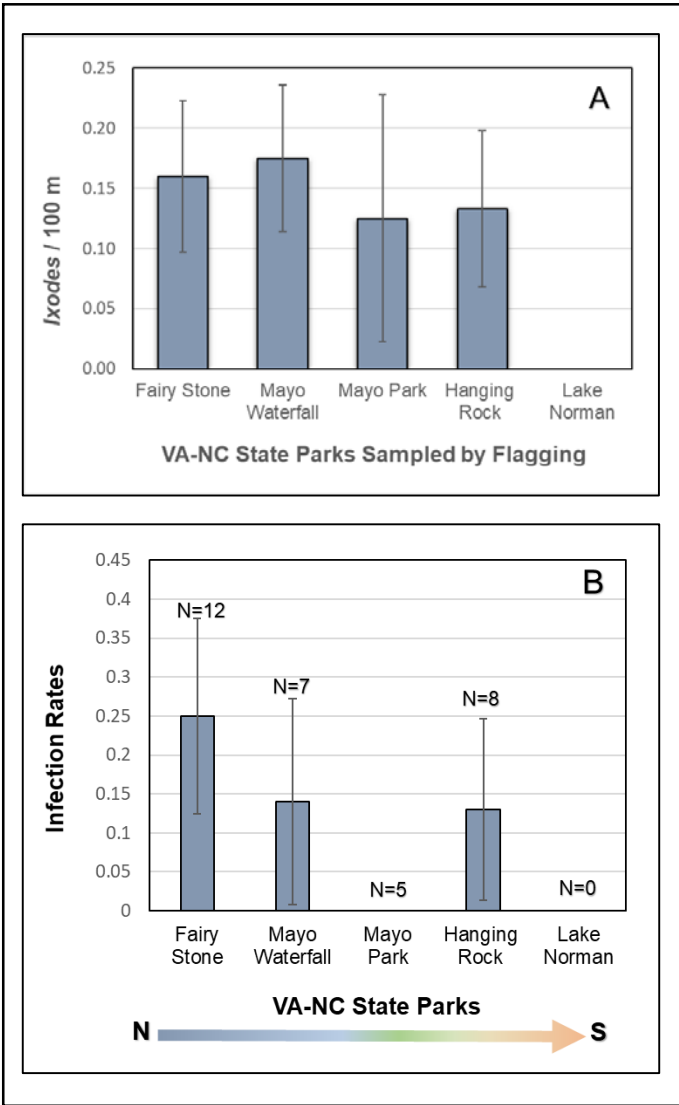
Strategy & Study Sites



The image features a dark gray background with three overlapping circles in shades of blue. A white horizontal band runs across the center, containing the word "Results" in a dark blue, sans-serif font.

Results

Tick Flagging



Abundance:

- Highest Collected North-Most Parks
- Absent Lake Norman State Park

Infection Rates:

- North-to-South Trend
- Lake Norman (Iredell County) No Information Available

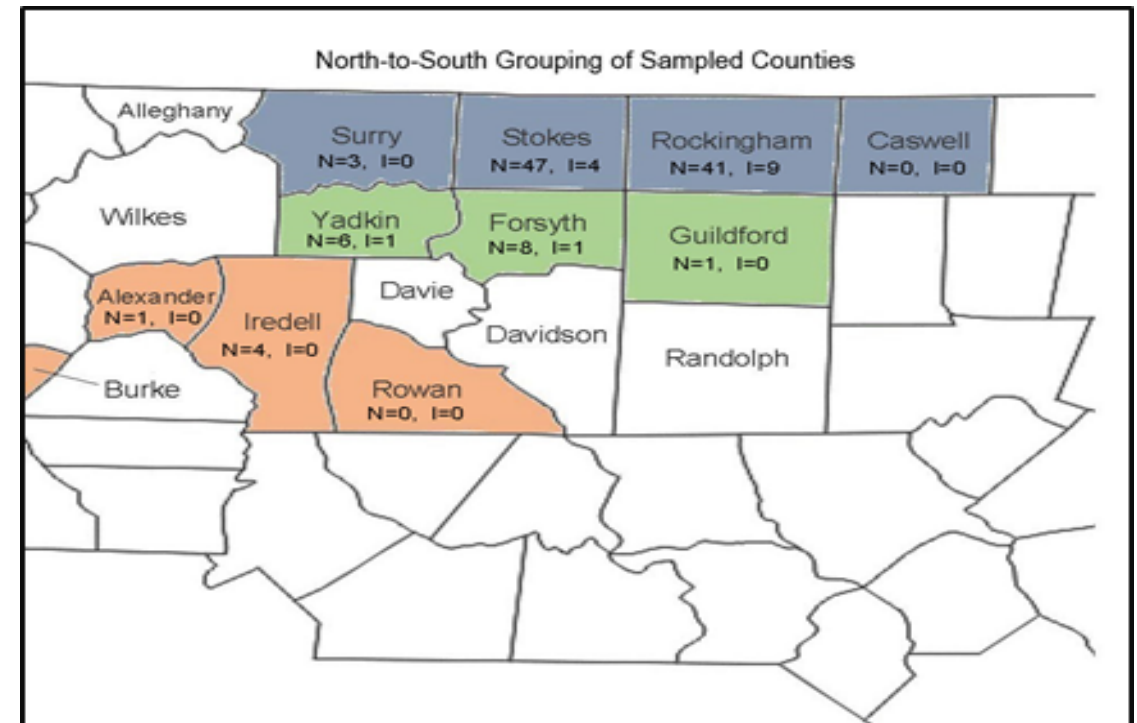
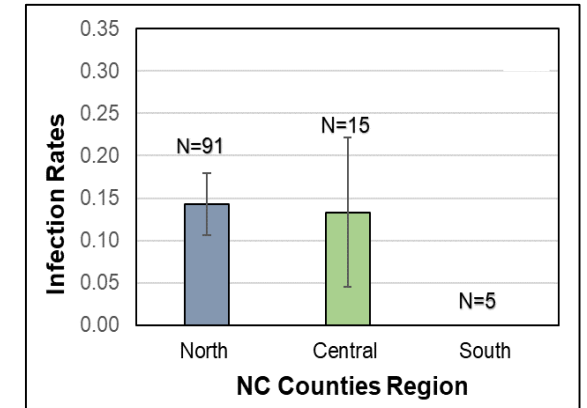
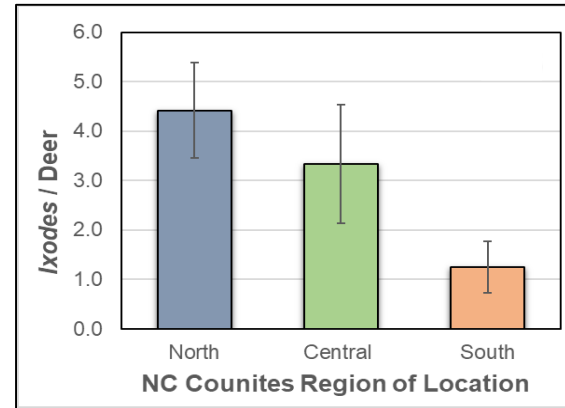
Hunter-Harvested Deer

Abundance:

- Grouping of Counties
- Trend of North-to-South Decrease in Tick Burden
- Seems Consistent With Flagging Data
- Contrast With Flagging Data

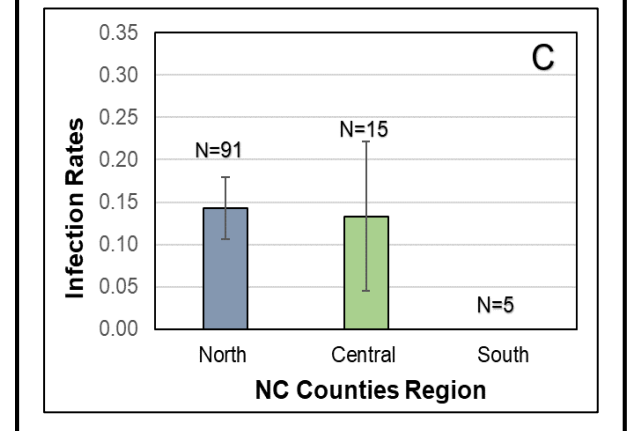
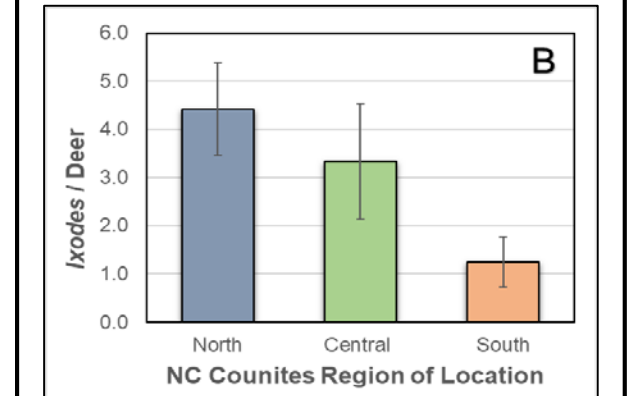
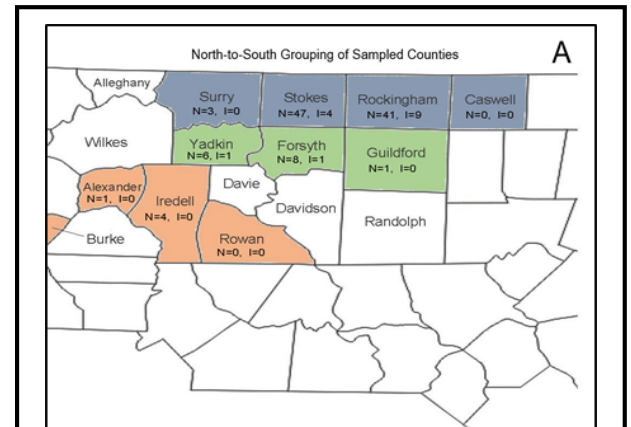
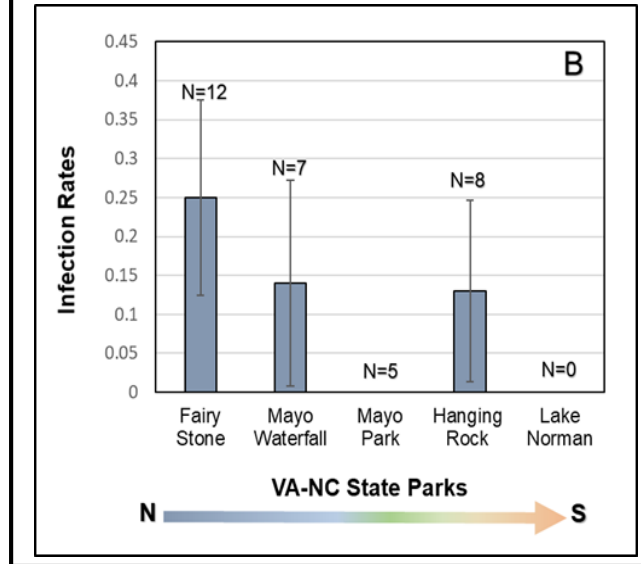
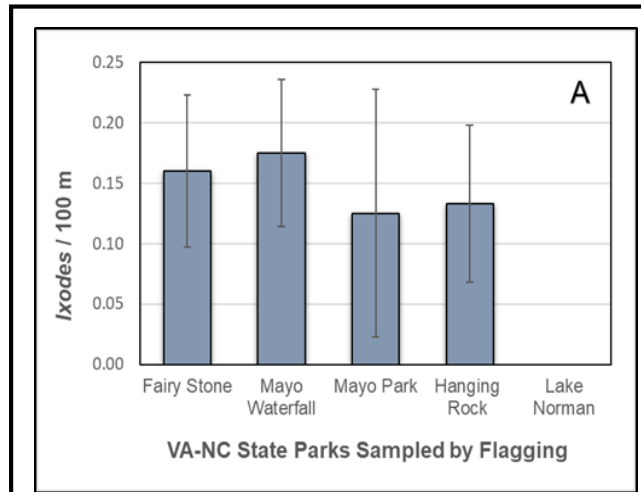
Infection Rates:

- Similar (14-13%) Northern, Central Counties
- No Detection Southern Counties (N=5)
- County Level
 - Rockingham 22%
 - Yadkin 17%
 - Forsyth 13%

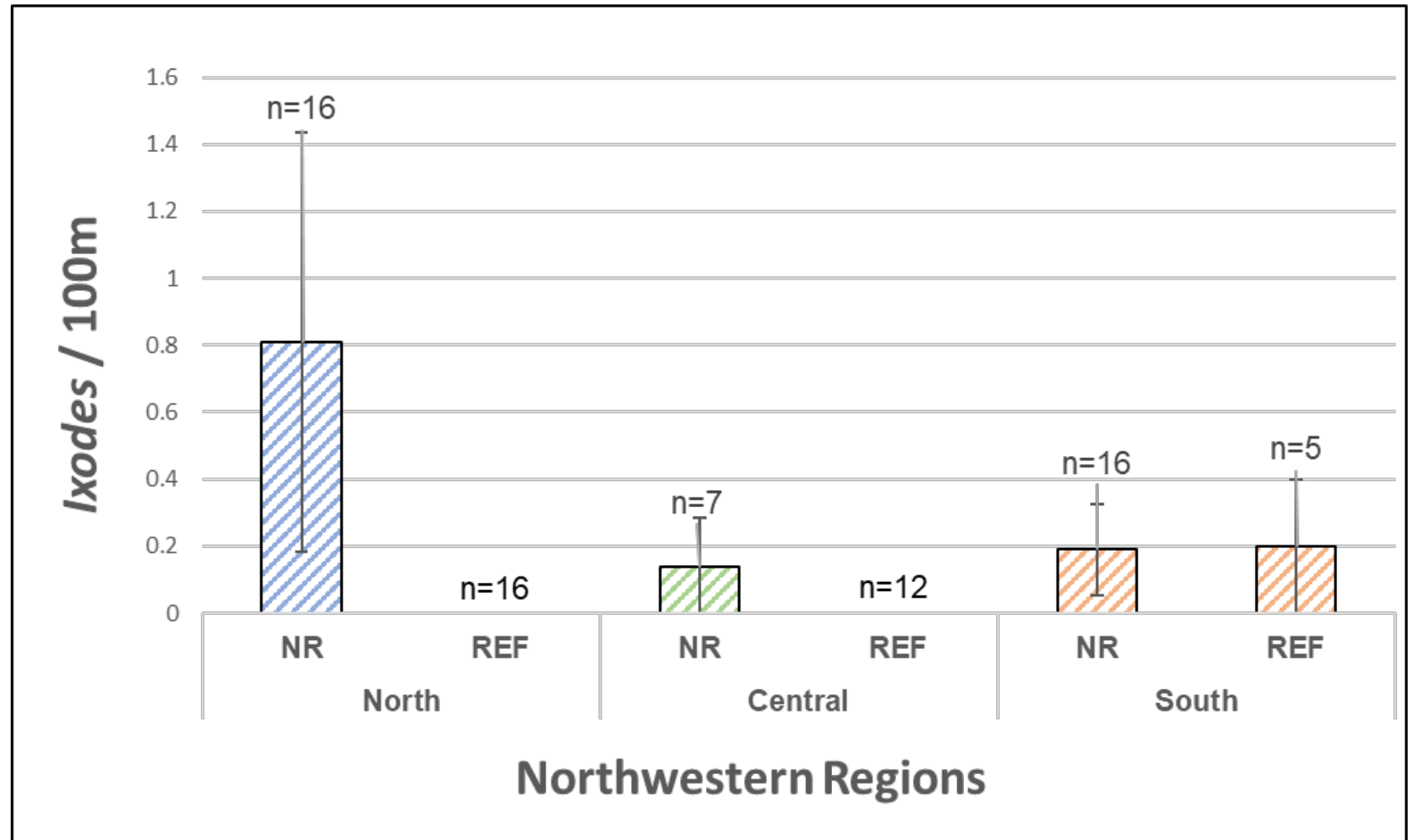


Preliminary Interpretations

- Implies North-to-South gradient in *I. scapularis* densities
- Suggest North-to-South distribution of *B. burgdorferi* infection
- Entomological Risk



Tick Surveillance in Northwestern North Carolina



Screening for Other
Pathogens:

- Rockingham County
 - 2 Ticks (5%) *Borrelia miyamotoi* (Tick-Relapsing Fever)
 - 8 Ticks (20%) *Anaplasma phagocytophilum* (Anaplasmosis)
 - 1 Tick (2%) Coinfection For
 - *B. burgdorferi*, *A. phagocytophilum*
 - 1 Tick (2%) Coinfection For
 - *B. miyamotoi*, *A. phagocytophilum*
- *A. phagocytophilum*
 - 1 Forsyth County (13%)
 - 2 Stokes County (4%)

Deer Location	Entomological Classification	
	2015 Classification	2017 Classification
Surry	Reported Occurrence	Established Populations
Stokes	Established Populations	Established Populations
Rockingham	Absence of Ticks	Established Populations
Caswell	Absence of Ticks	Reported Occurrence
Yadkin	Absence of Ticks	Established Populations
Forsyth	Reported Occurrence	Established Populations
Guilford	Reported Occurrence	Reported Occurrence
Burke	Absence of Ticks	Absence of Ticks
Alexander	Absence of Ticks	Reported Occurrence
Iredell	Absence of Ticks	Reported Occurrence
Rowan	Established Populations	Absence of Ticks

Future Direction

- Role of Topographic Corridors
- Anthropogenic Forested Fragmentation
- Local Vector-Host Interactions

Wrap-up

Funding By:

- UNCG Graduate Research Grant
- NCDHHS

- Biology Department
- Wasserberg's Lab
 - Graduate Students
 - Undergraduate Students
 - AHA
- NCDHHS
 - Carl Williams
 - Alexis Barbarin
- NCWLRC
 - James Tomberlin
- NC State
 - Charles Apperson



Special Thanks

Thesis Committee:

- Dr. Gideon Wasserberg (Advisor)
- Dr. Olav Rueppell
- Dr. Brian Byrd
- Dr. Lorenza Beati

Questions

