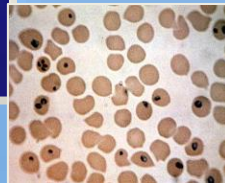


Veterinary Services: Vectors, Vector-borne Diseases, and Animal Health



Vector and Vector-borne Disease Activities



- ❖ Data Management
- ❖ Application and Analyses
- ❖ Stakeholders Community and Communication
- ❖ Evaluation and Decision Making

Veterinary Services': High Priority vector-borne diseases of horses, cattle, sheep, goats, and swine



Vector Group	Equine	Cattle	Sheep/Goats	Swine
Ticks	<ul style="list-style-type: none"> • Endemic: <ul style="list-style-type: none"> ○ Anaplasmosis ○ Ehrlichiosis ○ Lyme disease • FAD: <ul style="list-style-type: none"> ○ Equine piroplasmosis ○ African Horse Sickness ○ Louping ill 	<ul style="list-style-type: none"> • Endemic: <ul style="list-style-type: none"> ○ Babesiosis ○ Anaplasmosis ○ Ehrlichiosis • FAD: <ul style="list-style-type: none"> ○ Heartwater ○ East Coast fever ○ Louping ill 	<ul style="list-style-type: none"> • Endemic: <ul style="list-style-type: none"> ○ Anaplasmosis • FAD: <ul style="list-style-type: none"> ○ East Coast fever ○ Nairobi sheep disease ○ Louping ill 	<ul style="list-style-type: none"> • FAD: <ul style="list-style-type: none"> ○ African swine fever
Mosquitos	<ul style="list-style-type: none"> • Endemic: <ul style="list-style-type: none"> ○ West Nile virus ○ Eastern equine encephalitis ○ Sporadic ○ St. Louis encephalitis ○ Western encephalitis • FAD: <ul style="list-style-type: none"> ○ Venezuelan equine encephalitis ○ Japanese encephalitis ○ African Horse sickness 	<ul style="list-style-type: none"> • FAD: <ul style="list-style-type: none"> ○ Rift Valley fever 	<ul style="list-style-type: none"> • Endemic: <ul style="list-style-type: none"> ○ Cache Valley fever virus • FAD: <ul style="list-style-type: none"> ○ Rift Valley fever 	<ul style="list-style-type: none"> • FAD: <ul style="list-style-type: none"> ○ Japanese encephalitis
Sand flies and Black flies	<ul style="list-style-type: none"> • Sporadic, limited distribution: <ul style="list-style-type: none"> Vesicular stomatitis virus 	<ul style="list-style-type: none"> • Sporadic, limited distribution: <ul style="list-style-type: none"> Vesicular stomatitis virus 		<ul style="list-style-type: none"> • Sporadic, limited distribution: <ul style="list-style-type: none"> Vesicular stomatitis virus
Tabanids (horse flies, deer flies, and stable flies)	<ul style="list-style-type: none"> • Endemic: <ul style="list-style-type: none"> ○ Equine infectious anemia virus 			
Midges (<i>Culicoides</i> species)	<ul style="list-style-type: none"> • Sporadic, limited distribution: <ul style="list-style-type: none"> Vesicular stomatitis virus • FAD: <ul style="list-style-type: none"> African horse sickness 	<ul style="list-style-type: none"> • Endemic: <ul style="list-style-type: none"> Bluetongue virus • Sporadic, limited distribution: <ul style="list-style-type: none"> Vesicular stomatitis virus • FAD: <ul style="list-style-type: none"> Schmallenberg virus 	<ul style="list-style-type: none"> • Endemic: <ul style="list-style-type: none"> Bluetongue virus • FAD: <ul style="list-style-type: none"> Schmallenberg virus 	<ul style="list-style-type: none"> • Sporadic, limited distribution: <ul style="list-style-type: none"> Vesicular stomatitis virus
Calliphorids (<i>Cochliomyia</i> spp)	<ul style="list-style-type: none"> • FAD: <ul style="list-style-type: none"> Primary or new world screwworm 	<ul style="list-style-type: none"> • FAD: <ul style="list-style-type: none"> Primary or new world screwworm 	<ul style="list-style-type: none"> • FAD: <ul style="list-style-type: none"> Primary or new world screwworm 	<ul style="list-style-type: none"> • FAD: <ul style="list-style-type: none"> Primary or new world screwworm

Vector Surveillance Activities



- ❖ In Veterinary Services, vector surveillance activities include active surveillance with ongoing vector collections from hosts, traps, and vegetation and passive surveillance activities with tick and screwworm specimens sent to our NVSL laboratories in Ames, Iowa. The majority of other vector specimens are identified with the support from other federal and state agencies, or universities.

Vector Species Maps:

- State and county-level distributions
- Geographic coordinates – point locations

National History Vector Tables

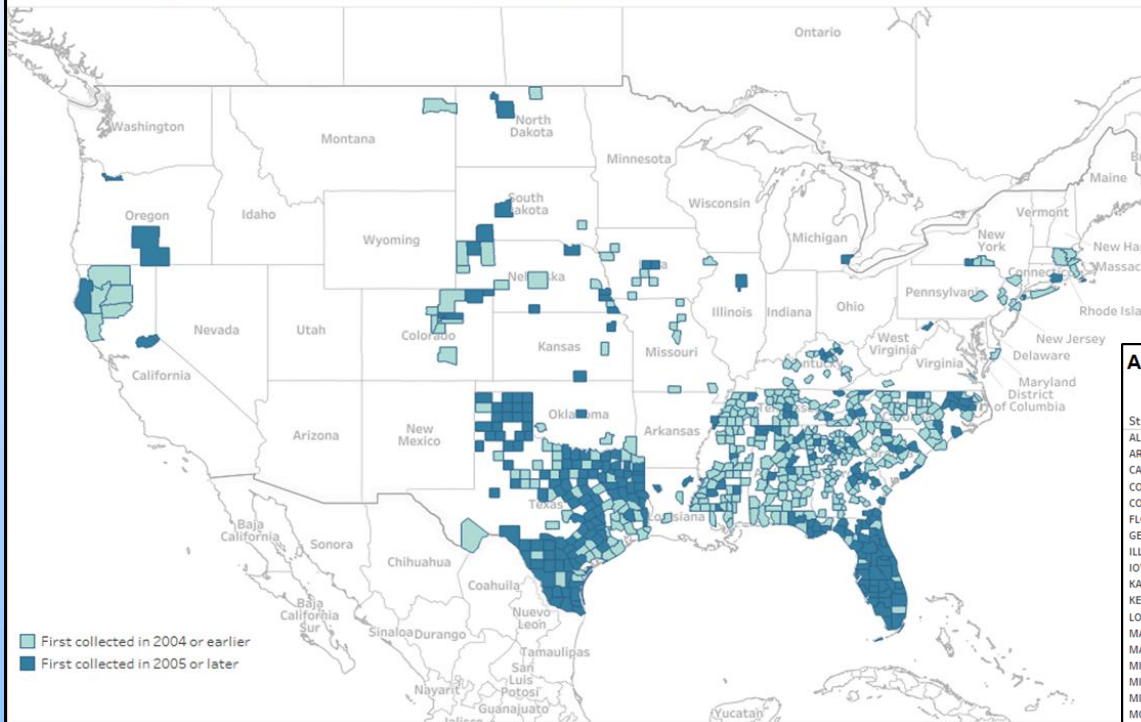
- State and county distributions by month or year
- Host and vegetation associations
- Seasonal activity by life stage (adult, nymph, larva)
- Abundance by life stage

Models of Potential Habitats

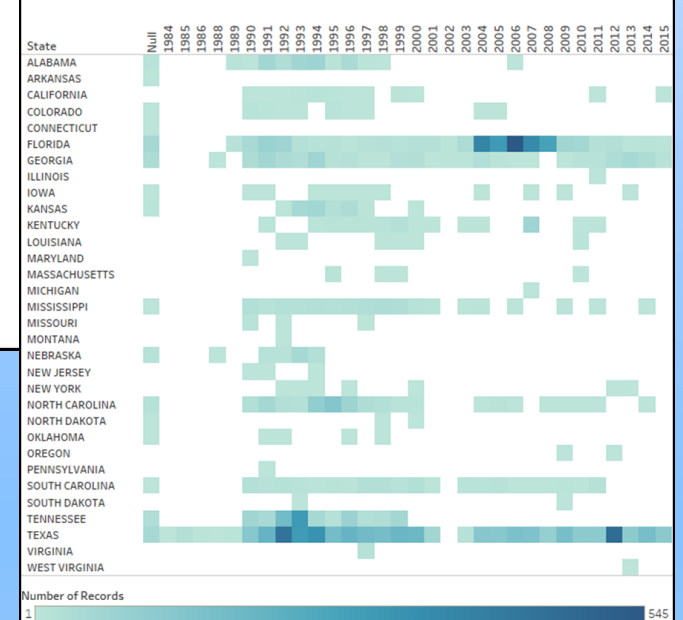
Passive Surveillance – NVSL Data



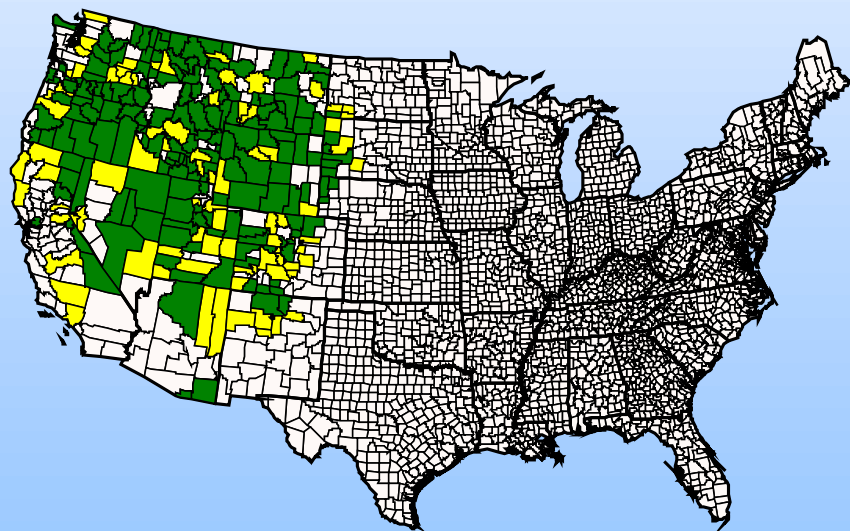
American dog tick collections by County during the years 1984 to 2015



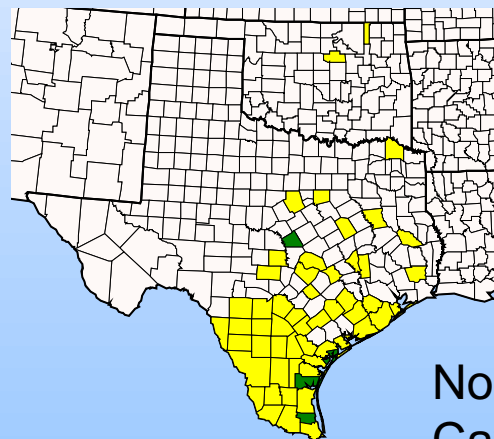
American dog tick collections within each State by Year



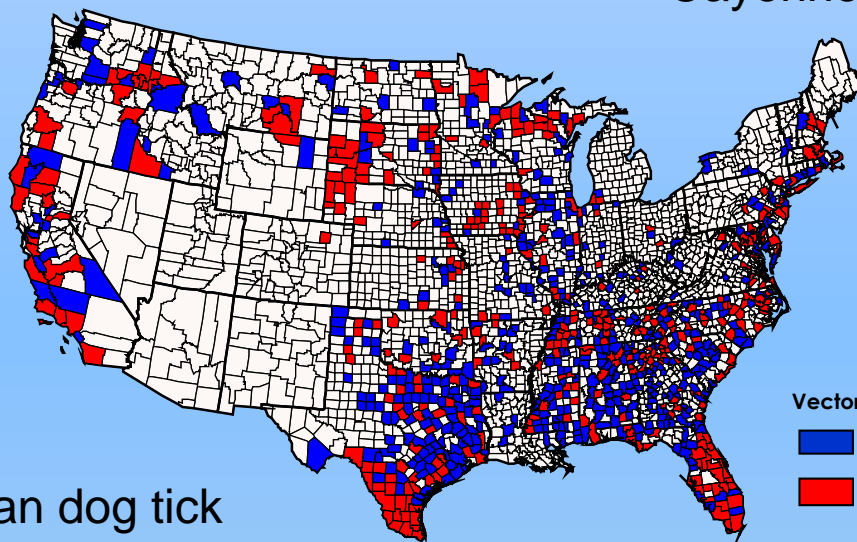
Geographic Distribution of Ticks Across the United States



Rocky Mountain Wood tick



Northern
Cayenne tick

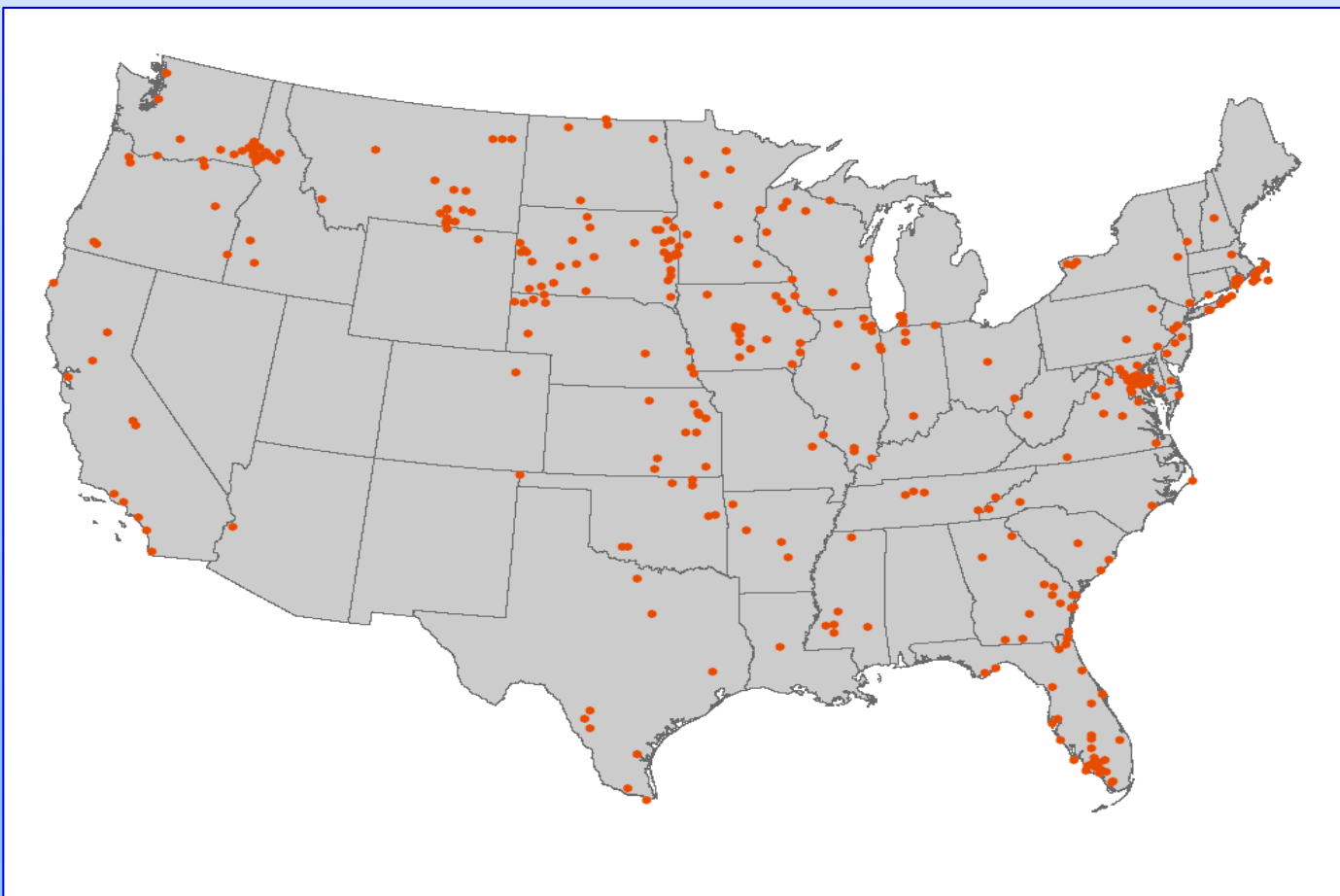


American dog tick

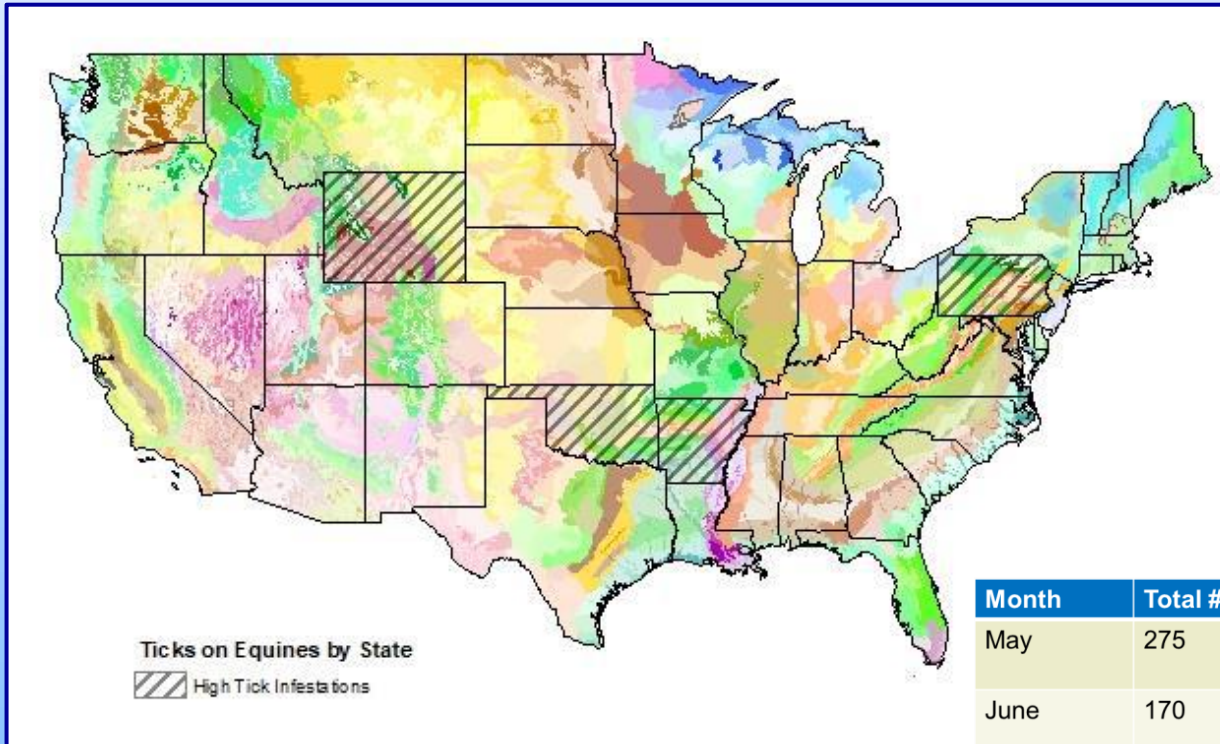
Vector Presence

- Reported
- Established

American Dog Tick Distribution – Geographic Coordinates



Habitat Types and Environmental Factors Associated with Equines and Ticks




Month	Total # of Ticks	Tick Life Stage	*Region
May	275	A, N	South Central Western
June	170	A, N	Northeast Southeast South Central Western
July	104	A, N	Southeast South Central
August	49	A, N, L	South Central Southeast
September	17	A,N	Southeast
October	109	A	Northeast



United States Department of Agriculture


New World Screwworm Story Map


**United States Department of Agriculture**
Animal and Plant Health Inspection Service


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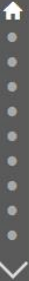
A USDA story map 



New World Screwworm

What is Screwworm?

New World Screwworm disease is an infestation of livestock, or other mammals, with fly larvae (maggots) of the New World screwworm fly (*Cochliomyia*)



Active Surveillance – Southeastern Cooperative Wildlife Study Data And Other Agencies



Site Selection

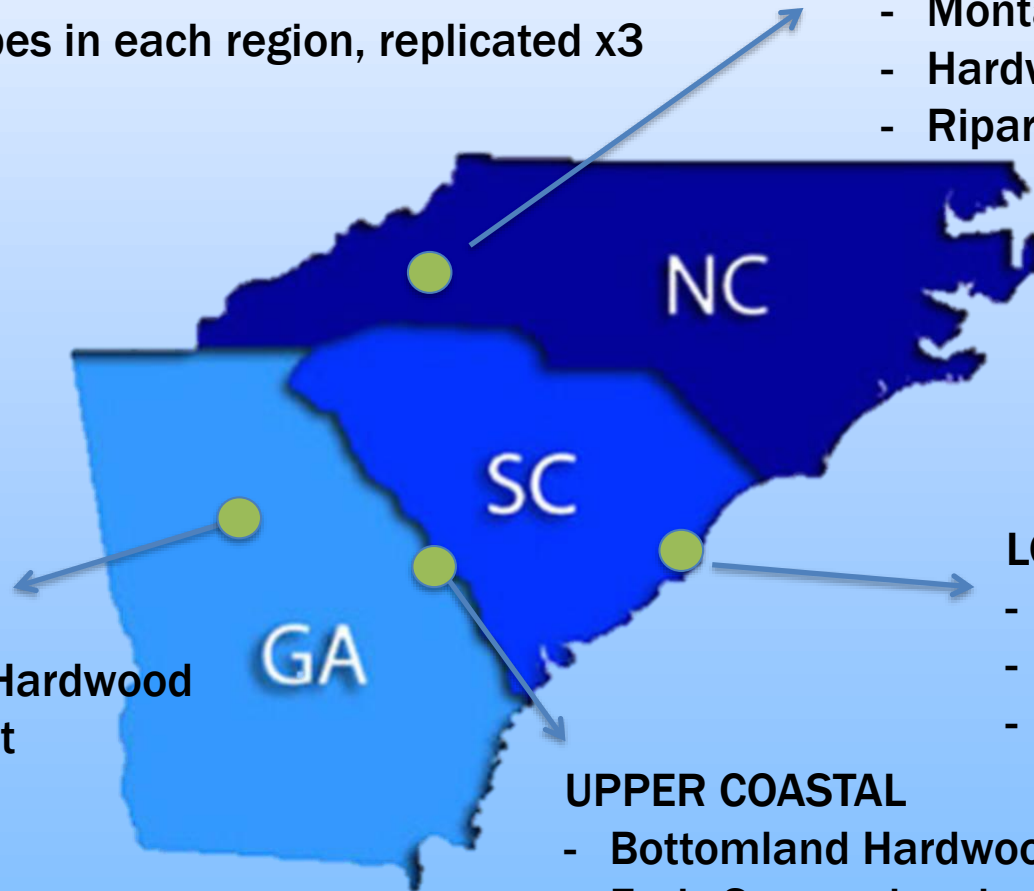
- 3 habitat types in each region, replicated x3

MOUNTAIN

- Montane conifer
- Hardwood Forest
- Riparian Forest

PIEDMONT

- Bottomland Hardwood
- Upland Forest
- Pine



LOWER COASTAL

- Maritime Forest
- Bottomland Hardwood
- Longleaf Pine

UPPER COASTAL

- Bottomland Hardwood
- Early Successional
- Pine

Example of Lower Coastal Habitats



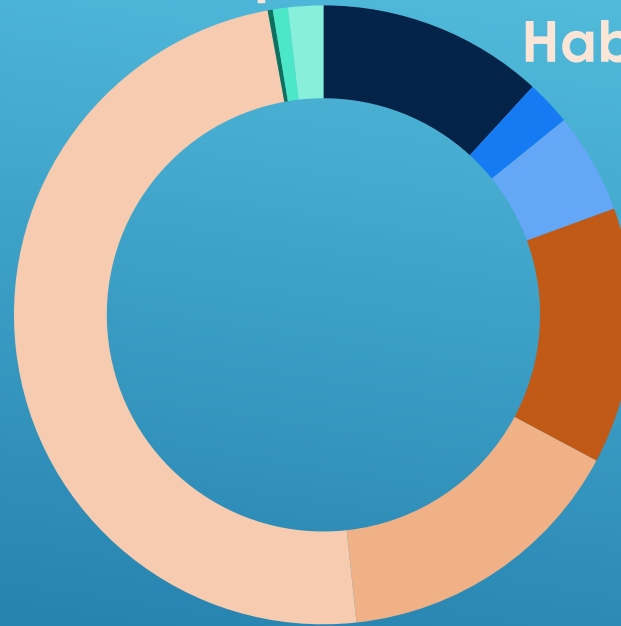
Summer 2016

Tick Species Abundance



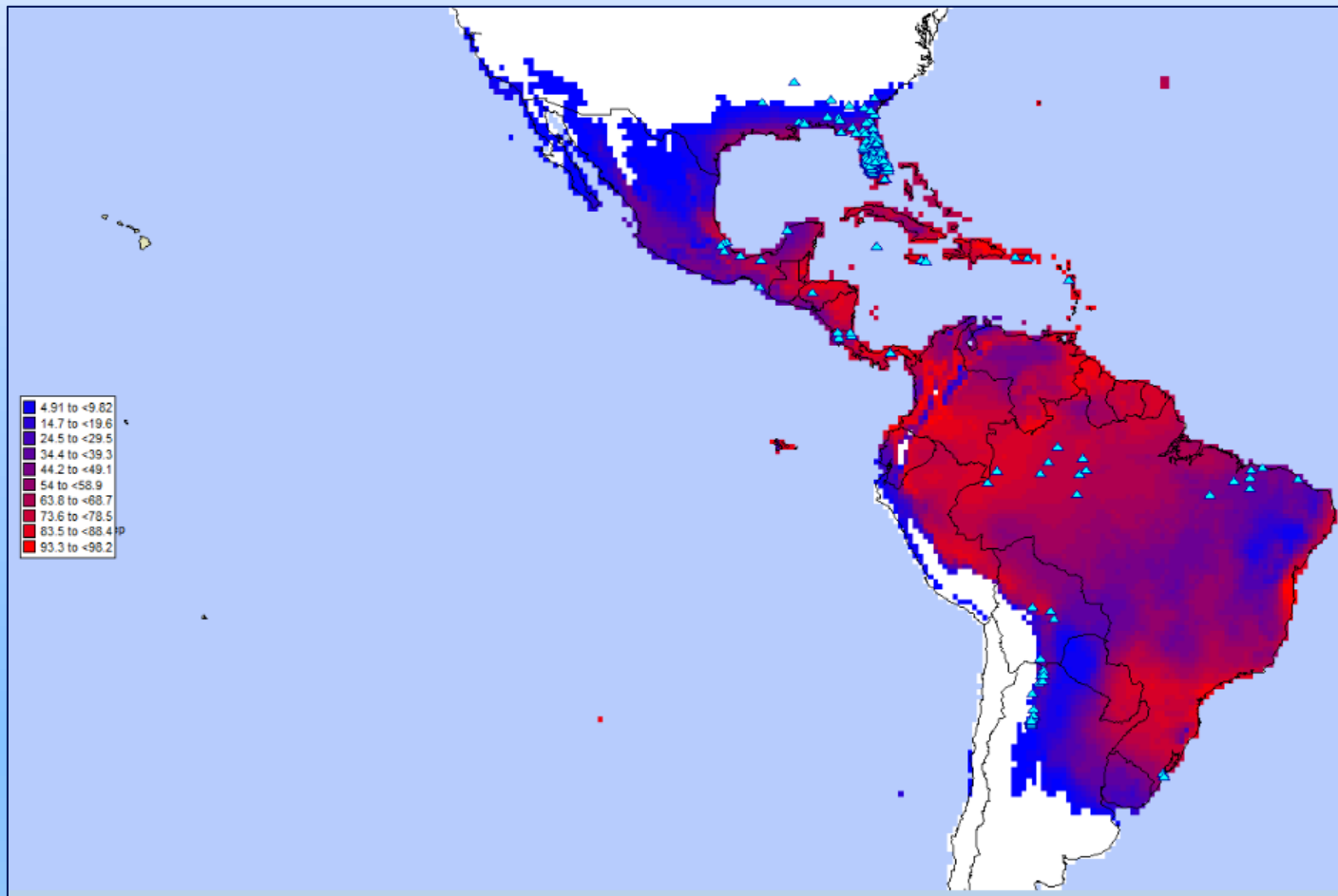
■ *Amblyomma americanum* - 368
■ *Ixodes affinis* - 5

Proportion of ticks by Region and Habitat



■ LC Bottomland Hardwood
■ LC Pine
■ LC Maritime
■ P Bottomland Hardwood
■ P Pine

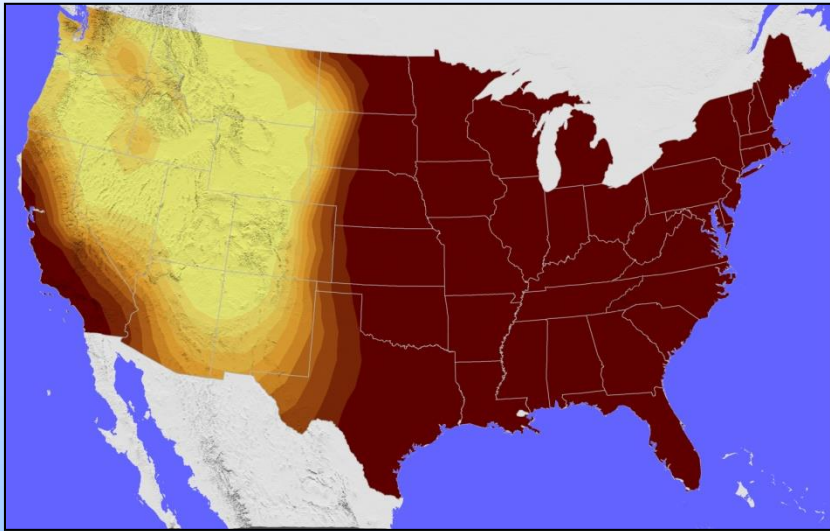
Climex Model: *Culicoides insignis*: Predicted Distribution



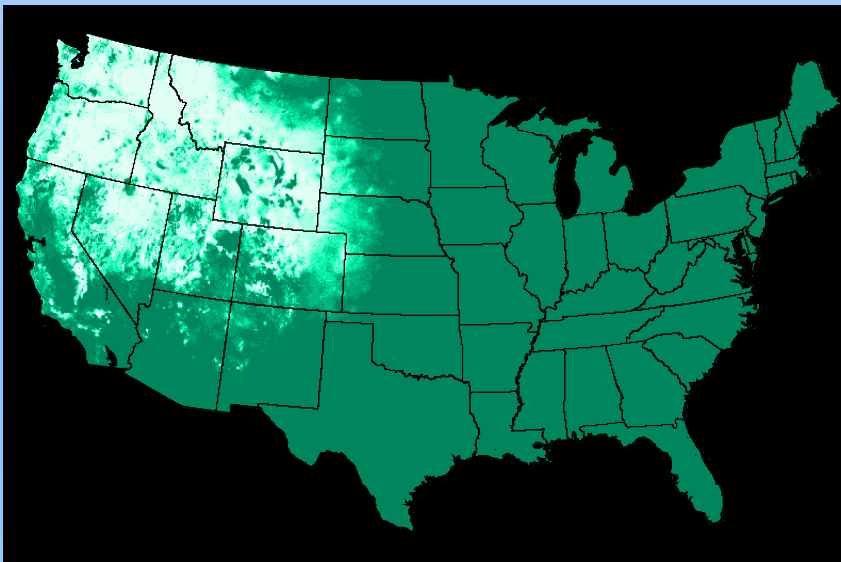


Predictive Distributions

Probability Distribution of the Rocky Mountain Wood tick



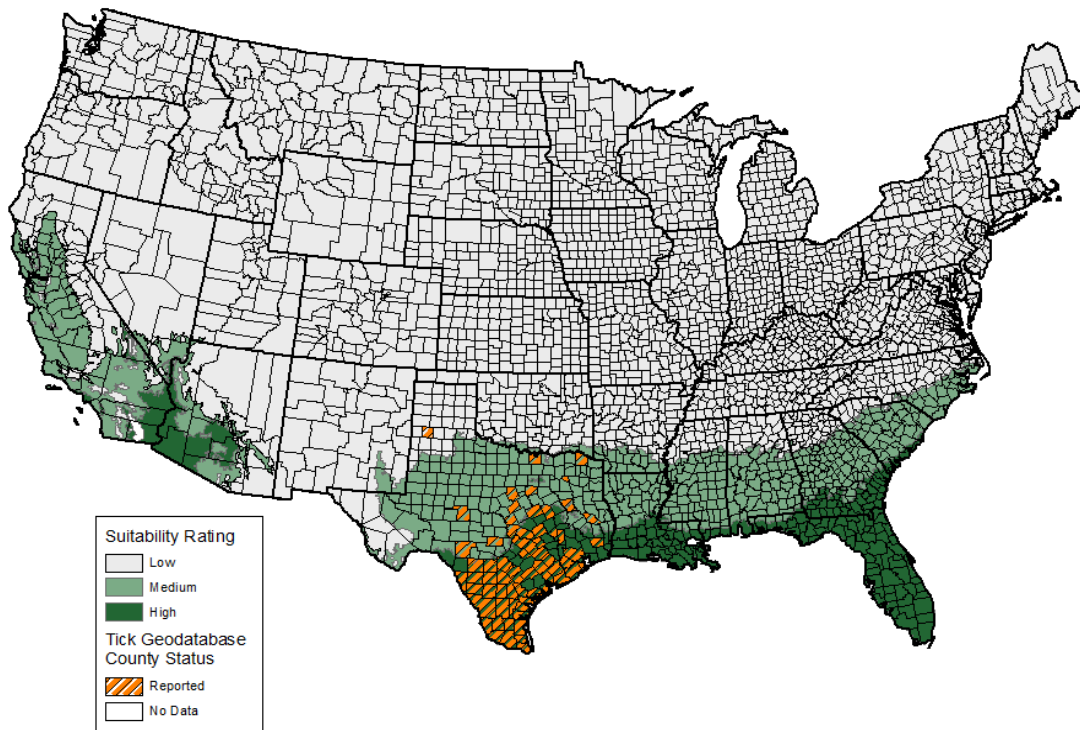
Kriging



Logistic Regression

Current and Potential Distribution of the Cayenne Tick, *Amblyomma mixtum*, in the U.S. Equine Piroplasmosis Vector

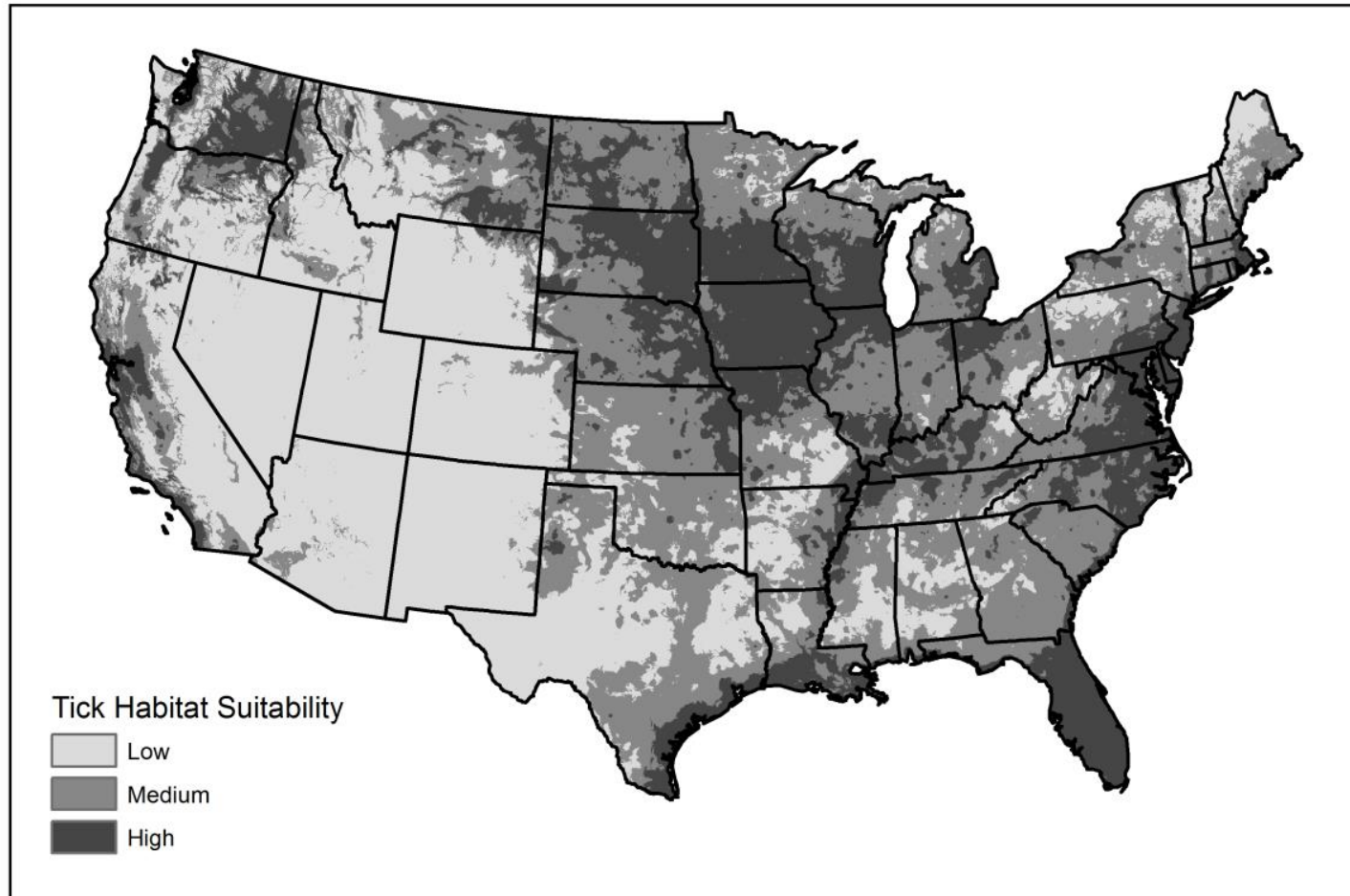
Overlay of Tick Geodatabase Records onto the Cayenne Tick Suitability Habitat Model



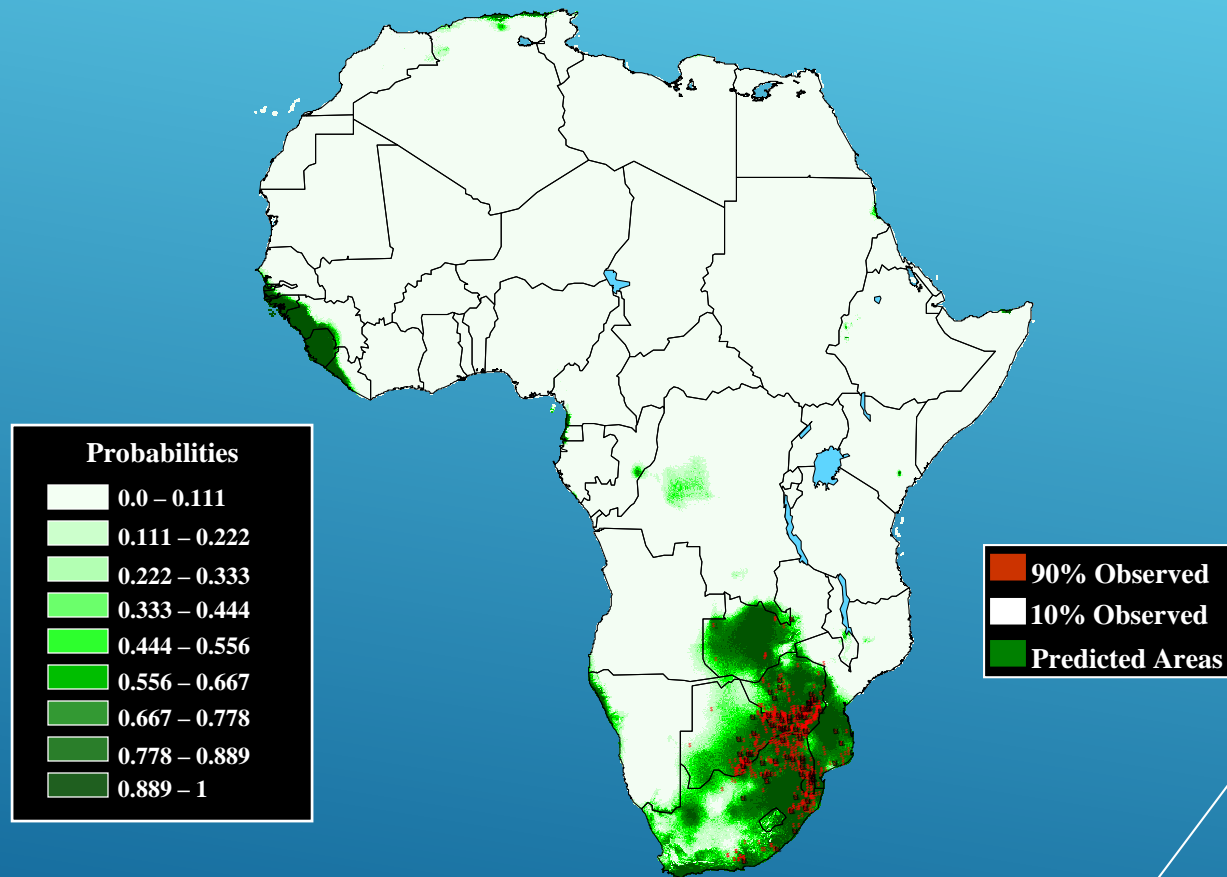
The U.S. Department of Agriculture's Animal and Plant Health Inspection Service collected the data displayed for internal agency purposes only. These data may be used by others, however, they must be used for their original intended purpose. Tick specimens are submitted to APHIS-NVSL for identification within a passive surveillance system.



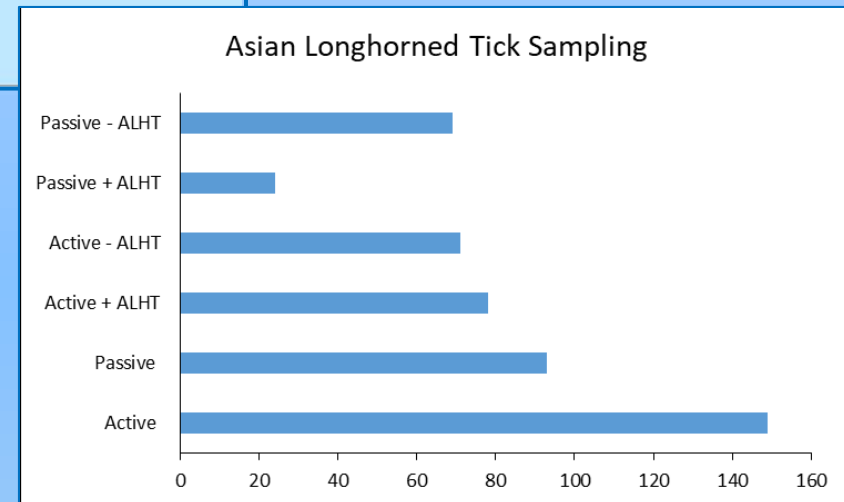
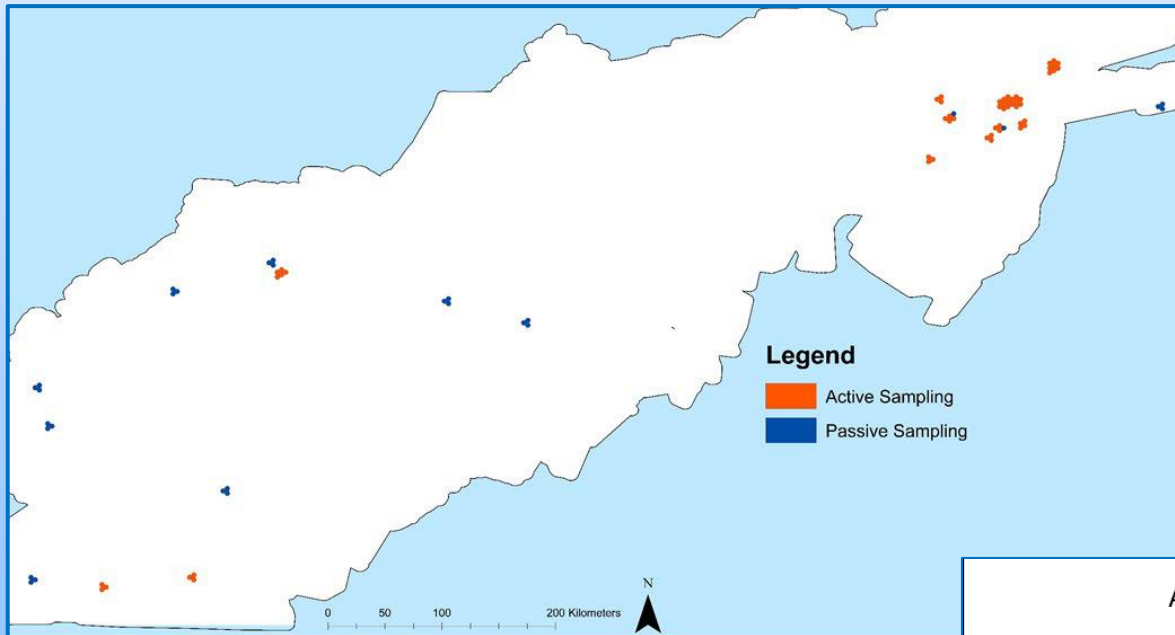
American Dog Tick Habitat Suitability Model



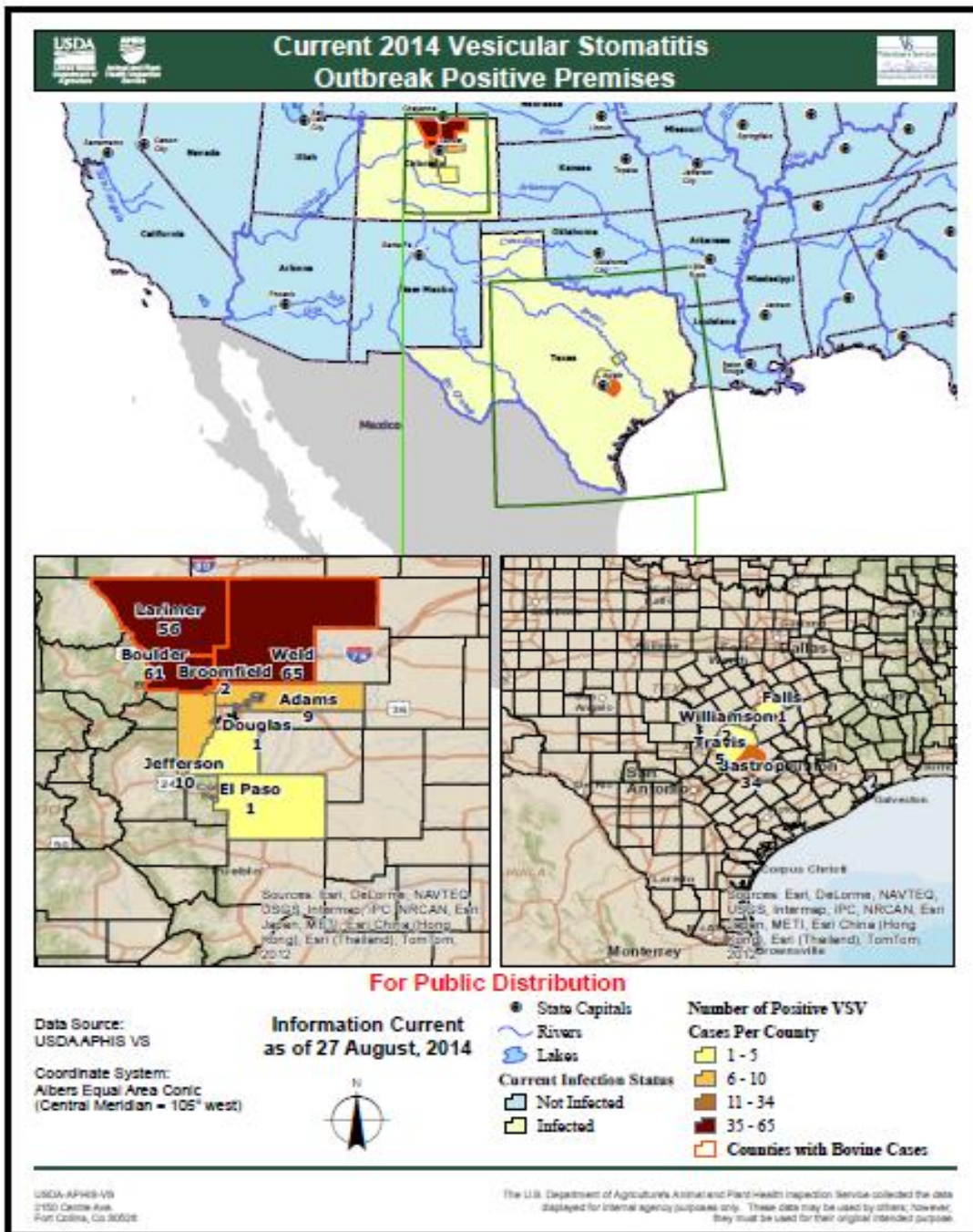
Predicted vs Observed Distribution of *A. hebraeum* in Africa: Logistic Model



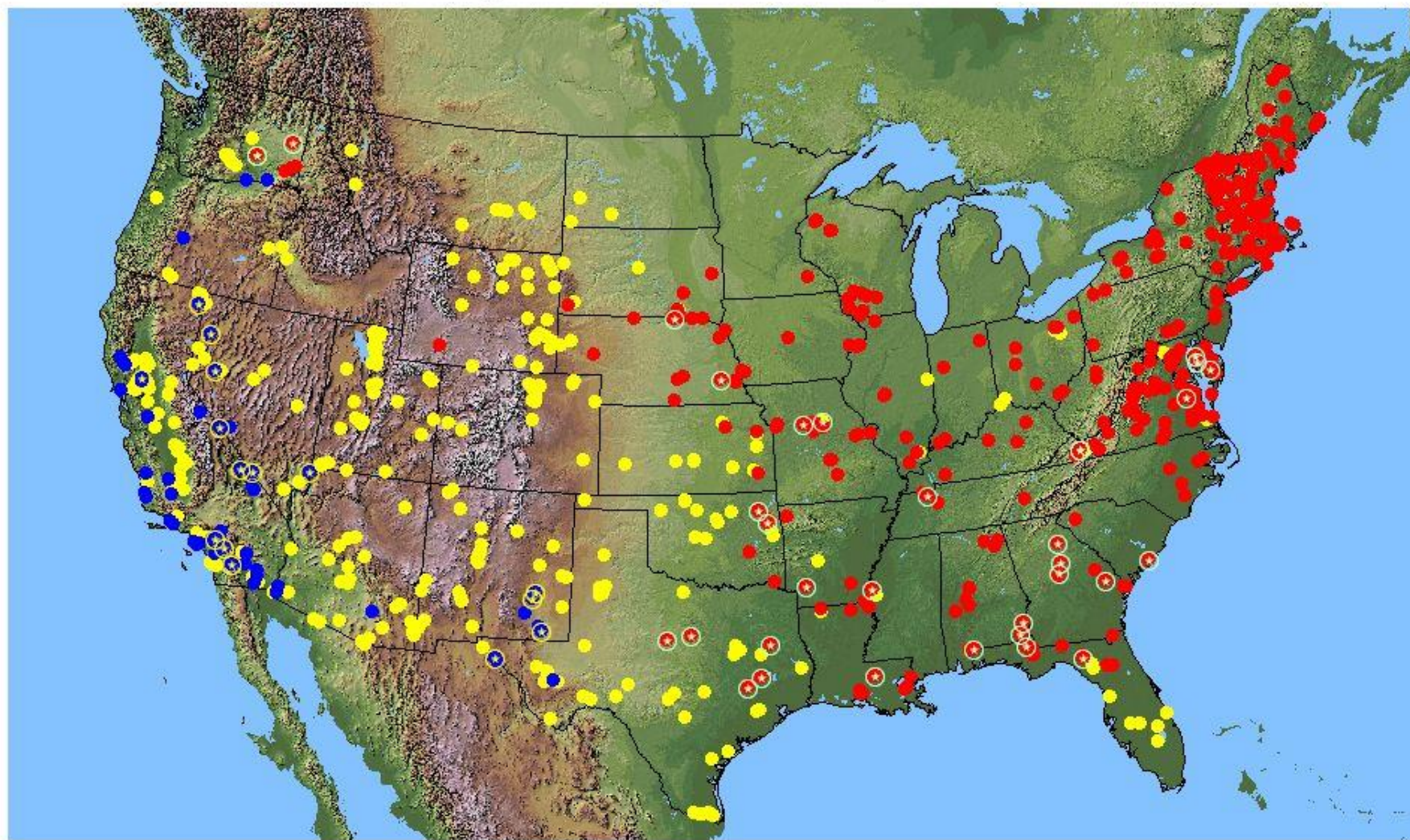
Spatial Occurrence Patterns of the Invading Tick Vector *Haemaphysalis longicornis*: Unravelling reported versus established populations



Vesicular Stomatitis Virus in 2014: Monitoring and Surveillance Activities








Culicoides variipennis species complex in the United States.



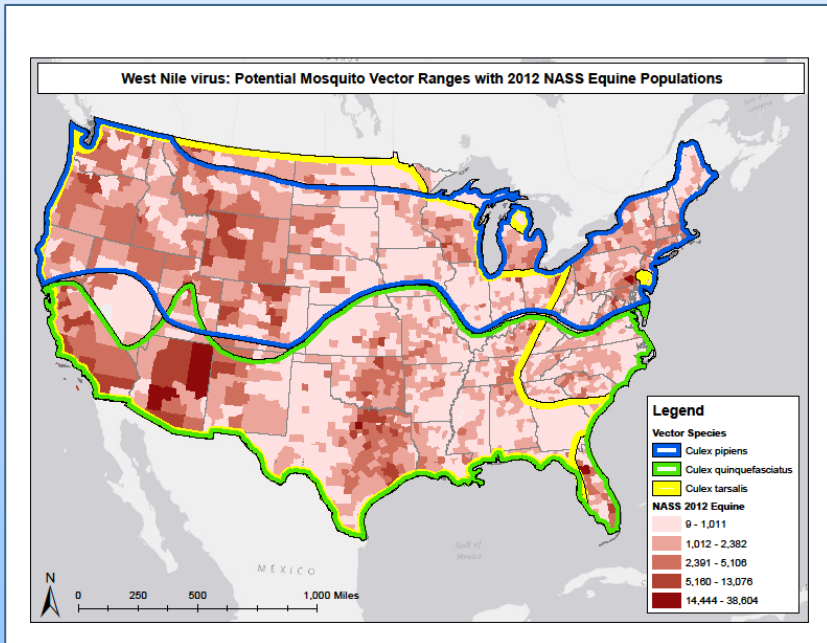
200 0 200 400 Miles



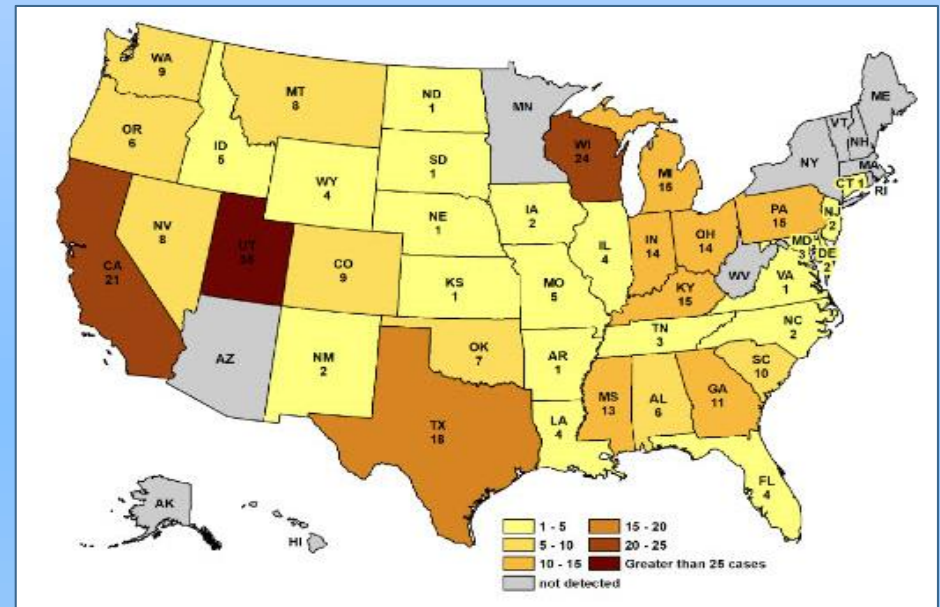
-  Mixed *C. sonorensis* and *C. variipennis*
-  Mixed *C. sonorensis* and *C. occidentalis*
-  *Culicoides variipennis*
-  *Culicoides occidentalis*
-  *Culicoides sonorensis*



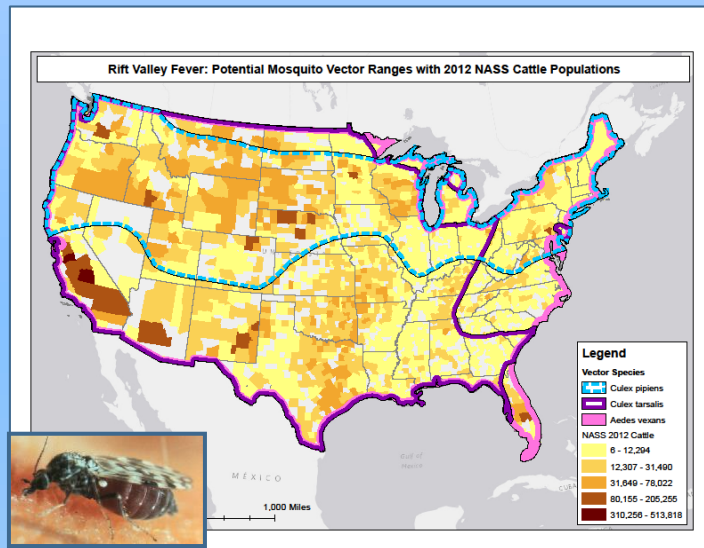
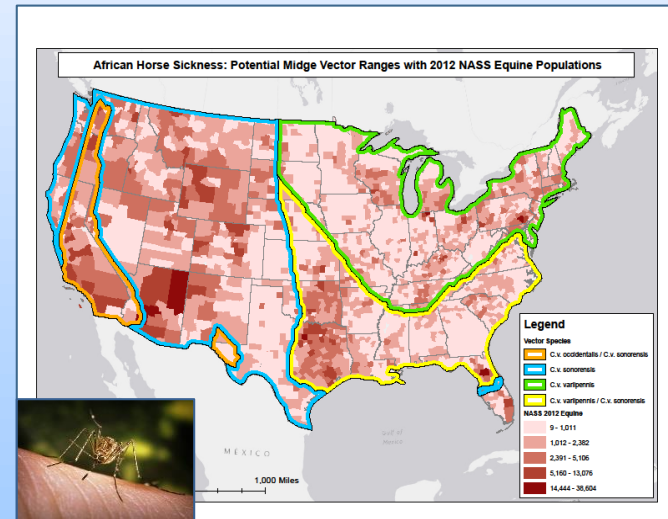
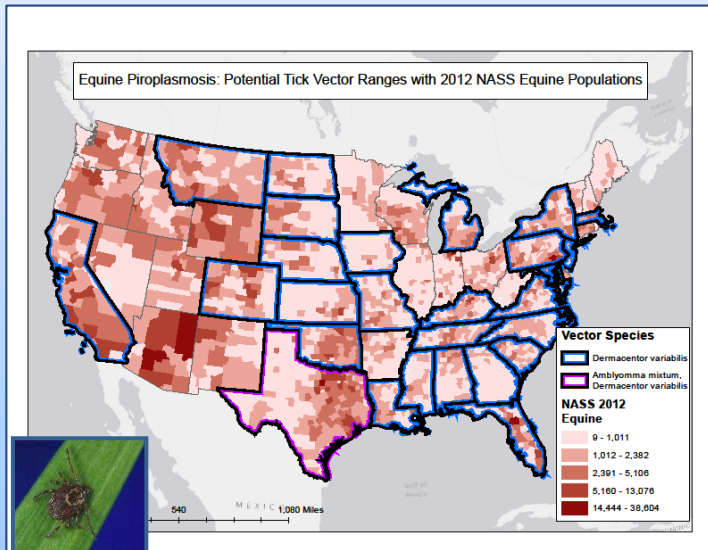
Mosquitoes and Mosquito-borne Diseases



West Nile Virus in Equines by State, 2017



Vectors and Vector-borne Diseases



The risk for vector-borne diseases in the United States is highly geographically diverse with an assortment of vector(s) and livestock species affected on a seasonal basis.

Vector Surveillance Activities and Risk Assessments



- ❖ Variety of Data Sources: importation of vector and pathogen identification data
- ❖ County-level distribution maps
- ❖ Risk maps based on integration of distribution and habitat suitability models
- ❖ Field validation of risk maps



United States Department of Agriculture

