

National Park Service
U.S. Department of the Interior
Natural Resource Stewardship and Science



Ticks and Tickborne Diseases

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Health and
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Tick Topics

- Tick basics
- Tick species
- Tick-borne diseases
- Tick prevention and removal



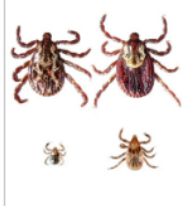
Not all ticks are the same!

Tick Species



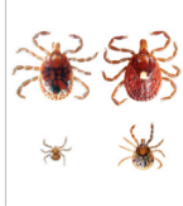
Ixodes scapularis
(Blacklegged tick or Deer tick)

Blacklegged ticks (a.k.a. Deer ticks) take 2 years to complete their life cycle and are found predominantly in deciduous forest. Their distribution relies greatly on the distribution of its reproductive host, white-tailed deer. Both nymph and adult stages transmit diseases such as Lyme disease, Babesiosis, and Anaplasmosis.



Dermacentor variabilis
(American Dog tick)

American Dog ticks are found predominantly in areas with little or no tree cover, such as grassy fields and scrubland, as well as along roadways and trails. They feed on a variety of hosts, ranging in size from mice to deer, and nymphs and adults can transmit diseases such as Rocky Mountain Spotted Fever and Tularemia. American dog ticks can survive for up to 2 years at any given stage if no host is found. Females can be identified by their large off-white scutum against a dark brown body.



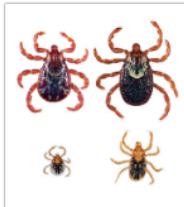
Amblyomma americanum
(Lone Star tick)

Lone Star ticks are found mostly in woodlands with dense undergrowth and around animal feeding areas. The larvae do not carry disease, but the nymphal and adult stages can transmit the pathogens causing Monocytic Ehrlichiosis, Rocky Mountain Spotted Fever and "Star" borreliosis. Lone Star ticks are notorious pests, and all stages are aggressive human biters.



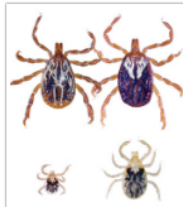
Rhipicephalus sanguineus
(Brown Dog Tick)

Brown Dog Ticks have a worldwide distribution, and can be found throughout the United States, although they are encountered more frequently in the southern tier of states. All life stages of this tick can transmit Rocky Mountain Spotted Fever (Rickettsia rickettsii) to dogs, and rarely to humans. Both nymphal and adult stages can transmit the agents of canine ehrlichiosis (Ehrlichia canis) and canine babesiosis (Babesia canis vogeli and Babesia gibsoni-like) to dogs.



Dermacentor andersoni
(Rocky Mountain Wood tick)

Rocky Mountain Wood ticks are found predominantly in shrublands, lightly wooded areas, open grasslands, and along trails, mainly at lower elevations. All life stages of this tick can transmit Colorado tick fever virus (CTFV) to humans, and Rocky Mountain spotted fever (RMSF) rickettsia (Rickettsia rickettsii) to humans, cats, and dogs. Rocky Mountain wood tick saliva contains a neurotoxin that can occasionally cause tick paralysis in humans and pets; usually a bite from an adult female induces an ascending paralysis that dissipates within 24-72 hrs after tick removal.



Amblyomma maculatum
(Gulf Coast Tick)

Images available, content summary in development.



Dermacentor occidentalis
(Pacific Coast Tick)

Images available, content summary in development.



Ixodes pacificus
(Western-Blacklegged Tick)

Images available, content summary in development.



Amblyomma cajennense
(Cayenne Tick)

Images available, content summary in development.



Photo: Pintrest

Tick Life Cycle



Photo Credit: Jen Sidge

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Ticks lay a lot of eggs!

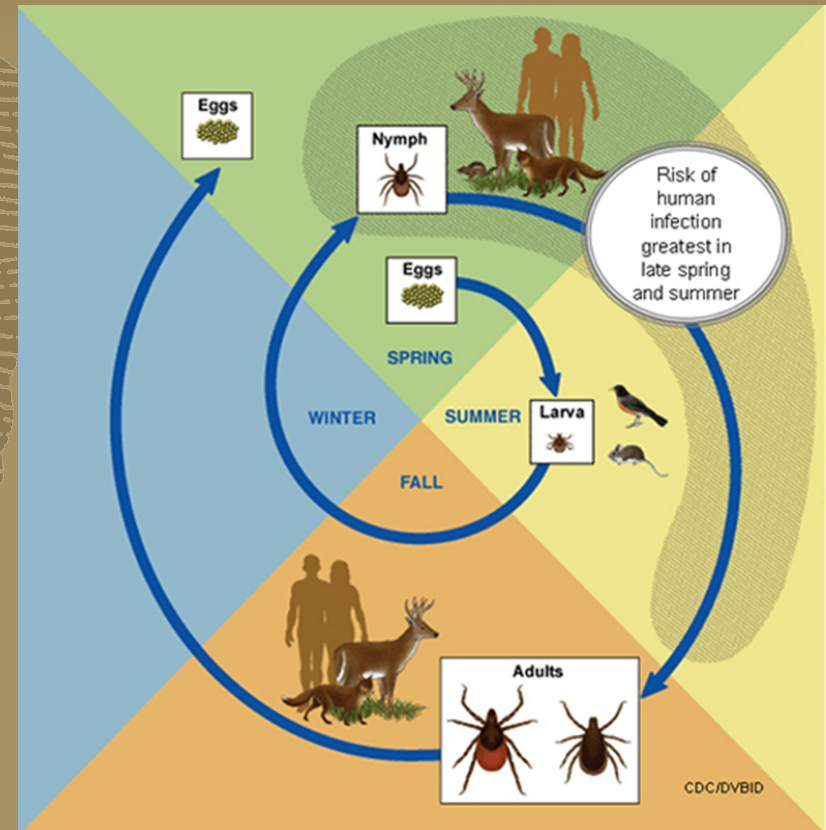


Photo: Mosquito Squad of West Montgomery

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Tick Life Cycle

- After hatching, ticks must eat blood at each stage
- Ticks can feed on mammals, birds, reptiles, and amphibians
- Most ticks prefer a different host animal at each stage; some prefer single host



How Ticks Find a Host

- Tick ascends blade of grass or other vegetation
- Tick detects host through odors (carbon dioxide, ammonia, lactic acid, etc.), body heat, moisture, and vibrations
- Ticks cannot jump, they must make direct contact with host to attach



Prevent Contact!

- Stay on trail
 - Sitting on logs can exponentially increase exposure to ticks
- Check yourself for ticks
- Spray your boots or treat uniform with permethrin



TICKS FOUND IN THE UNITED STATES

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Ixodes scapularis

- Blacklegged tick
- Transmits
 - Lyme disease (*Borrelia burgdorferi*)
 - *Borrelia miyamotoi*
 - *Borrelia mayonii*
 - Anaplasmosis
 - Babesiosis
 - Powassan disease
 - Probable vector for Ehrlichia muris-like (EML)
- Attach for 3-5 days
- Must feed 24-48 hours to transmit Lyme disease, and at least 12-24 hours to transmit anaplasmosis

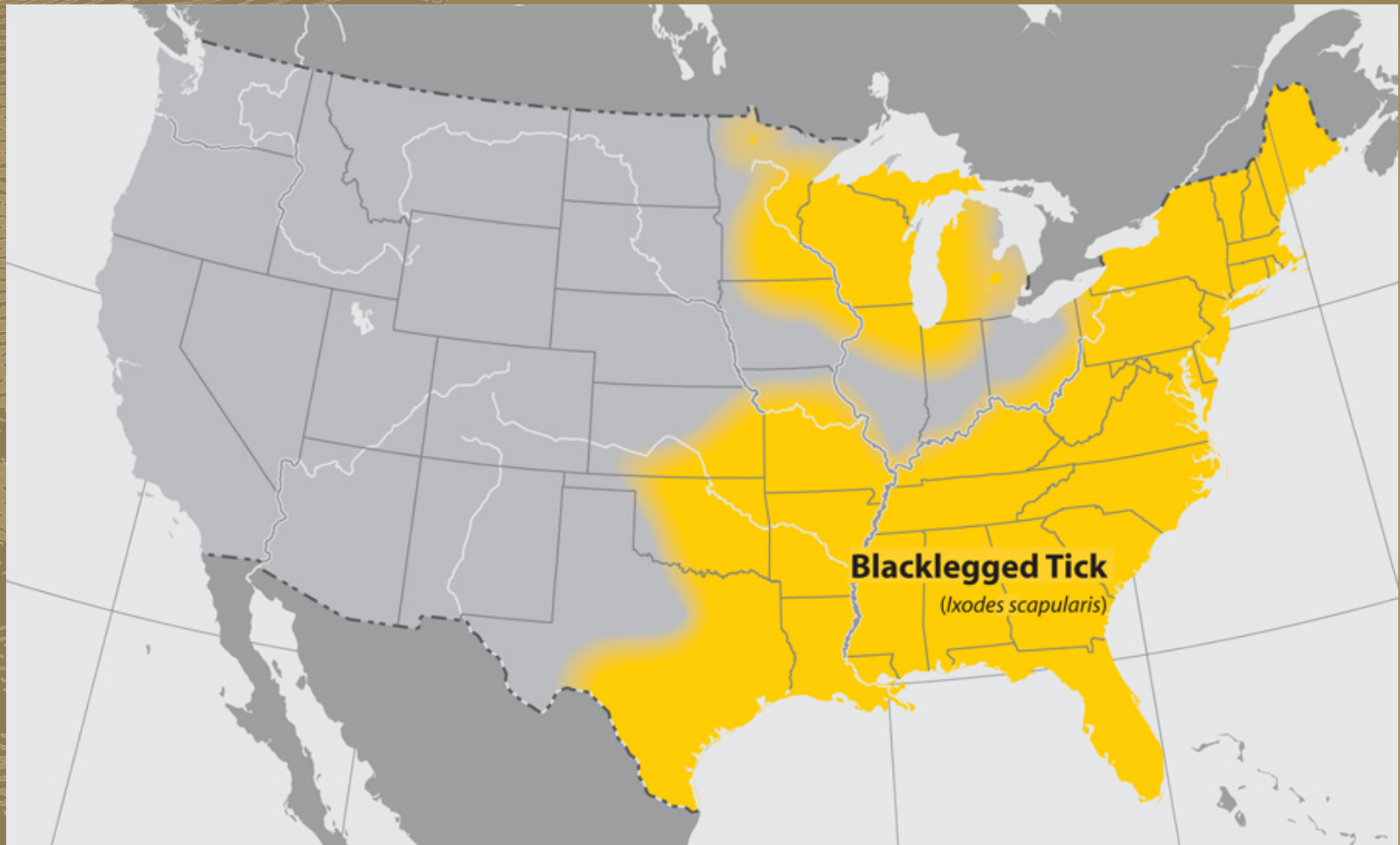


Ixodes scapularis

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Blacklegged Tick Distribution



Blacklegged Tick Habitat

- Live in wooded, brushy areas
- Need humidity to survive- stays near leaf litter
- Host preference based on life stage



Life Stages of Blacklegged Tick



TickEncounter Resource Center ***Ixodes scapularis* (Blacklegged ticks or Deer ticks)**



Larva



Nymph



Adult Male



Adult Female

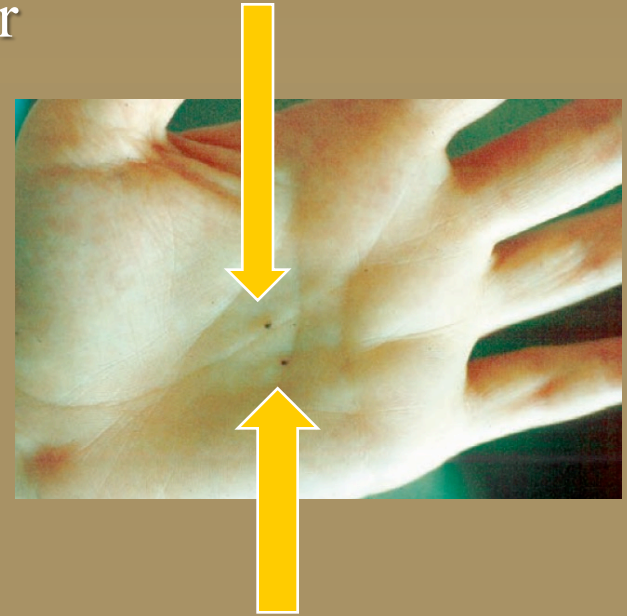
Blacklegged tick – two clades

- Northern ticks
 - 2-year life cycle
 - Feed primarily on mammals and birds
- Southern ticks
 - 1 year lifecycles or less depending on environmental conditions
 - Feed primarily on lizards
 - Nymphs rarely bite humans



Blacklegged Ticks - Nymphs

- Mostly likely to transmit tick-borne disease to humans
- Small! (about the size of a poppy seed or freckle)
- Harder to detect and remove
- Most active May through July
- Feed on white-footed mice, chipmunks, lizards and birds





We told you they are the size of poppy seeds...

Amblyomma americanum

- Lone Star Tick
- Transmits
 - *Ehrlichia chaffeensis*
 - *Ehrlichia ewingii*
 - Tularemia
 - STARI (Southern Tick-Associated Rash Illness)
 - Heartland virus???? Bourbon virus????
 - Meat allergy
- Adult female has a white dot (lone star) on back
- Nymphs and female adults are most likely to bite and most active in May and June



Lone Star Tick Distribution



Life Stages of Lone Star Tick



TickEncounter Resource Center

***Amblyomma americanum* (Lone Star ticks)**



Larva



Nymph



Adult Male



Adult Female

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Lone Star Tick Habitat

- Found in a variety of habitats- wooded, grassy, and agricultural
- White-tailed deer major adult host



Photo: University of Missouri Extension



Lone Star Tick Feeding Behavior

- Aggressive tick
- Nymphs can move very quickly
- Nymphs and larvae often feed on humans and can be present in large numbers
 - Sometimes call “seed ticks”



Photos: University of Kentucky

Dermacentor variabilis

- American dog tick, wood tick
- Transmits
 - Tularemia
 - Rocky Mountain Spotted Fever
- Greatest risk of being bitten in spring and summer
- Female adults are most likely to bite
- Nymphs and larvae are very uncommon on humans



American Dog Tick Distribution



Life Stages of American Dog Tick

 **TickEncounter** Resource Center

***Dermacentor variabilis* (American Dog ticks)**



Larva



Nymph



Adult Male



Adult Female

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Image: http://www.tickencounter.org/tick_identification/dog_tick#top

American Dog Tick Habitat

- Edge, shrubby or tall grass habitats
- Prefer overgrown vacant lots, waste farm fields, weedy roadsides, and edges of paths and hiking trails
- Adults are mostly found in tall grass and low brush

Rhipicephalus sanguineus

- Brown dog tick, kennel tick
- Transmits
 - Rocky Mountain Spotted Fever
 - *Ehrlichia chaffeensis*
 - *Ehrlichia ewingii*
- Dogs are the primary host for each life stage
 - Almost exclusively a parasite of dogs
- Unique because it can complete life cycle indoors
- Female adults are most likely to bite



Brown Dog Tick



- Considered a single host tick
- Associated domestic dogs
- Adapted to indoor living
 - Can hide in and around furniture, windows, edges of rugs, house siding, and foundations
- Rarely seen in uninhabited wild or forested areas
- Rocky Mountain Spotted Fever in humans and dogs; canine ehrlichiosis and babesiosis

Brown Dog Tick Distribution



Life Stages of Brown Dog Tick

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***Rhipicephalus sanguineus* (Brown Dog Tick)**



Larva



Nymph



Adult Male



Adult Female

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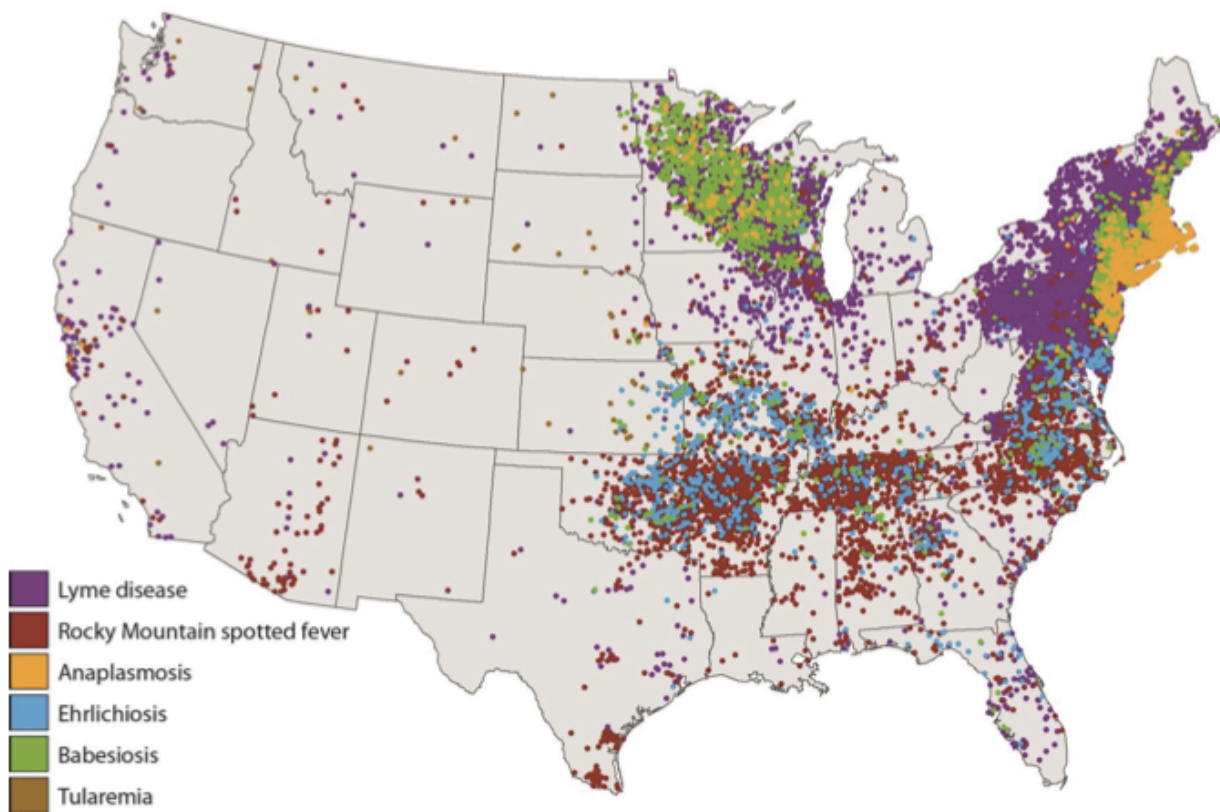


TICKBORNE DISEASES

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Selected tickborne disease of the United States, 2012

Ticks can spread serious and potentially fatal diseases like Lyme disease, Rocky Mountain spotted fever, ehrlichiosis, and tularemia. Early treatment can prevent more serious complications, so see your doctor right away if you have a fever, rash, or flu-like illness.



Tick-borne Disease

- Most tick bites do not result in disease
- Many tick-borne diseases have similar symptoms
 - Fever/chills
 - Aches and pains
 - Rash
- Tick-borne diseases caused by bacteria can be easily treated with antibiotics (the earlier the better)
- Viral tick-borne diseases do not have a specific treatment, only supportive care

Lyme Disease

- Agent: *Borrelia burgdorferi* - bacteria
- Tick: *Ixodes scapularis*; *Ixodes pacificus*
- Signs and Symptoms vary person to person
- Early in disease- within 3 to 30 days post-exposure
 - Flu-like symptoms – fever, chills, headache, fatigue
 - Muscle and joint
 - A distinctive rash

Distinctive Rash of Lyme Disease

Seen in ~70% of patients



Centers for Disease Control and Prevention, <http://phil.cdc.gov/phil/>



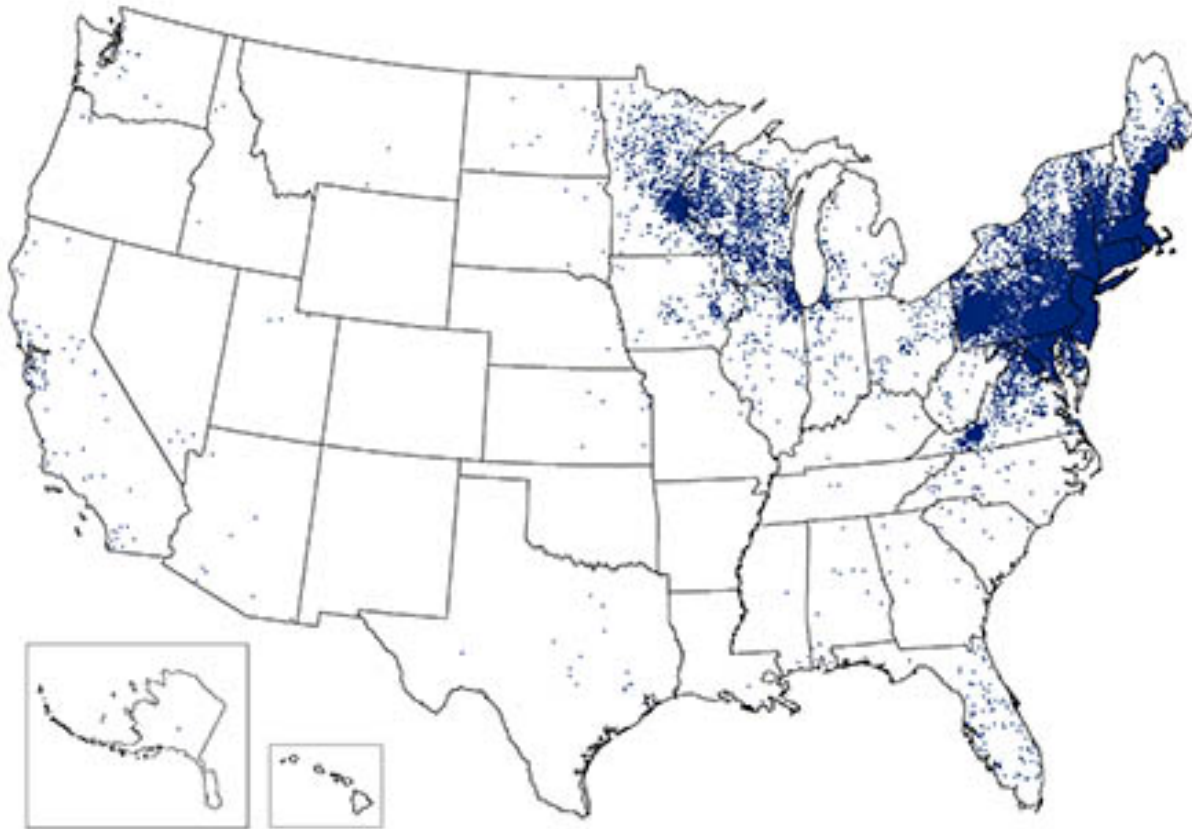
© Taryn Holman, Dermatlas: <http://www.dermatlas.org>

Lyme Disease

- **Longer-term symptoms possible:**
 - Facial paralysis on one side of the face
 - Stiff neck
 - Headache
 - Weakness, numbness or pain in arms or legs
 - Irregular heart beat
 - Dizziness, feeling lightheaded, or heart palpitations
 - Persistent weakness and fatigue

Lyme Disease

Reported Cases of Lyme Disease -- United States, 2015



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

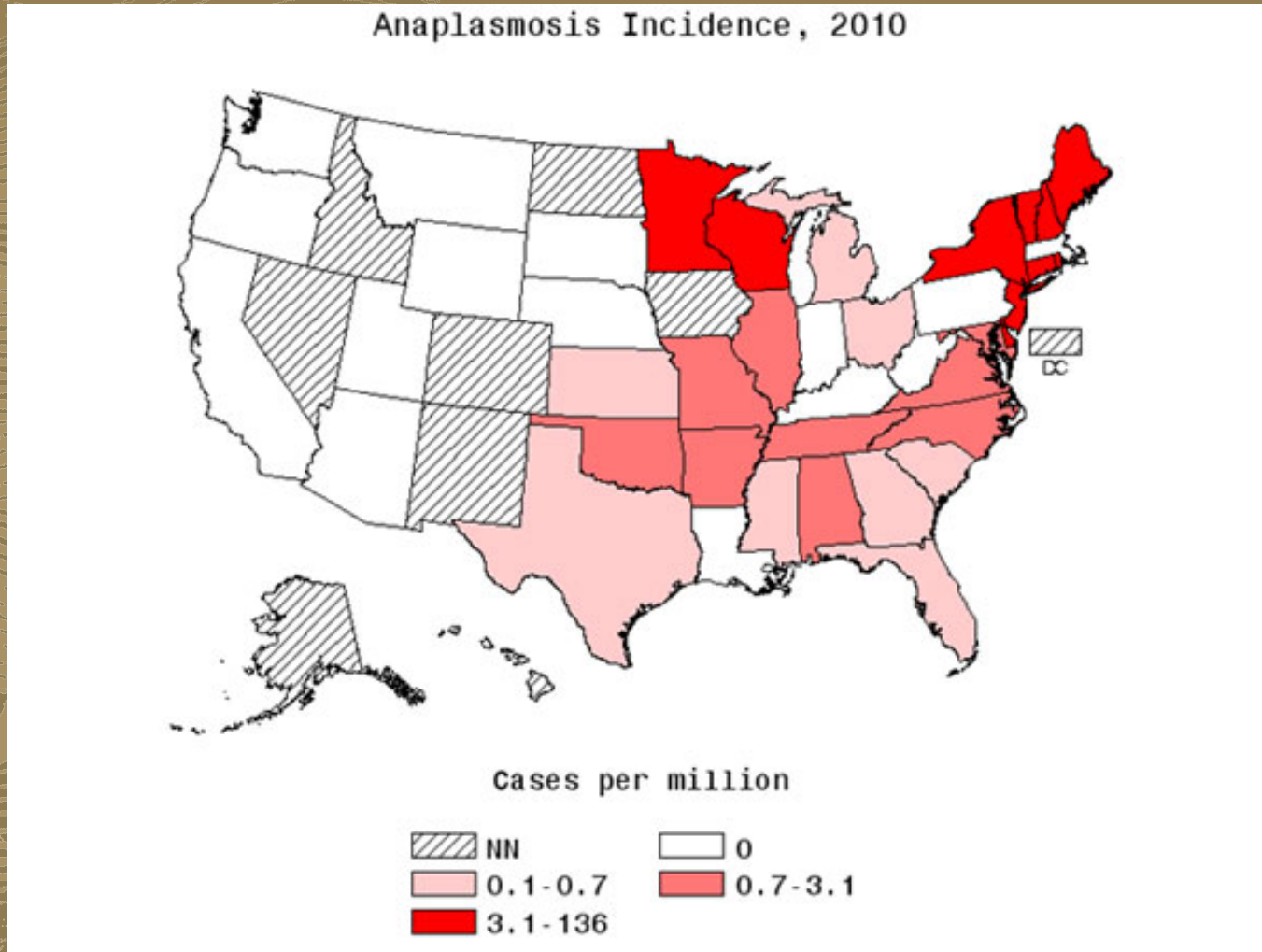
Post-treatment Lyme Disease Syndrome

- Persistent symptoms after recommended 2-4 week course of antibiotics
- Exact cause unknown; immune changes suggested but animal studies have stimulated need for more research
- Long term studies have found no benefit to long-term antibiotic treatment and have found increased risk of serious complications with long-term treatment (1 in 5 receiving long-term treatment had serious complications)

Anaplasmosis

- Agent: *Anaplasma phagocytophilum* –bacteria
- Tick: *Ixodes scapularis*; *Ixodes pacificus*
- Incubation period: 1-2 weeks
- Symptoms
 - Fever, chills
 - Severe headache
 - General discomfort and muscle pain
 - GI symptoms – (nausea, vomiting, diarrhea, lack of appetite)
 - Cough
 - Stiff neck
 - Rash is rare (10% of cases)

Anaplasmosis

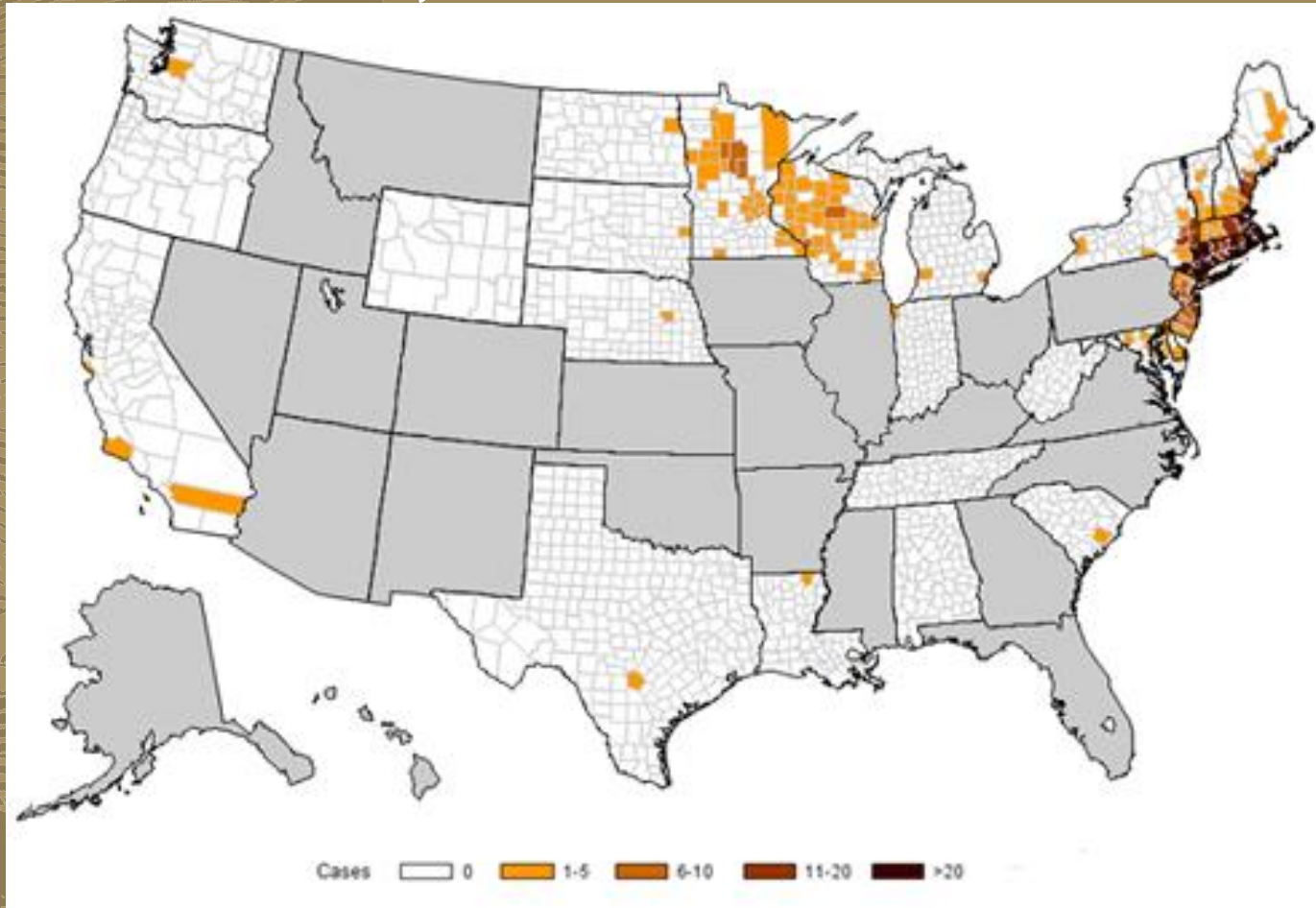


Babesiosis

- Agent: *Babesia microti*; protozoan parasite that infects red blood cells
- Tick: *Ixodes scapularis*
- Incubation period: 1-6 weeks
- Symptoms
 - Fever, chills, sweats
 - General discomfort and fatigue
 - GI symptoms- mostly lack of appetite and nausea
 - Muscle pain, joint pain, and headaches
 - Dark urine

Babesiosis

Number of reported cases of babesiosis, by county of residence — 27 states, 2013



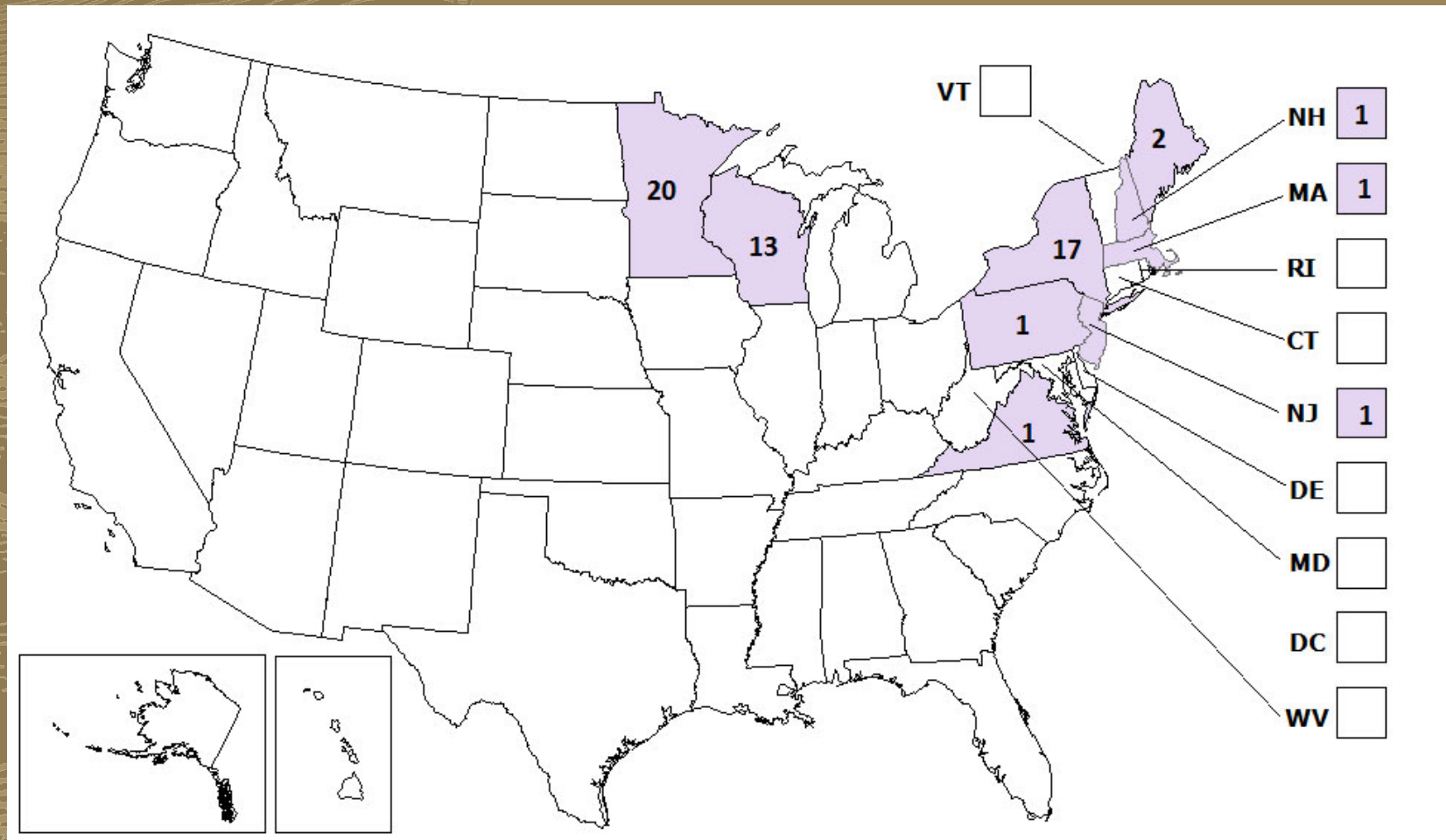
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Powassan Disease

- Agent: Powassan virus
- Tick: *Ixodes scapularis*; *Ixodes cookei*
- Incubation period: 1 – 4 weeks
- Rare disease
- Symptoms
 - Fever, headache, vomiting, and general weakness
 - Affects the central nervous system and causes inflammation of the brain and tissues that surround the brain
 - May lead to confusion, loss of coordination, speech difficulties, and memory loss

Powassan Disease

Powassan virus neuroinvasive disease cases reported by state, 2004–2013



Tularemia

- Agent: *Francisella tularensis*- bacteria
- Ticks: *Dermacentor andersoni*; *Dermacentor variabilis*; *Amblyomma americanum*
- Incubation period: average 3-5 days; range 1-21 days
- Multiple ways to be exposed
 - Tick and deer fly bites
 - Skin contact with infected animals (often rabbits or hares)
 - Ingestion of contaminated water
 - Inhalation of contaminated dusts or aerosols

Tularemia

- Symptoms depend on how you were exposed
 - Can include insect bite that won't heal, swollen and painful lymph nodes, inflamed eyes, or cough
 - All forms are accompanied by fever, which can be as high as 104 °F

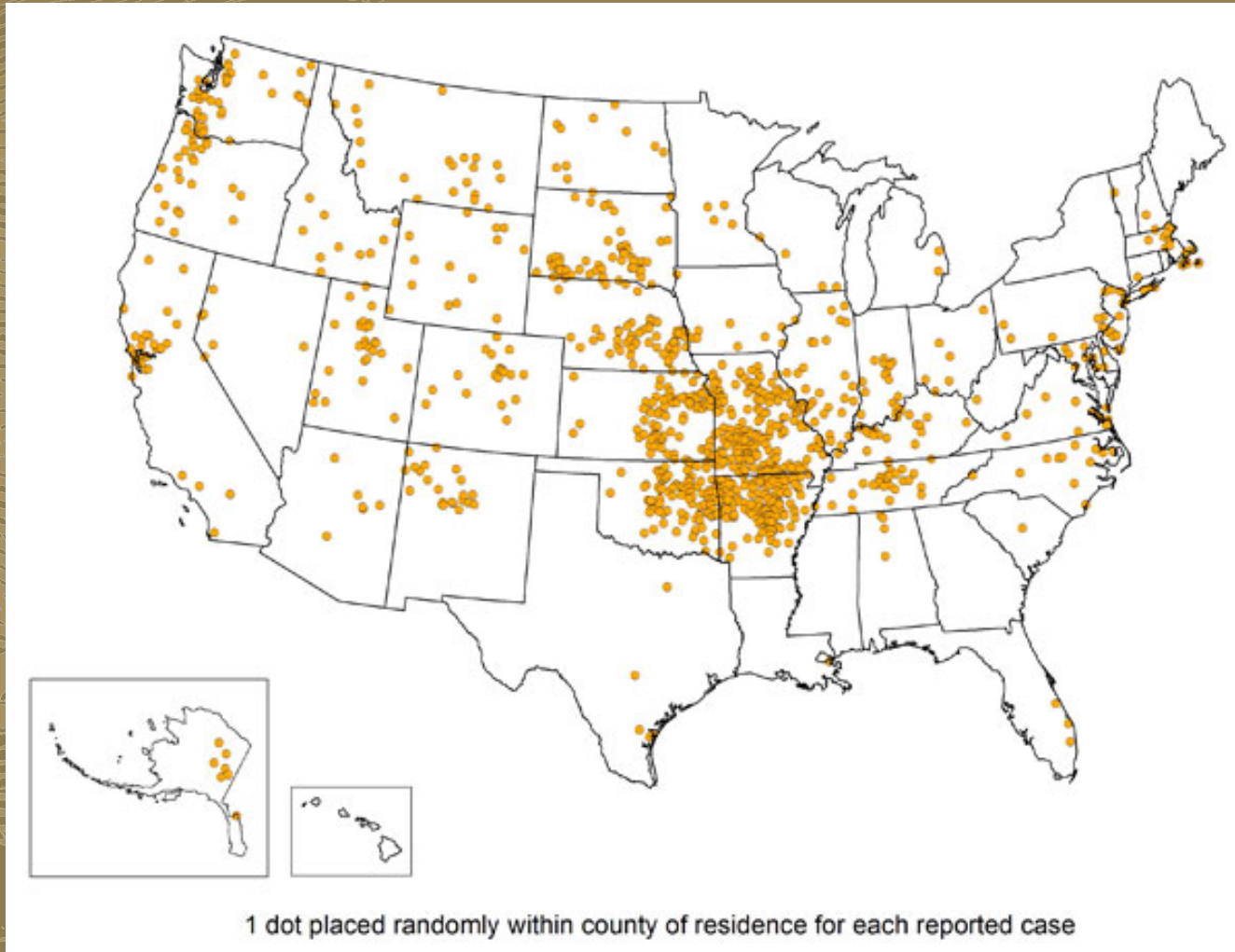
Tularemia

- Most common form involves a skin ulcer present at the site of infection
- Usually caused by tick or deer fly bite
- Will also see swelling of regional lymph glands, usually in the armpit or groin



Tularemia

Reported tularemia cases — United States, 2004-2013



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Rocky Mountain Spotted Fever

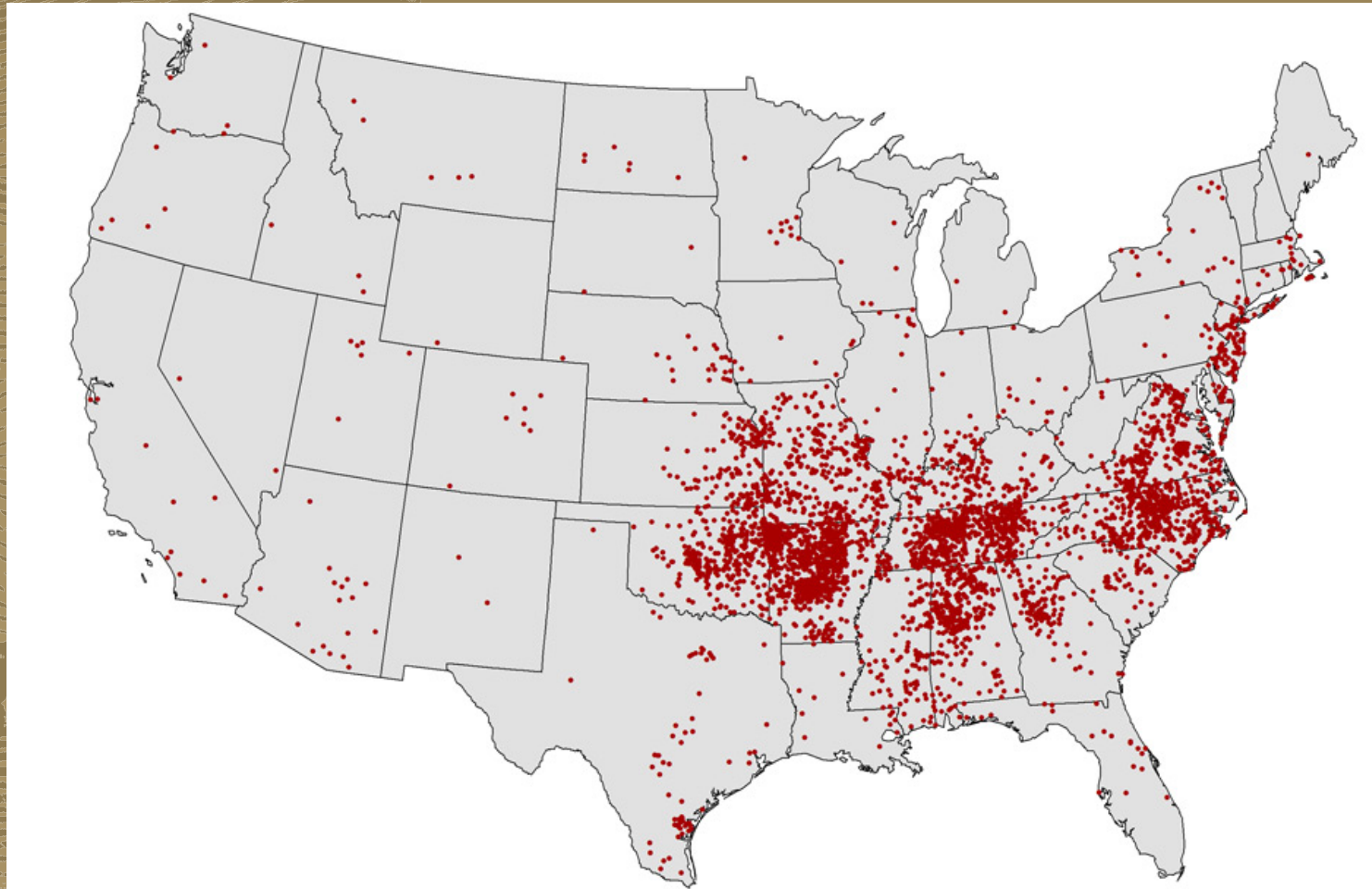
- Agent: *Rickettsia rickettsii* – bacteria
- Tick: *Dermacentor andersonia*; *Dermacentor variabilis*; *Rhicephalus sanguineus*
- Incubation period: 2- 14 days, 3-5 days most common
- Symptoms
 - Fever, chills
 - Severe headache, general discomfort, muscle pain
 - GI symptoms- nausea, vomiting, lack of appetite, abdominal pain and tenderness, diarrhea
 - Cough
 - Red eyes
 - Rash
 - Up to 30% of cases are fatal without antibiotics

Rocky Mountain Spotted Fever



Rocky Mountain Spotted Fever

Reported RMSF cases in the United States in 2015

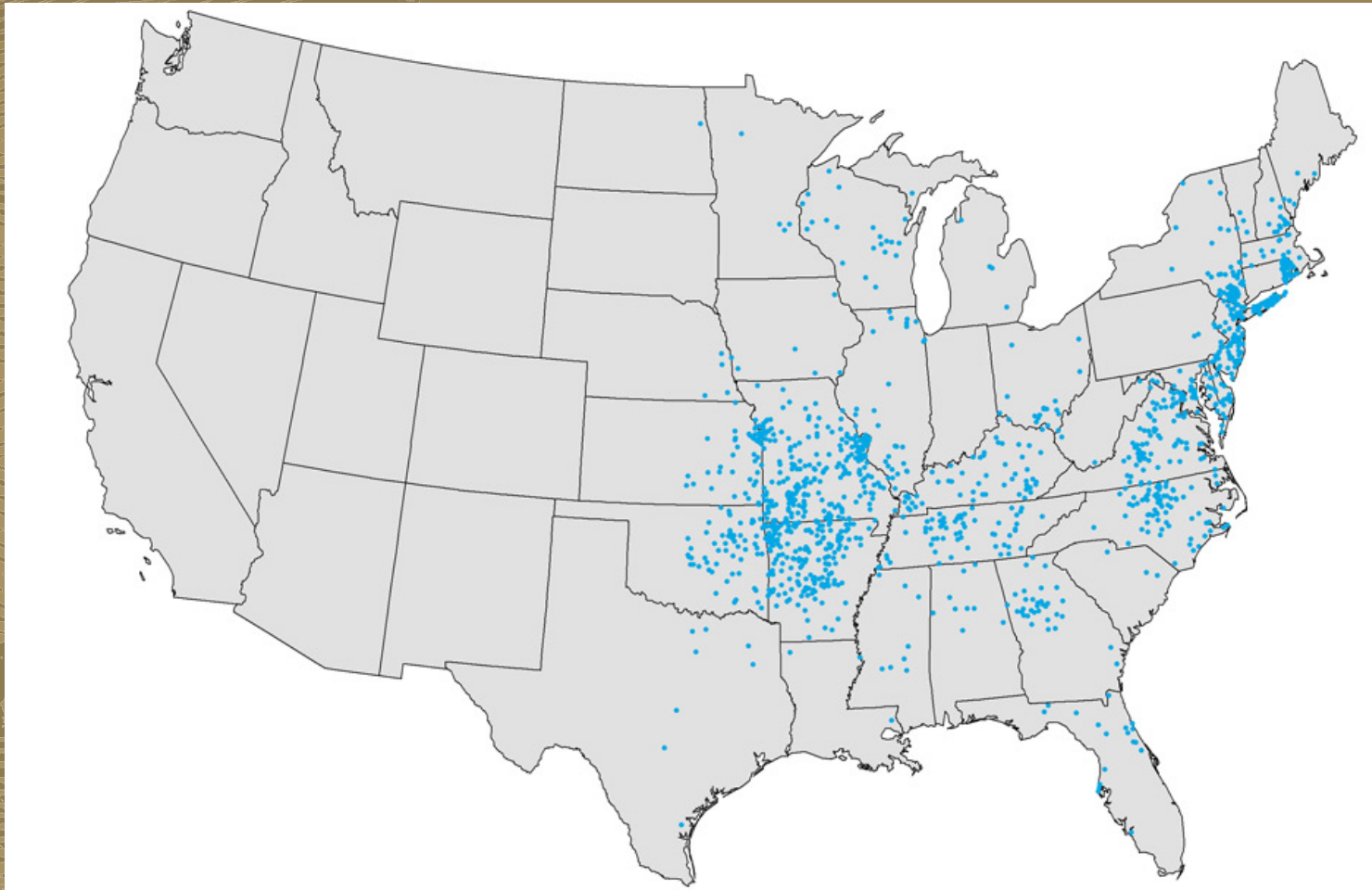


Ehrlichiosis

- Agent: *Ehrlichia chaffeensis*, *Ehrlichia ewingii*, *Ehrlichia muris*-like (EML) – bacteria
- Ticks: *Amblyomma americanum*
- Incubation period: 7-10 days
- Symptoms
 - Fever, chills
 - Severe headache
 - Muscle pain, joint pain, general weakness
 - GI symptoms- nausea, vomiting, diarrhea
 - Rash more common in children than adults

Ehrlichiosis

Reported cases in the United States in 2015



STARI

- Southern Tick-Associated Rash Illness
- Agent- unknown
- Tick: *Amblyomma americanum*
- Symptoms
 - Rash similar to the Lyme Disease rash
 - The rash usually appears within 7 days of tick bite
 - Flu-like symptoms (fatigue, headache, fever, and muscle pains)

STARI



Heartland

- Agent: Heartland virus
- Tick: suspect *Amblyomma americanum*
- New suspected tickborne disease- discovered in 2012
- Incubation period: not yet known (days to weeks?)
- Distribution: Cases in MO, TN, and OK
- Symptoms
 - All had fever and felt tired
 - Some patients complained of headaches, muscle aches, diarrhea, loss of appetite, or nausea

Red Meat Allergy

- Specific allergy related to a carbohydrate called alpha-gal
- Tick: *Amblyomma americanum*
- Symptoms often take several hours to develop after consumption of red meat
- Allergic reaction:
 - Itching, GI symptoms, severe cases can result in anaphylaxis



PREVENTION

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Three Stages for Intervention:

- Prevent contact: keep them from getting on you
- Prevent attachment: remove before they attach
- Prevent transmission: remove, clean, and monitor

Remember: for most diseases, ticks need to feed for up to 48 hours before they can transmit disease

Prevent Contact

- Stay in the center of trails
 - Sitting on logs can exponentially increase exposure to ticks
- Check yourself for ticks
- Spray your boots or treat uniform with permethrin

Prevent Contact

Spray
yourself, not
the
environment



Insect Repellents

- Check the label
- DEET
 - Use a product containing no more than 30 percent DEET
- Other EPA approved tick repellents
 - IR3535
 - Picaridin
 - Oil of Lemon Eucalyptus
 - p-Menthane-3,8-diol
- Permethrin – for clothes

Permethrin-treated clothing

- Variety of companies sell pre-treated clothing that lasts up to 70 washes
- Do-it-yourself kits 0.5% permethrin – make sure to follow label
 - Lasts 5-6 washes

Permethrin

- Treat boots and socks!
 - One study showed that spraying shoes offers 74 times the protection from ticks latching onto your shoes and crawling up your leg

Daily Tick Checks: prevent attachment

Check for ticks in the following locations:



In and around the hair

In and around the ears

Under the arms

Inside the belly button

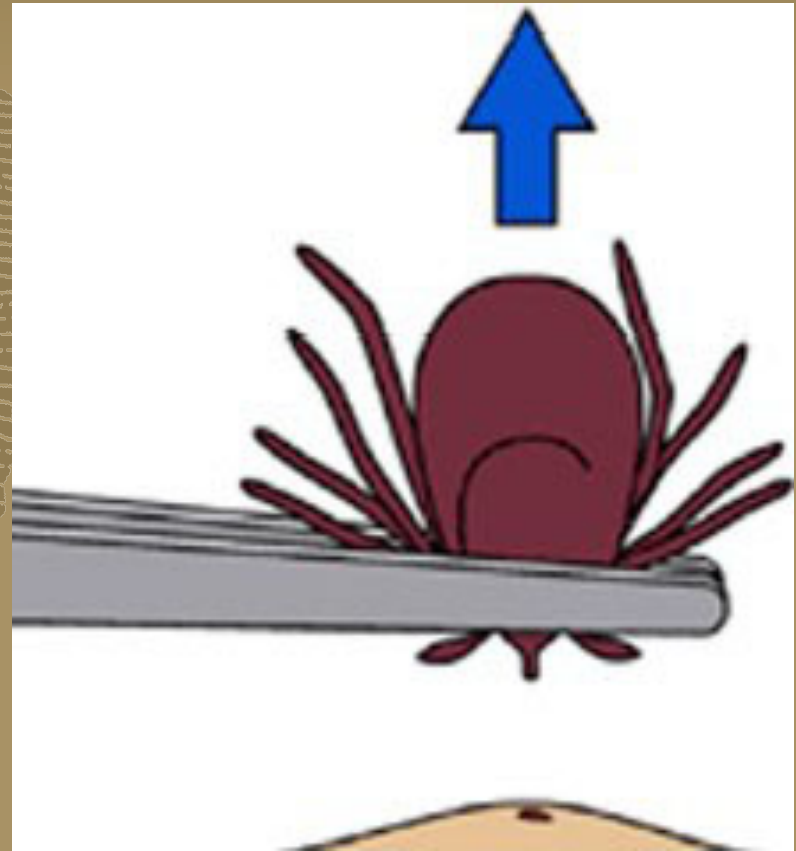
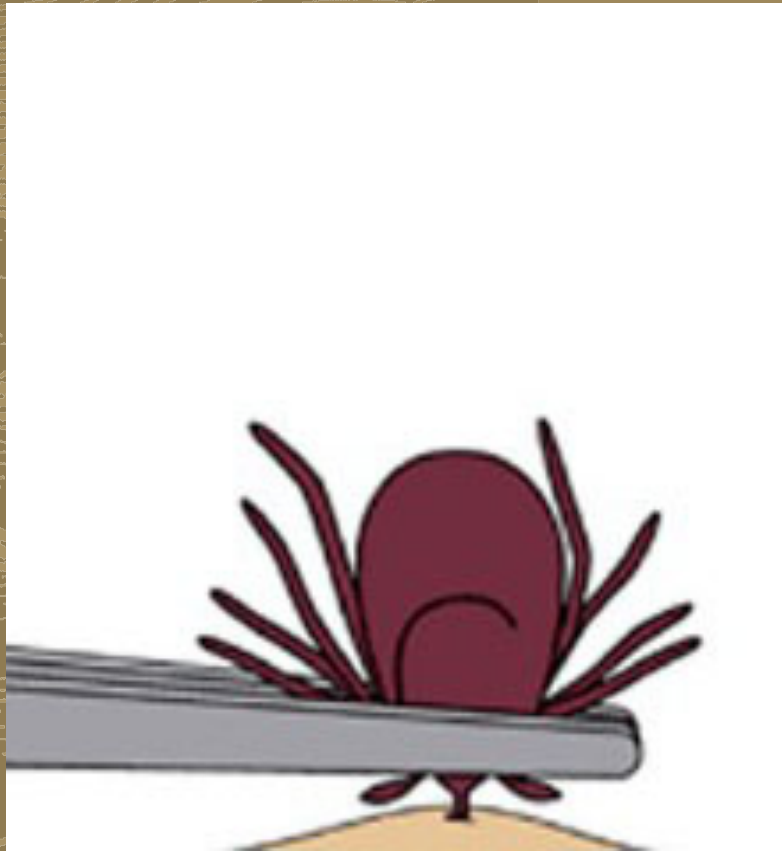
Between the legs

Back of the knees

Prevent Attachment

- Change clothes after being outdoors
 - Tumbling clothes on high heat in the dryer for one hour can help kill remaining ticks
- Shower soon after being outdoors (within 2 hours)

Tick Removal



Tick Removal

- Use fine-tipped tweezers to grasp the tick as close to the skin's surface as possible
- Pull upward with steady, even pressure
 - If the tick mouth-parts break off and remains in the skin, attempt to remove with tweezers
- Thoroughly clean the bite area and your hands with rubbing alcohol, iodine scrub, or soap and water
- Dispose of live tick by placing in alcohol, in a sealed container, or wrapping it in tape
 - Never crush a tick with your fingers

Three Stages for Intervention:

- Prevent contact: keep them from getting on you
- Prevent attachment: remove before they attach
- Prevent transmission: remove, clean, and monitor

Remember: for most diseases, ticks need to feed for up to 48 hours before they can transmit disease

Wildlife Health Branch

Natural Resource Stewardship and Science

www.nature.nps.gov



National Park Service
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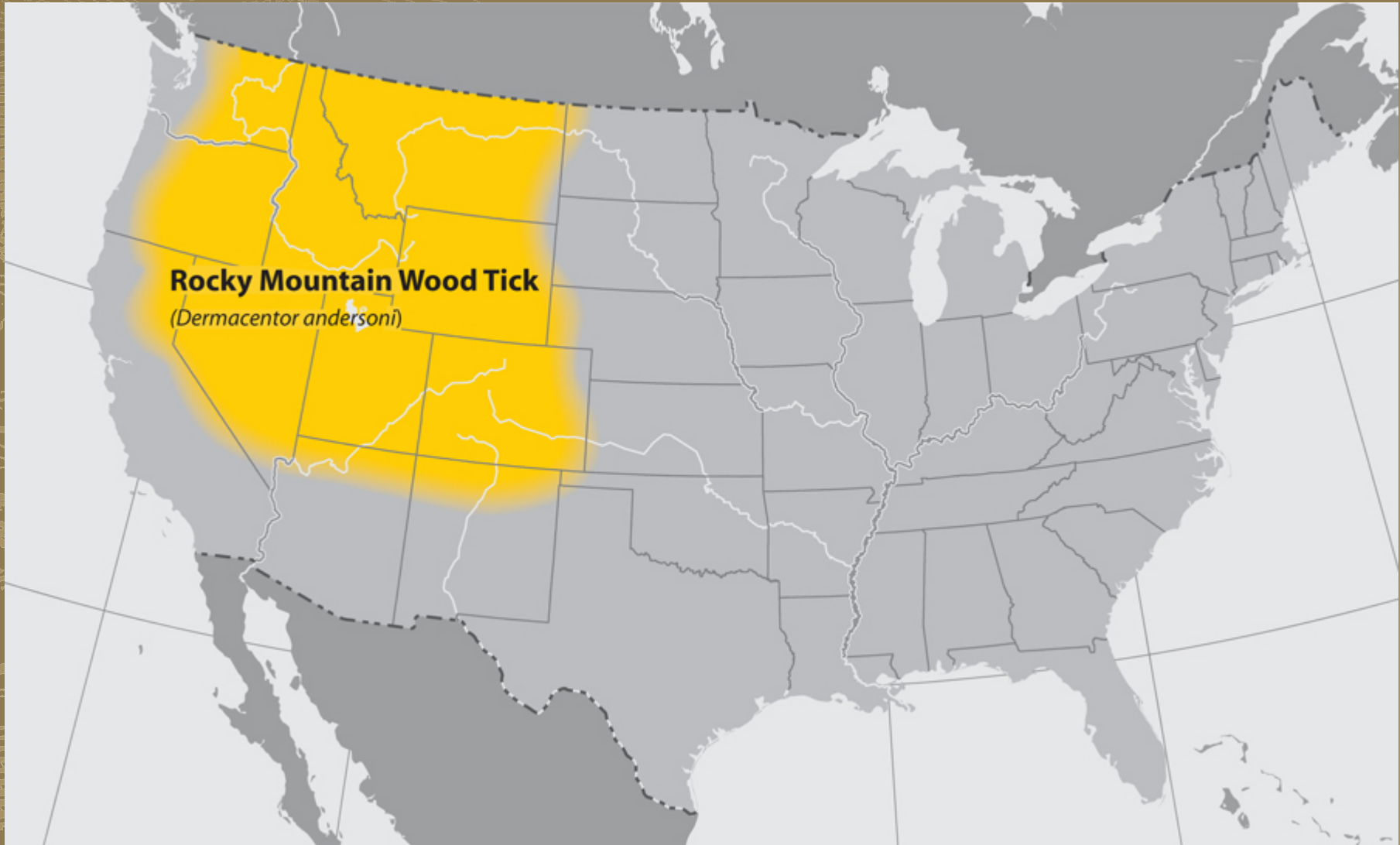
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Dermacentor andersoni

- Rocky Mountain Wood Tick
- Transmits
 - Rocky Mountain Spotted Fever, Colorado tick fever, tularemia, tick paralysis
- Adult ticks are primarily associated with transmission to humans
- Adults can be active January – November
 - Prime activity in late spring/early summer
- Long feeders – can stay attached for 3 -17 days depending of life stage



RM Wood Tick Distribution



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Image: http://www.cdc.gov/ticks/maps/rocky_mountain_wood_tick.html

RM Wood Tick Habitat

- Adults are generally found in elevations of 2100 m to 2500 m
- Temperature may be important in determining geographic range
- Prefer brushy areas of foothills and mountains, shrublands, lightly wooded areas, open grasslands, and along trails

Life Stages of RM Wood Tick



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***Dermacentor andersoni* (Rocky Mountain Wood Ticks)**



Larva



Nymph



Adult Male



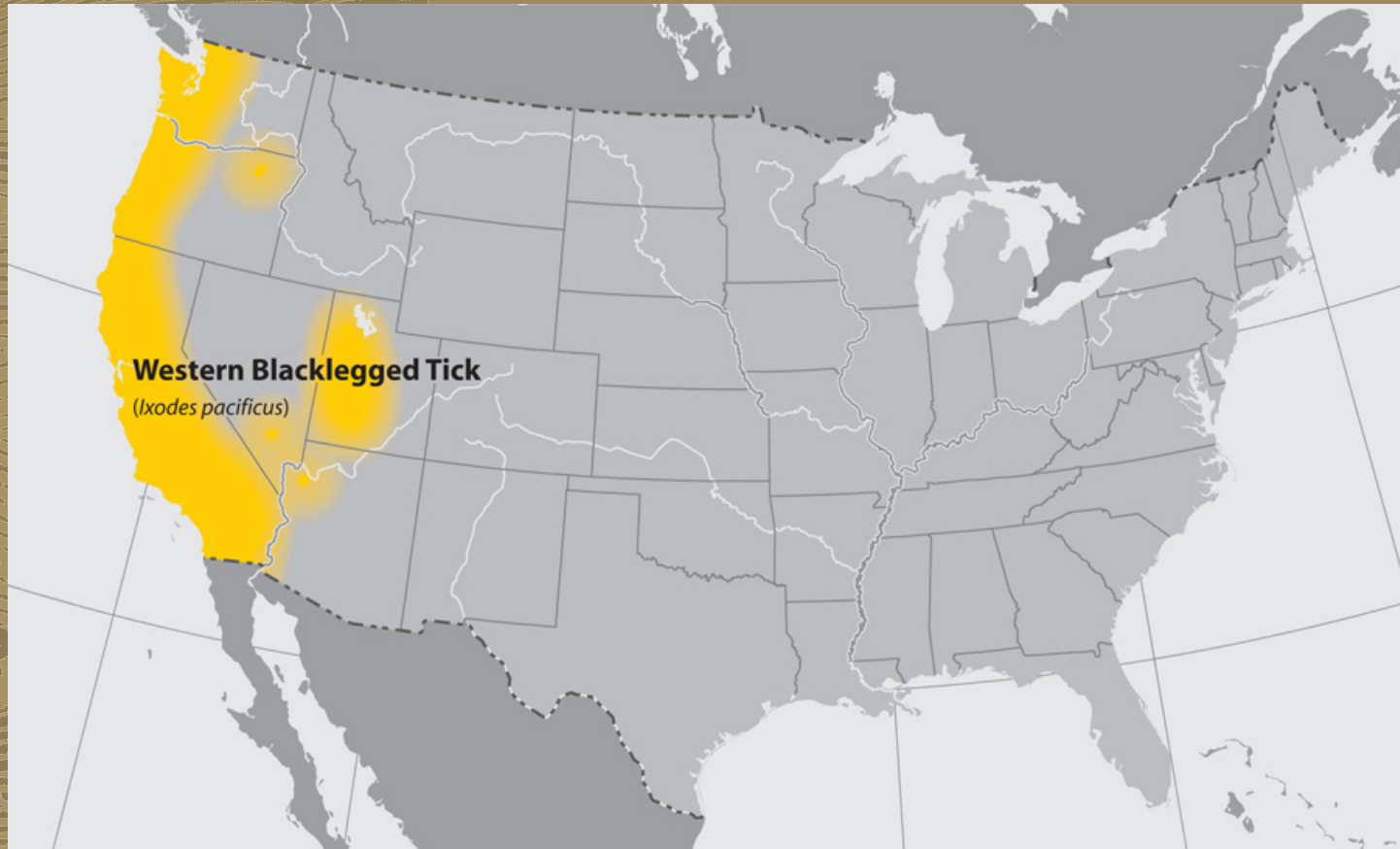
Adult Female

Ixodes pacificus

- Western blacklegged tick
- Transmits
 - Anaplasmosis
 - Lyme disease
- Both adult and nymphal ticks are known to transmit disease to humans
- Principle vector for Lyme disease in Western U.S.



Western Blacklegged Tick Distribution



Life Stages of Western Blacklegged Tick

 **TickEncounter** Resource Center

***Ixodes pacificus* (Western-Blacklegged Tick)**



Larva



Nymph



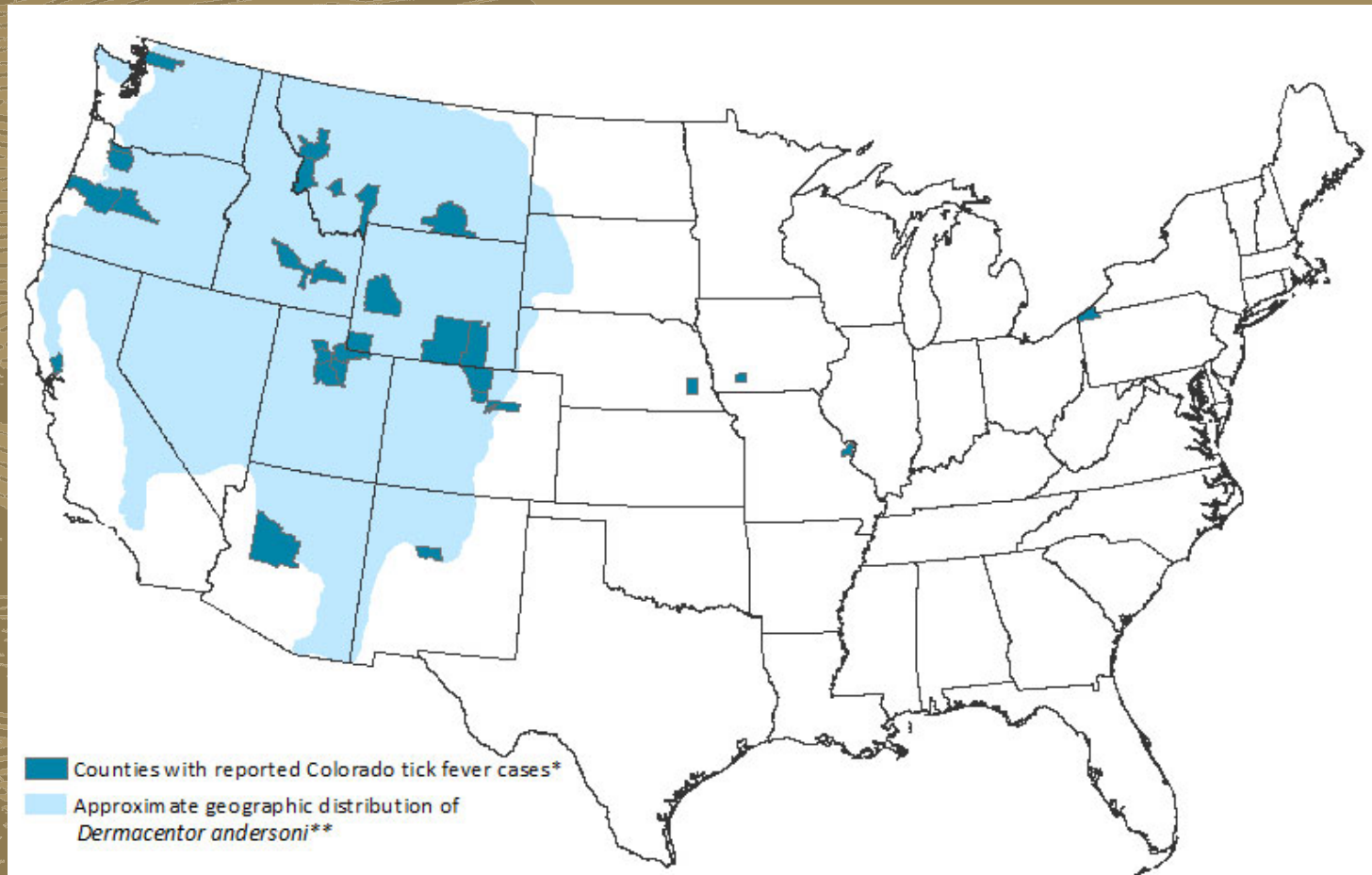
Adult Male



Adult Female

Colorado Tick Fever

Approximate geographic distribution of *Dermacentor andersoni* ticks and counties of residence for confirmed and probable Colorado tick fever (CTF) virus disease cases, United States, 2002–2012



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Colorado Tick Fever

- Agent: Colorado tick fever virus
- Tick: *Dermacentor andersoni*
- Incubation period: 1-14 days (3-5 days most common)
- Symptoms
 - Fever, chills, headache, muscle pain, lethargy
 - Common to get better for 2-4 days and then become ill again
 - Rash in 20% of cases
 - Swollen lymph nodes
 - Red eyes
 - Prolonged recovery characterized by weakness and fatigue