DEPARTMENT OF HEALTH

Vectorborne Diseases & How to Protect Yourself

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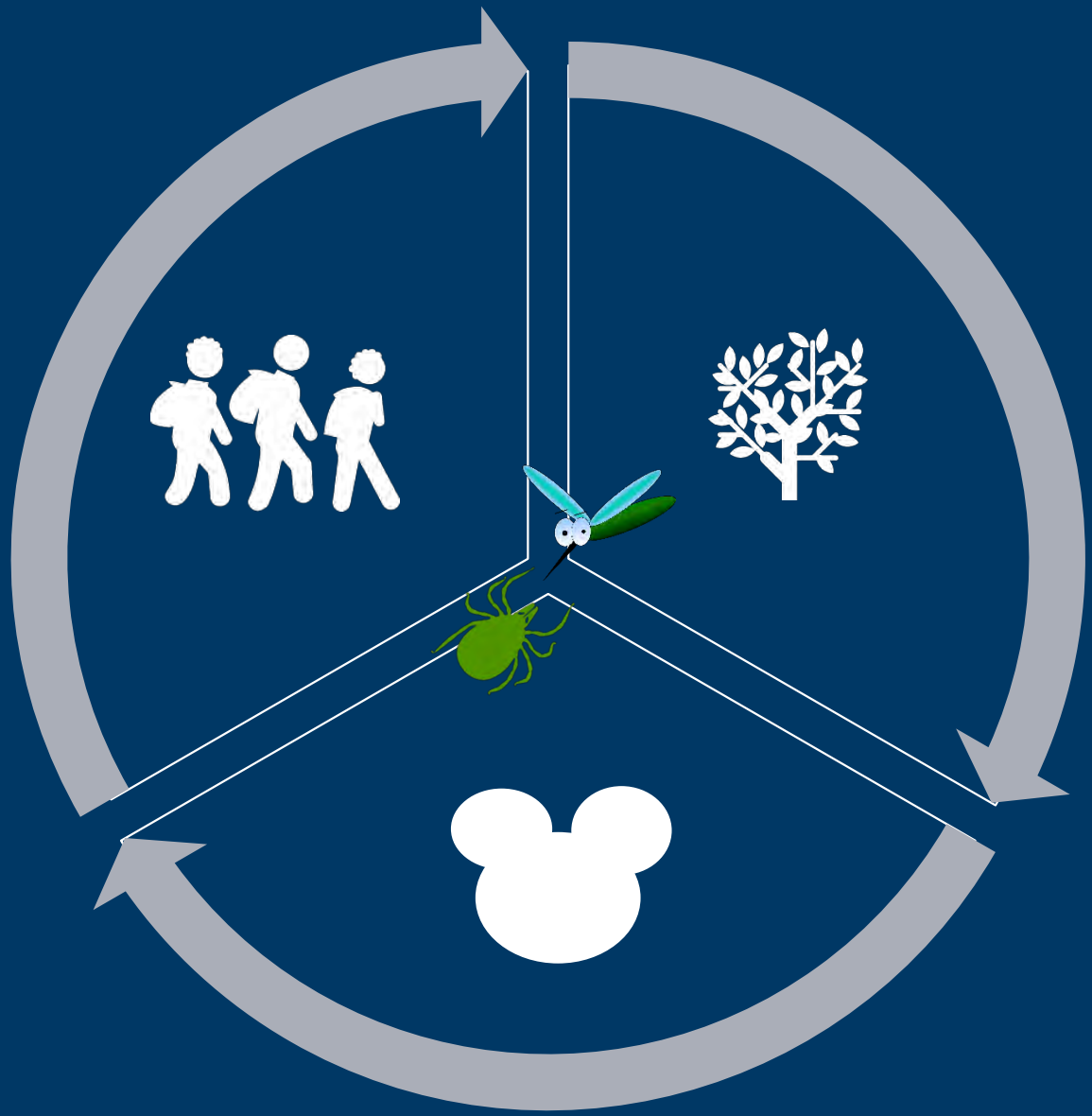
November 16th, 2017

MDH Vectorborne Diseases Unit

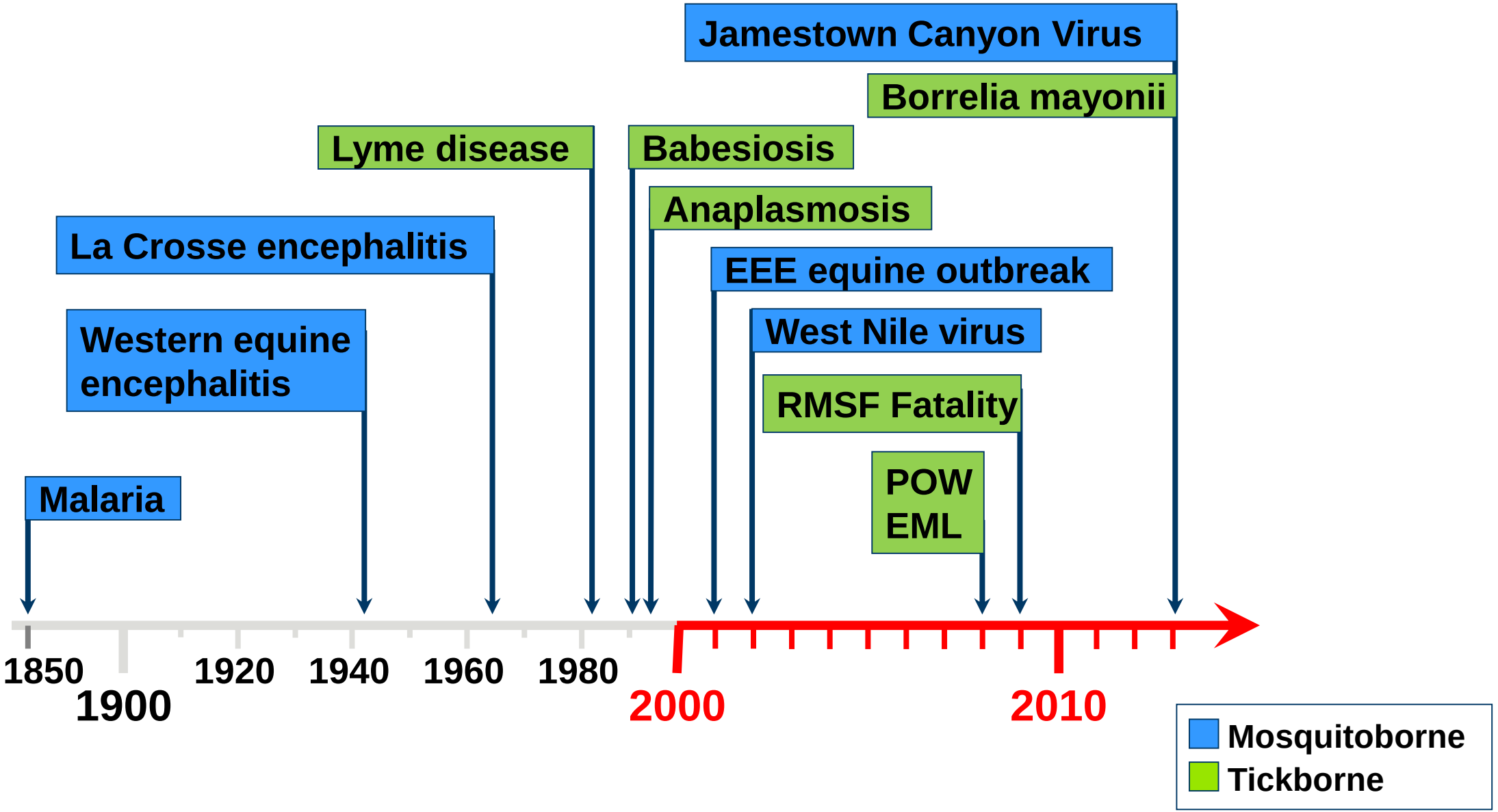
Activities

- Conduct surveillance for vectorborne diseases in MN
  - Diseases transmitted primarily by ticks and mosquitoes
- Collaborate with local, regional, and national partners
  - MMCD, COE, CDC
- Educate Minnesotans about vectorborne diseases
  - Public health agencies
  - General public
  - Medical community

Vectorborne Diseases: Complex and Dynamic



Timeline of Vectorborne Diseases in Minnesota



Tickborne Diseases of MN

3 Main Ticks of Public Health Concern in Minnesota

Blacklegged (Deer) Tick

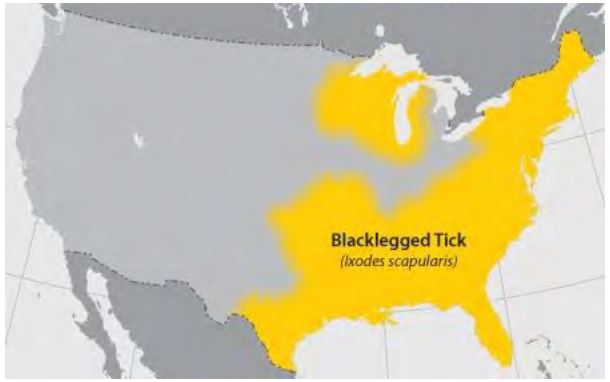
- Lyme disease (& other *Borrelia* species)
- Human anaplasmosis
- Babesiosis
- Ehrlichiosis
- Powassan virus disease

American Dog (Wood) Tick

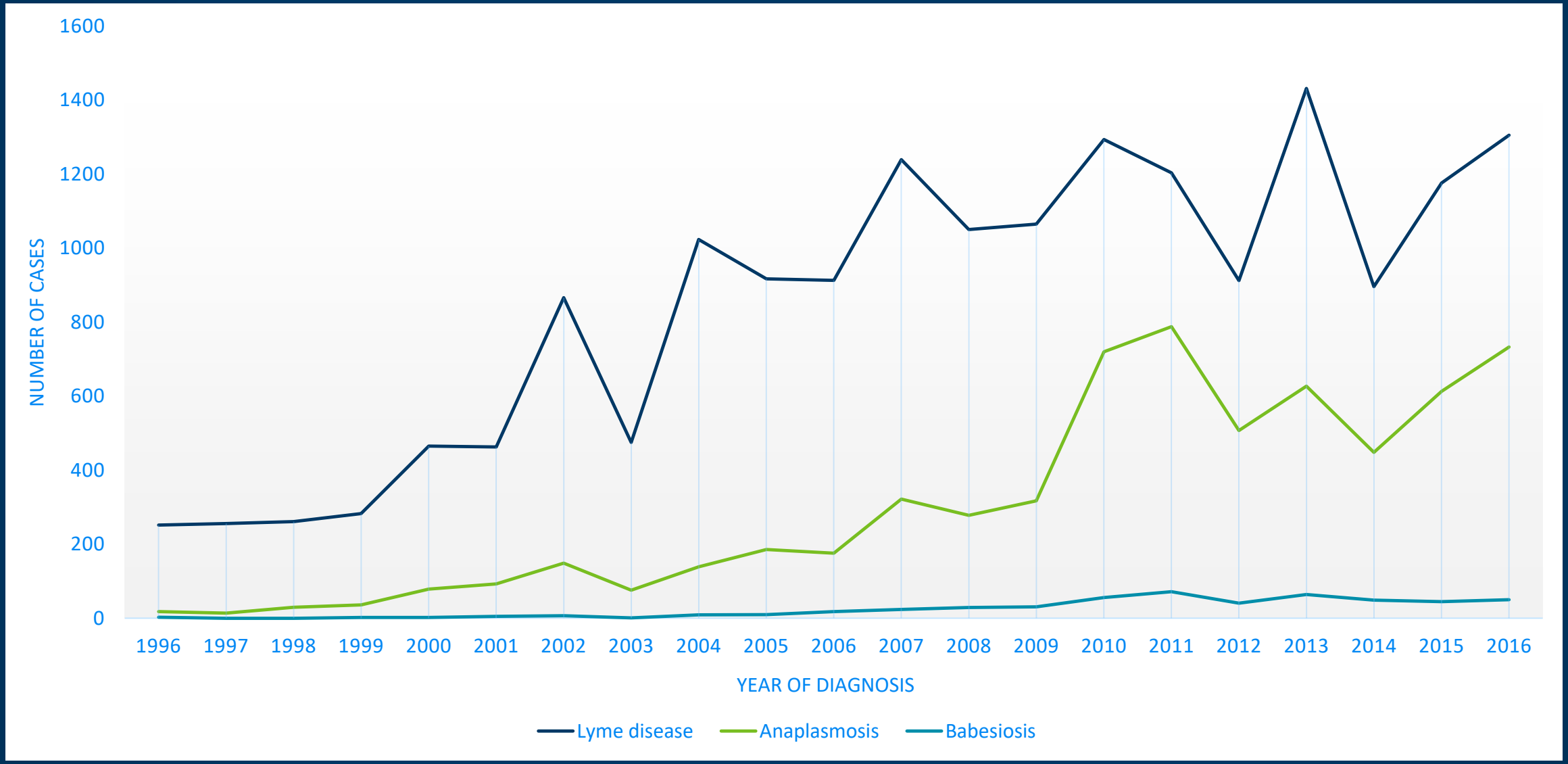
- Rocky Mountain Spotted Fever
- Tularemia

Lone Star Tick

- Ehrlichiosis
- Tularemia
- Southern Tick-Associated Rash Illness (STARI)

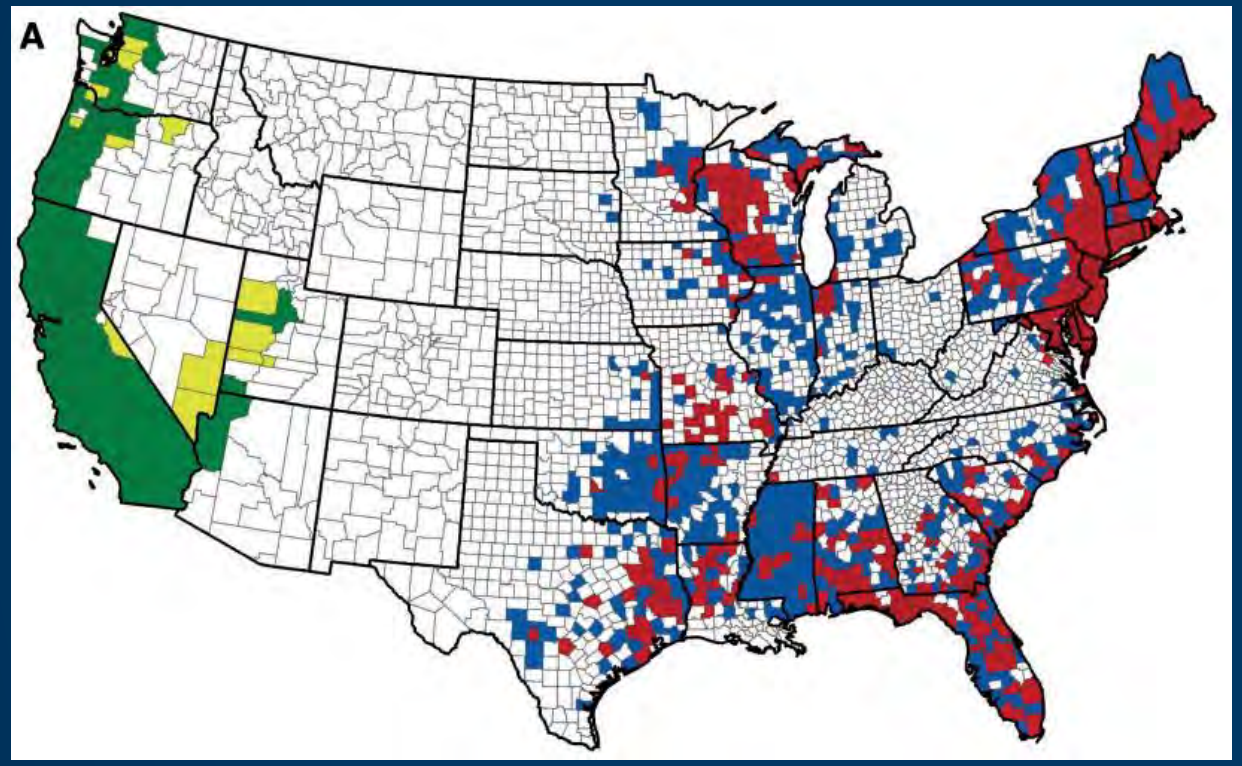


Reported Tickborne Disease Cases in Minnesota, 1996-2016

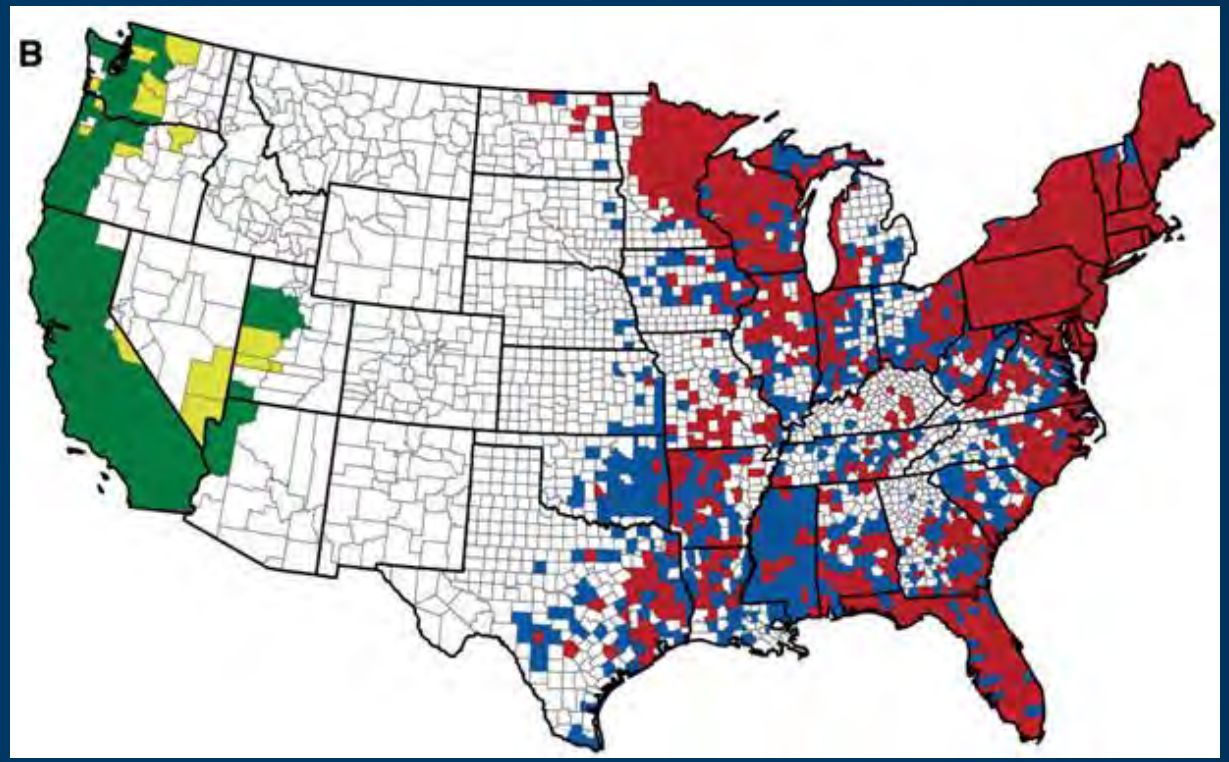


Blacklegged tick distribution by county of recorded presence

1907-1996



1907-2015

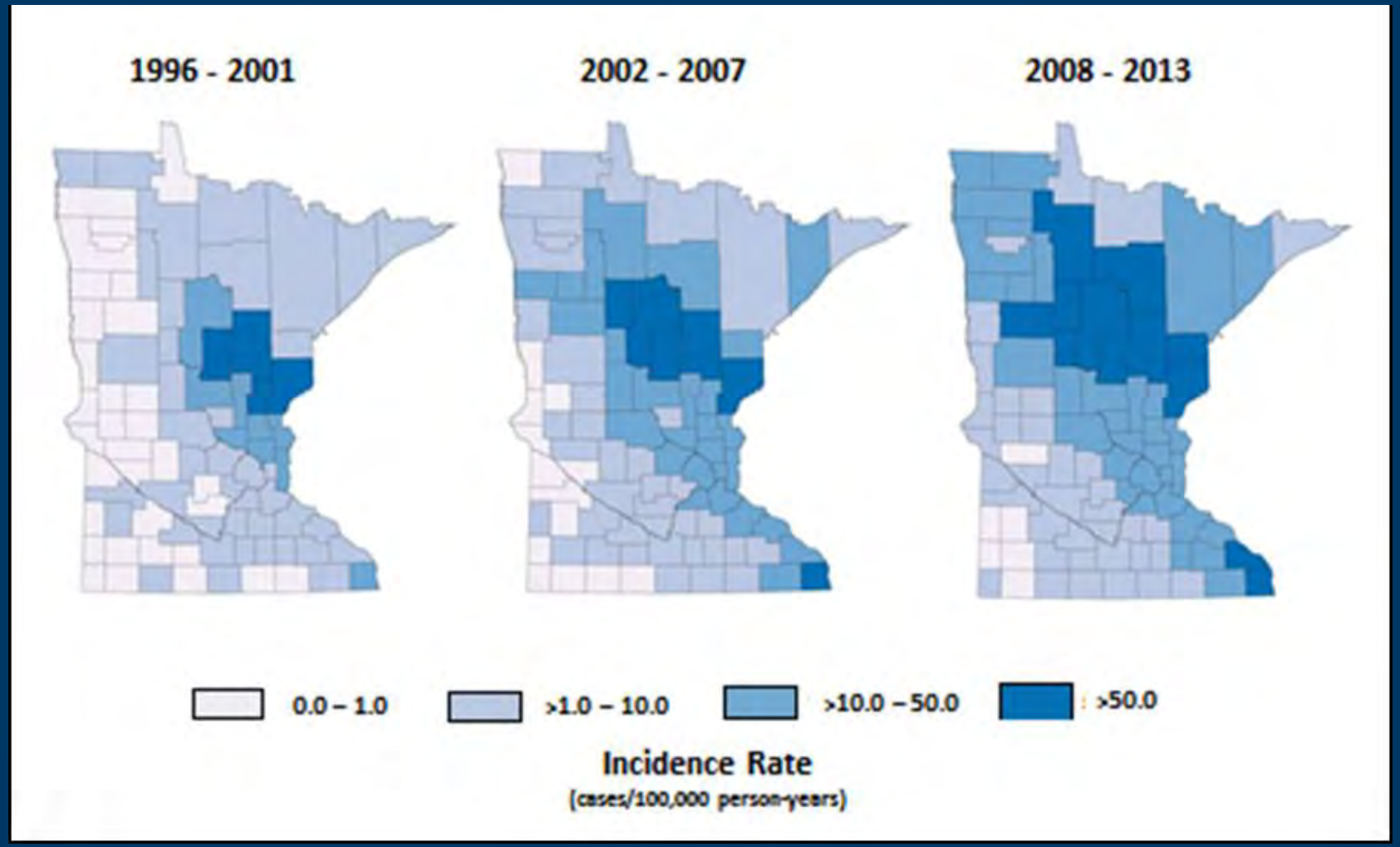


Established*
Reported**
No Records

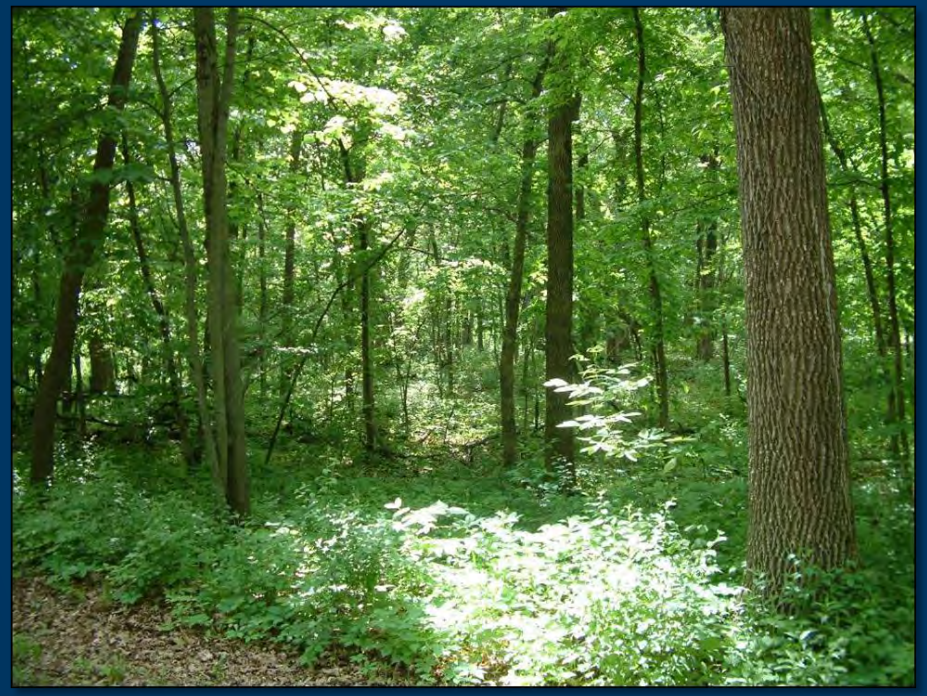
* ≥ 6 ticks or two life stages recorded within a single calendar year
** fewer ticks of a single life stage

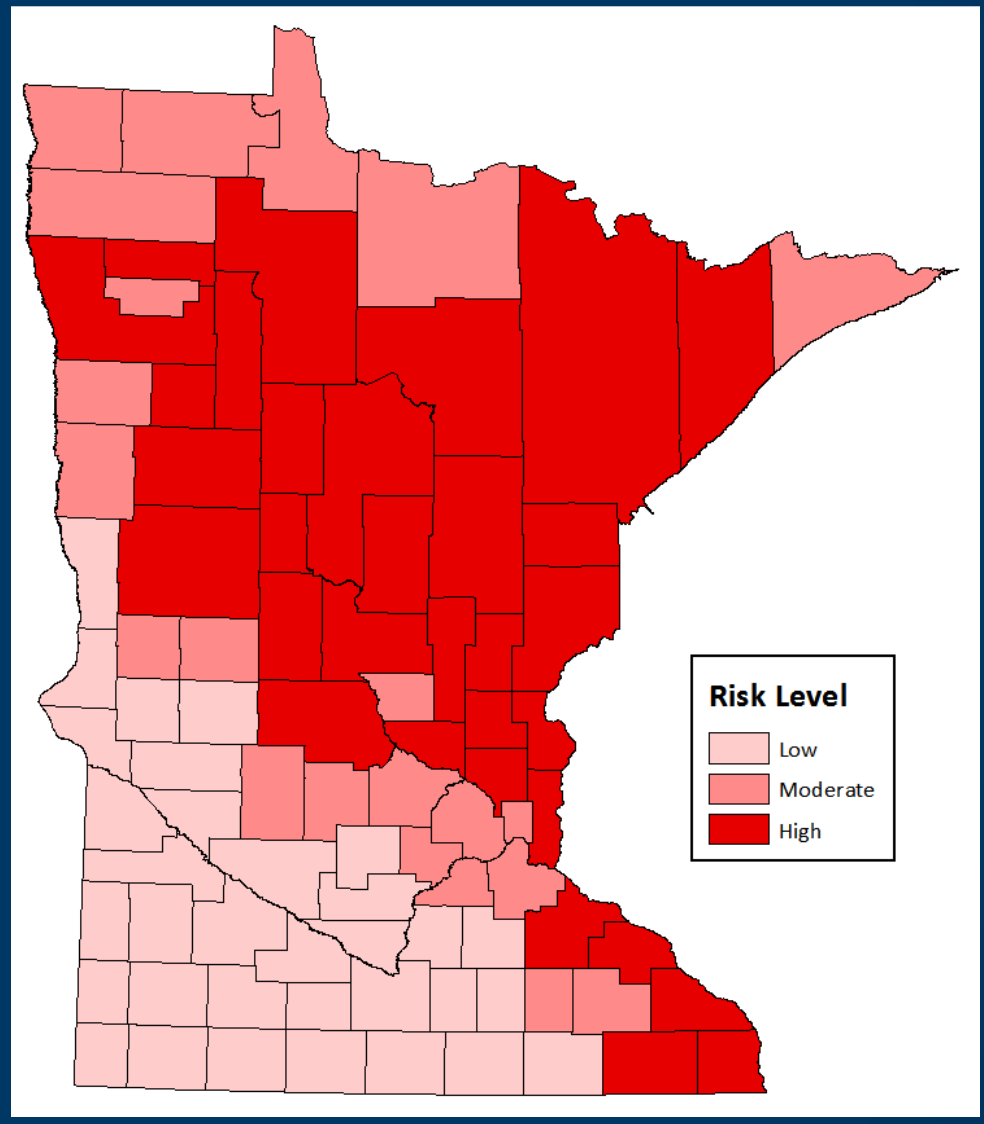
Eisen, R. J., Eisen, L., and C. B. Beard. County-Scale Distribution of *Ixodes scapularis* and *Ixodes pacificus* (Acari: Ixodidae) in the Continental United States. 2016. J Med Ent 0:0 (1-38). doi: 10.1093/jme/tjv237

Distribution of Lyme disease cases in Minnesota, 1996-2013

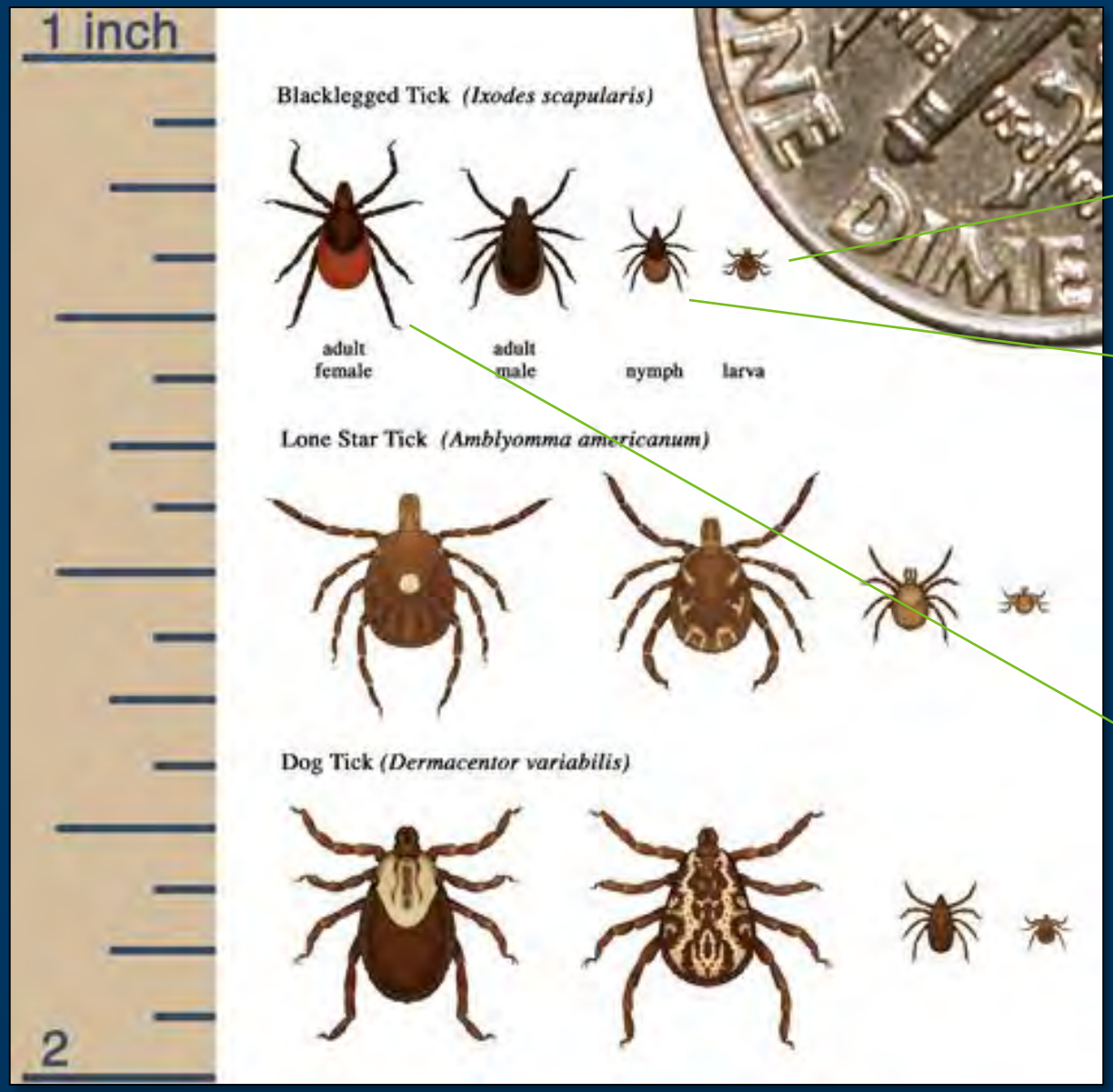


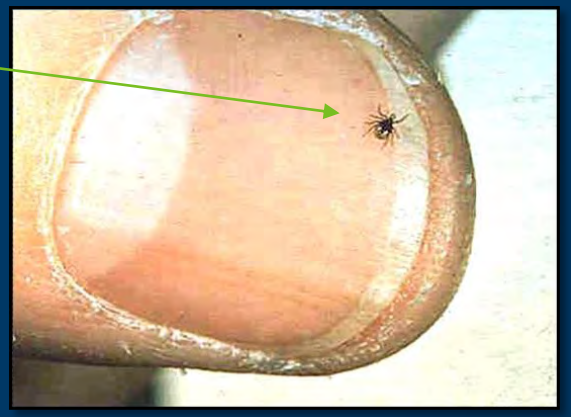
Tickborne Disease Risk in Minnesota



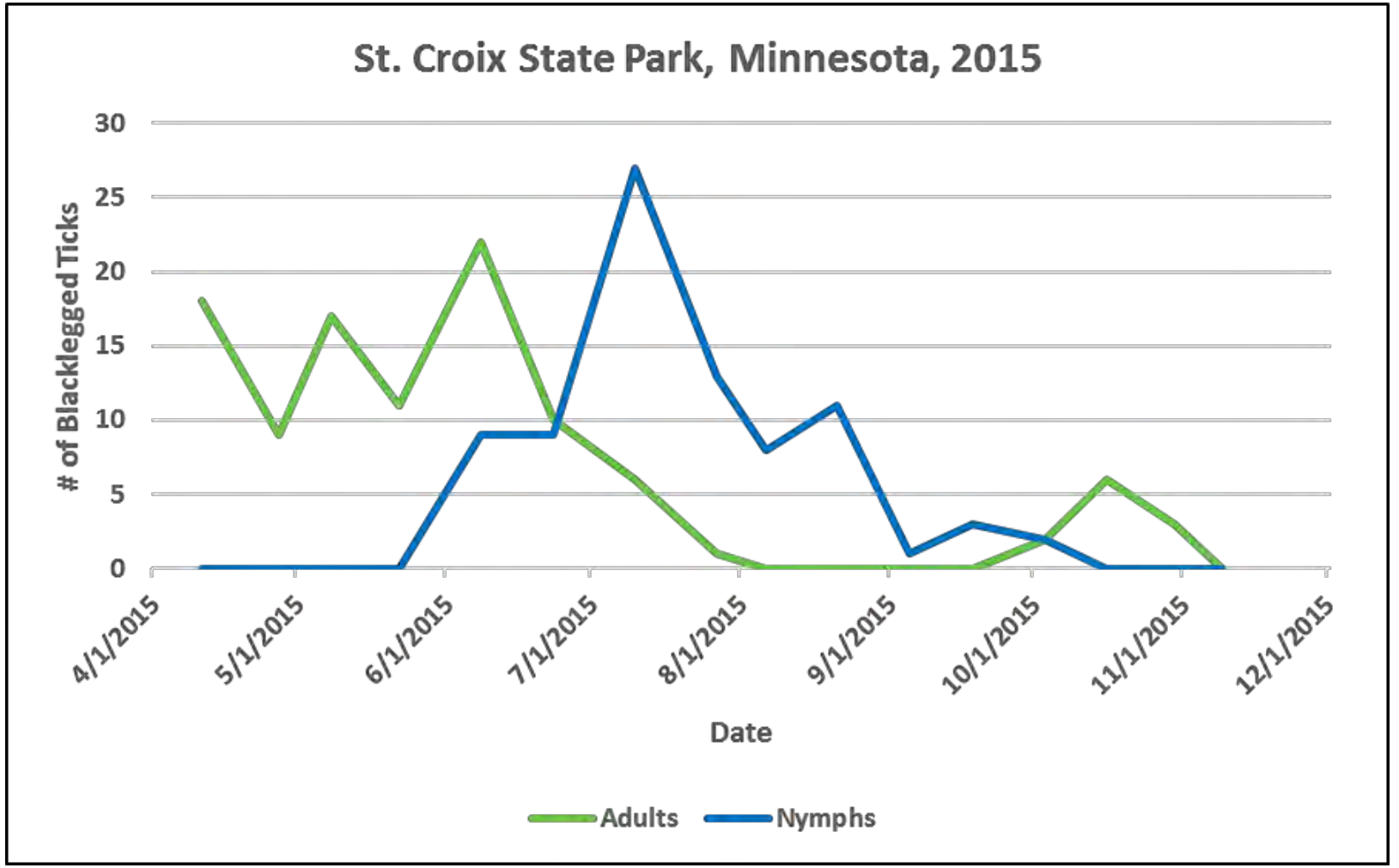


Tick Life Stages





Blacklegged Tick Phenology in Minnesota



Blacklegged Tick Questing Behavior

*What blacklegged ticks do:

- Search for a host from the tips of low-growing vegetation
- Sense body chemicals and other cues from potential hosts
- Climb onto a person or animal near ground level as they walk by

*What blacklegged ticks don’t do:

- Jump
- Fly
- Fall from treetops
- See

Tickborne Diseases

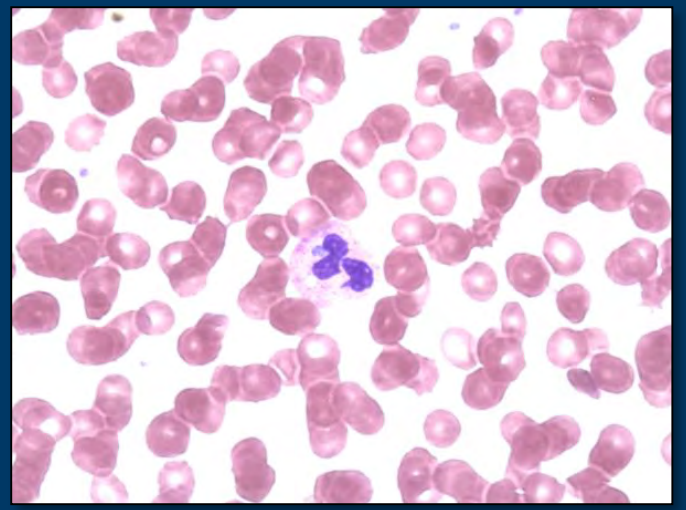
- Many tickborne diseases have similar symptoms and usually show up within 2-4 weeks of being bitten by an infected tick:
  - Rash
  - Fever
  - Headache
  - Fatigue
  - Muscle or joint aches
- If you think you could have a tickborne disease, contact your doctor immediately to discuss the following:
  - History of being around wooded or brushy areas
  - Physical examination
  - Blood tests
- Most tickborne diseases are treatable with antibiotics and have a good prognosis.
  - Babesiosis requires an antiparasitic medication and an antibiotic while Powassan virus requires supportive care only
  - For most people, symptoms go away after treatment but talk with your doctor about any symptoms that remain

Lyme Disease

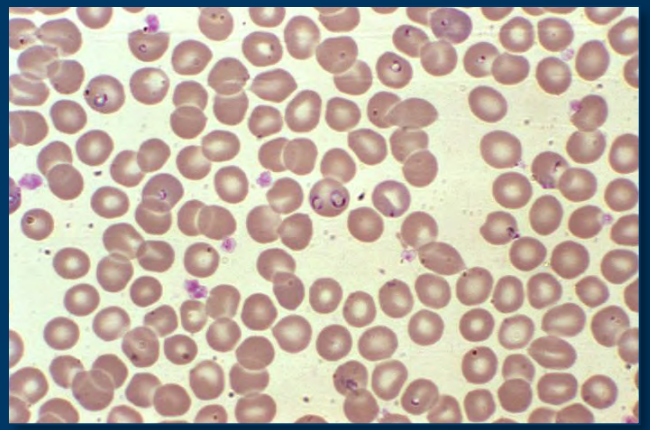
- *Borrelia burgdorferi*
- Symptoms
  - Characteristic Rash (bulls-eye)
  - Fever
  - Muscle and joint pain
  - Fatigue
  - Arthritis, Bells Palsy, Heart/Neurologic
- Diagnosis
  - History of exposure to ticks or wooded areas
  - Physical examination
    - Bulls-eye rash
  - Laboratory testing
    - Bloodwork or joint tap
- Treatment
  - Antibiotics

Human Anaplasmosis

- *Anaplasma phagocytophilum*
- Symptoms
  - Fever
  - Severe headache
  - Muscle or joint aches
  - Severe complications and death possible
- Diagnosis
  - History of exposure to ticks or wooded areas
  - Physical examination
  - Laboratory testing
    - Bloodwork
- Treatment
  - Antibiotics



Babesiosis



- *Babesia microti*
- Symptoms
  - Fever
  - Headache
  - Fatigue
  - Severe complications and death possible
- Diagnosis
  - History of exposure to ticks or wooded areas
  - Physical examination
  - Laboratory testing
    - Bloodwork
- Treatment
  - Patients without symptoms may not require treatment
  - Combination of anti-protozoal and antibiotic

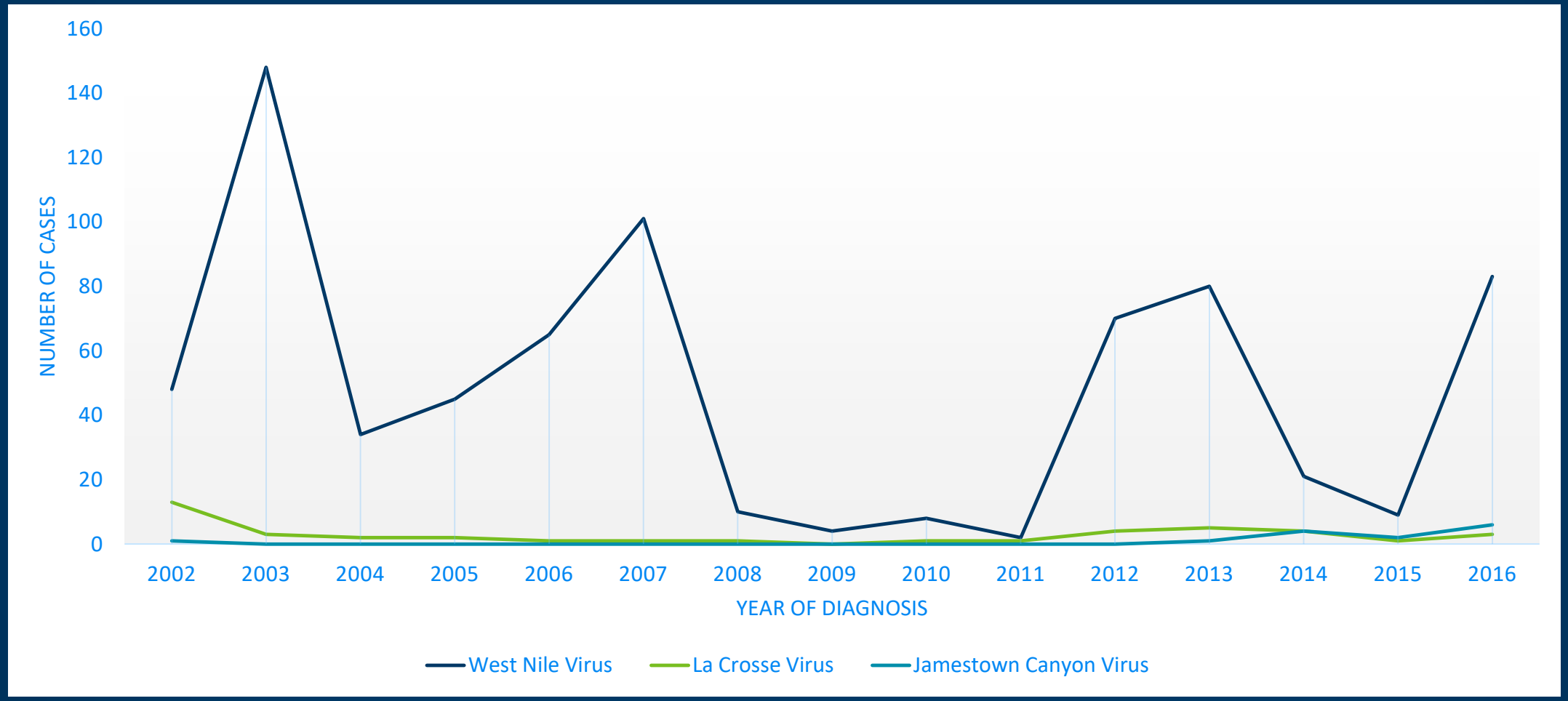
Rare/Emerging Tickborne Disease Agents in Minnesota

- Powassan virus
- *Ehrlichia muris eauclairensis*
- *Borrelia mayonii*
- *Borrelia miyamotoi*
- *Rickettsia rickettsii**
- *Francisella tularensis**

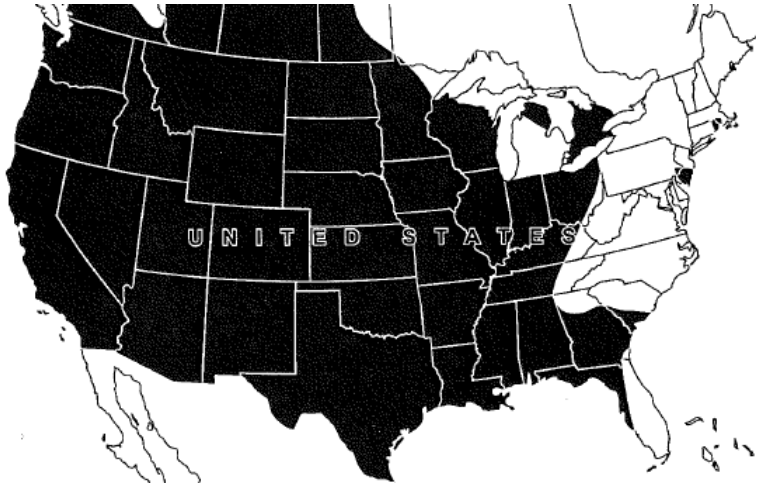
- *transmitted by the American dog (wood) tick, not the blacklegged tick

Mosquitoborne Diseases of MN

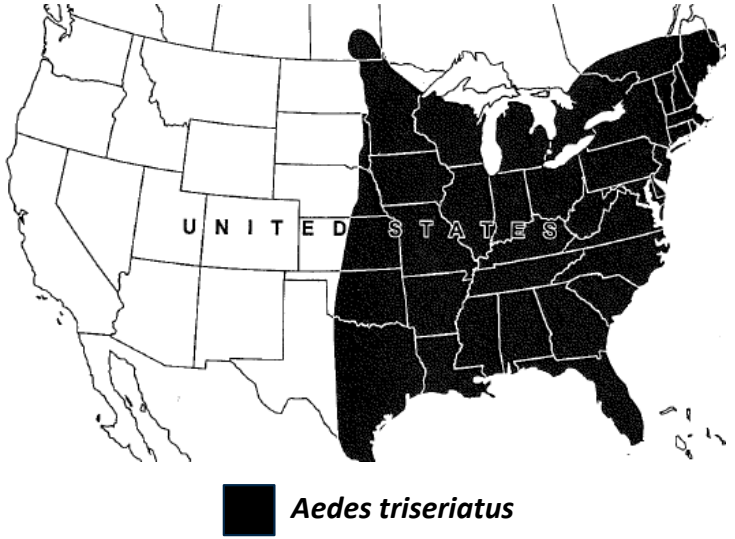
Reported Mosquitoborne Disease Cases in Minnesota, 2002-2016



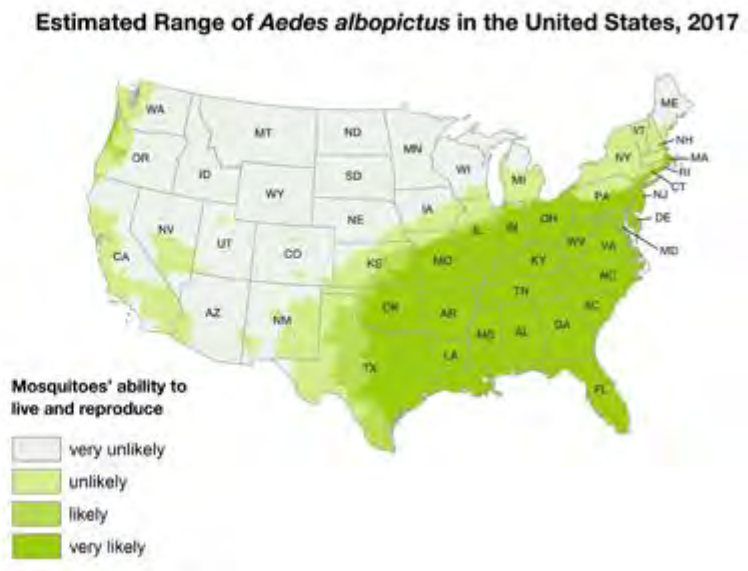
Distribution of Select Mosquito Vectors in the US



Culex tarsalis

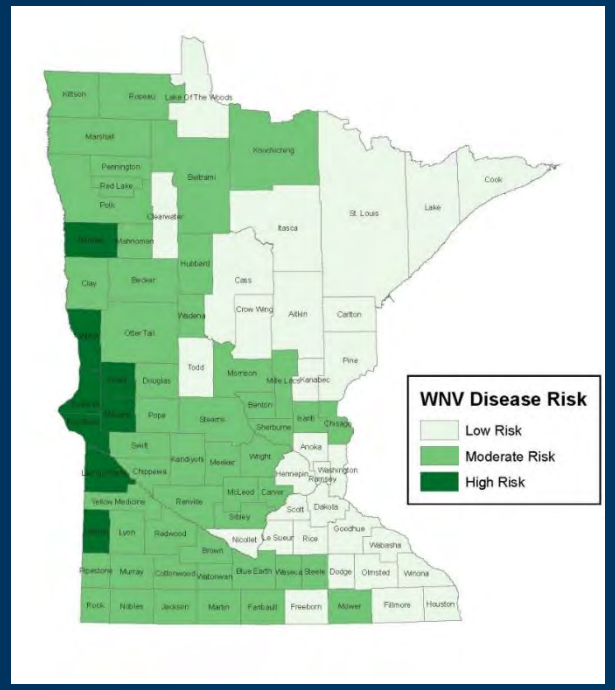


Aedes triseriatus

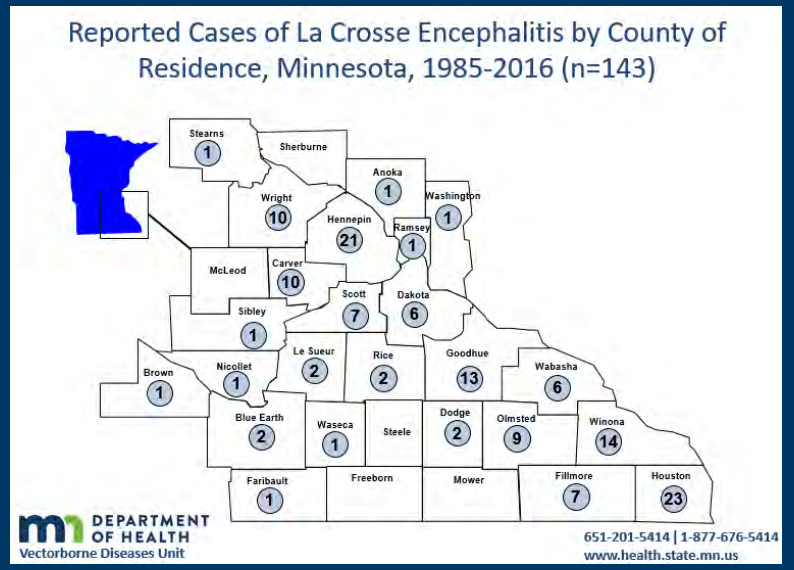


Mosquitoborne Disease Risk in Minnesota

West Nile Virus



La Crosse Virus



Jamestown Canyon Virus

Mosquitoborne Disease Symptoms

- Most people will have no symptoms or just a mild illness
- Symptoms usually show up within 1-2 weeks of being bitten by an infected mosquito
- A small percentage of people will develop encephalitis or meningitis
- Watch for symptoms like:
  - Fever
  - Headache
  - Stiff neck
  - Rash
  - Disorientation or seizures

Mosquitoborne Disease Diagnostics

- If you think that you may have a mosquitoborne disease, contact your health care provider immediately
- Your health care provider can determine if you have a mosquitoborne disease based on your:
  - History
  - Symptoms
  - Laboratory tests
    - Bloodwork or spinal tap

Mosquitoborne Disease Treatments

- There are no specific medications to treat viruses that are spread by mosquitoes
  - Symptoms are treated with supportive care
- People with mild illness typically recover on their own
- Those with severe nervous system illness may require hospitalization
  - Long-term nerve damage and death may occur

Vectorborne Disease Prevention – Personal Protection Methods

Know when & where you're at risk

Avoid bites

Wear repellent

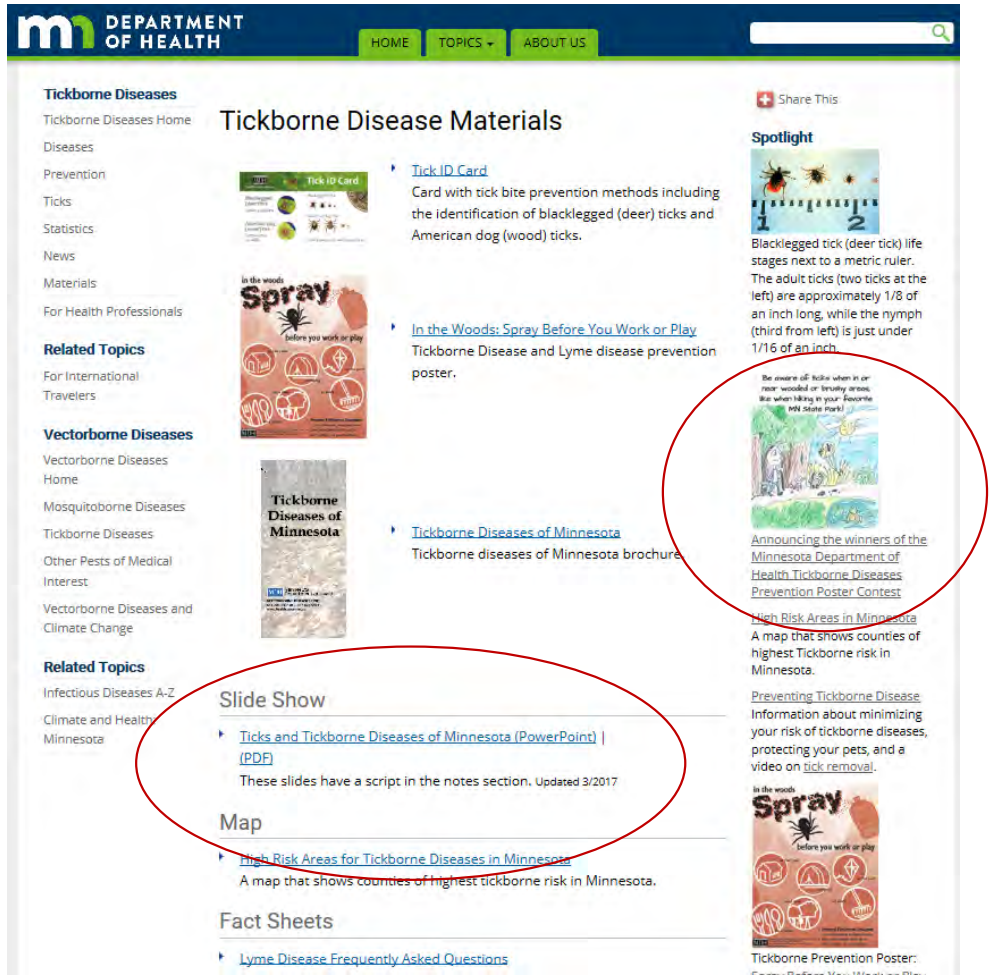
Check for ticks

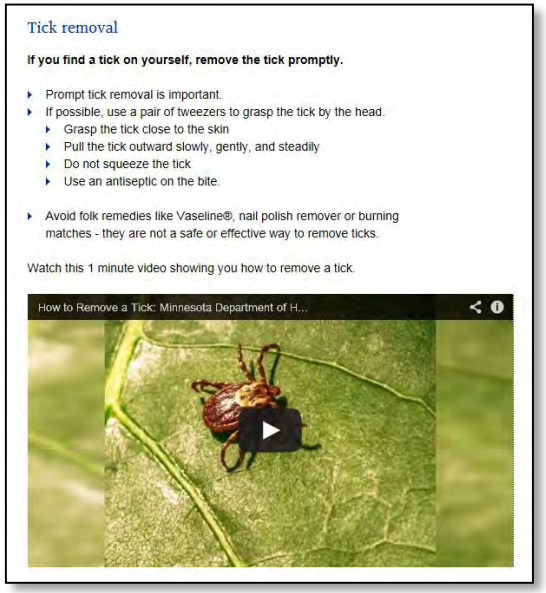
Watch for symptoms

Other Tickborne Disease Prevention Methods

Other Mosquitoborne Disease Prevention Methods

Outdoor Education





Encouraging daily tick checks

(image courtesy of tickencounter.org)

Take Home Messages

- Vectorborne diseases are complex and dynamic so difficult to give broad recommendations
- Know where to get accurate, up-to-date information
- Empower yourselves and your community about safe and effective prevention methods
- Be aware of symptoms and see your doctor if you get sick

Thank You!

Questions?

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Backcountry Water Treatment

Stephanie Gretsch| Epidemiologist

Midwest Risk Management Symposium, 2017

DEPARTMENT OF HEALTH

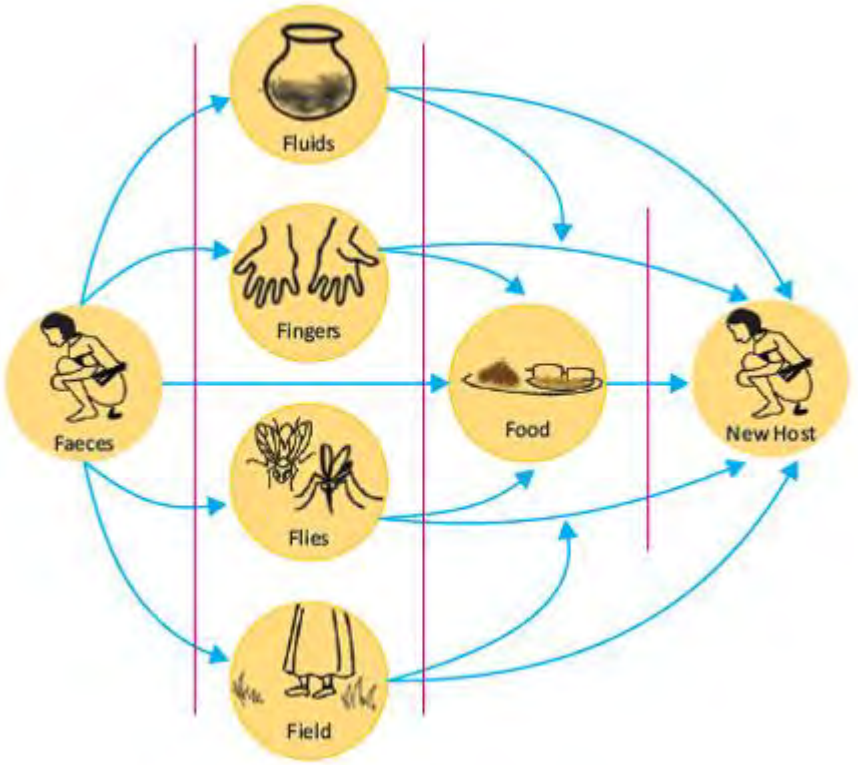
Water Treatment in the Backcountry

- A low level of risk exists with any water source – even those in the most remote locations or most pristine-looking
- *Giardia* is a concern when consuming surface water in Northern Minnesota
- Best to always treat your drinking water

Enteric (Gastrointestinal) Illnesses

- Spread fecal-orally
  - Pathogen is shed in the stool and must be ingested for someone else to become infected
  - Waterborne, foodborne, and person-to-person transmission possible
- Common symptoms include: diarrhea (sometimes bloody), vomiting, nausea, abdominal cramps, and fever

F-Diagram



Source: www.healthphone.org

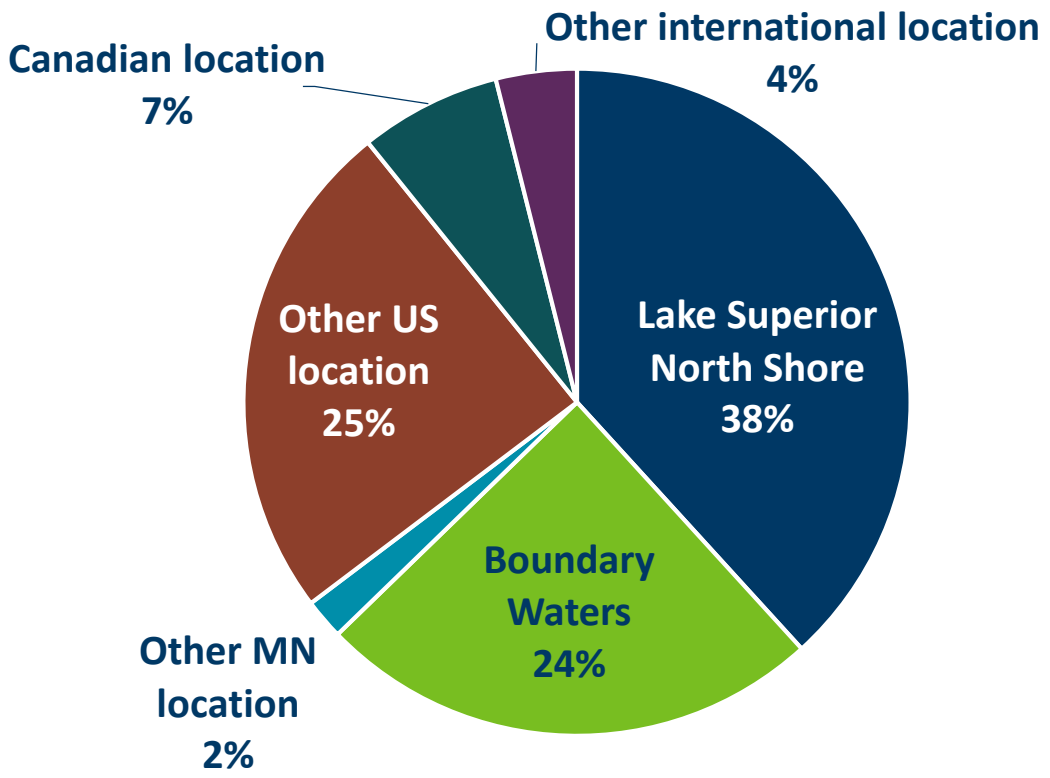
Giardia

- Around 650 cases reported in Minnesota annually
- Incubation: 7-10 days (range, 3 days to 3 weeks or more)
  - **Campers may not start getting sick until after they have left camp**
- Diarrhea, cramps, gas that lasts 1-2 weeks or longer
- Treatment can help shorten the duration of symptoms
- Risk factors: Contaminated water, person-to-person spread

Sporadic *Giardia* Cases

- From 2013 to 2016, 102 laboratory-confirmed *Giardia* cases reported consuming backcountry water in the 3 weeks prior to their illness onset

Backcountry locations where *Giardia* cases consumed water prior to illness onset



Treatment Methods

- 28% of cases reported not treating their water at all before drinking
- 19% reported using a filter at least part of the time vs. 82% of surveyed backcountry hikers
- 33% reported using a chemical (chlorine, iodine, chlorine dioxide) vs. 16% of surveyed backcountry hikers
- Cases were less likely to use a treatment method with high effectiveness against *Giardia* cysts

Giardiasis Outbreaks Associated with Backcountry Water Consumption

- Since 2013, 5 reported outbreaks of giardiasis associated with backcountry water consumption
- 87 cases reported, including 33 cases who tested positive for *Giardia*

Previous Outbreaks

- Outbreak of giardiasis among a group of university students
  - **224 students hiked along the Superior Hiking Trail for 5 days in Sept 2013**
  - **69 (30%) reported illness, including 21 who tested positive for *Giardia***
  - **Iodine drops and tablets used**

Previous Outbreaks

- Outbreak of giardiasis among a group of youth summer campers
  - Campers hiked along the Superior Hiking Trail in multiple groups for 7 days in July 2014
  - Six individuals reported illness, including two who tested positive for *Giardia*
  - Most water was treated with Aquamira water treatment drops; water was boiled occasionally

Previous Outbreaks

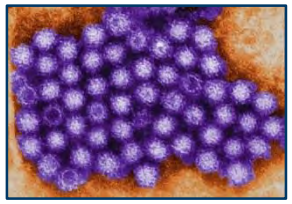
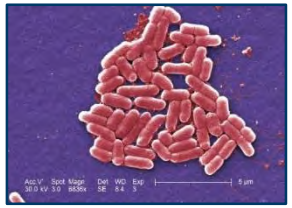
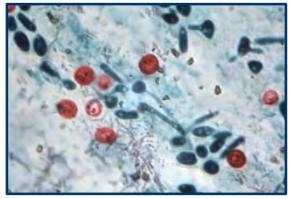
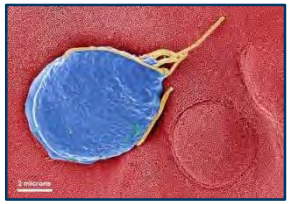
- Outbreak of giardiasis among a group of Boy Scouts
- 22 scouts and chaperones hiked in Olympic National Park, WA for 12 days in Aug 2015
  - 5 (23%) tested positive for *Giardia*
  - Primarily used SteriPENs (UV light treatment device) for water treatment

Lessons Learned

- Important to not only treat your water but use an effective treatment method
- Ensure product is being used properly
  - Educate campers and counselors about the method of choice prior to the trip

Effectiveness of Water Treatment Methods

Pathogen Properties

Type of Pathogen		Size	Halogen resistance
Viruses (e.g., norovirus)		0.004-0.1 microns	Low
Bacteria (e.g., *E. coli* O157)		0.2-4 microns	Low
Protozoa: ***Cryptosporidium***		4-6 microns	High
Protozoa: ***Giardia***		8-12 microns	Moderate

Chlorine Disinfection Timetable

Agent	Disinfectant Times*
E. coli O157:H7	<1 minute
Hepatitis A	16 minutes
Giardia	45 minutes
Cryptosporidium	15,300 minutes (10.6 days)

***Times based on 1 ppm free chlorine at pH 7.5 and 77° F**

Guide to Backcountry Water Treatment Methods

Treatment Method	Parasites		Bacteria	Viruses
	Cryptosporidium	*Giardia*	e.g., *E. coli*, *Shigella*	e.g., norovirus, rotavirus
Boiling	✓	✓	✓	✓
Filtration				
≤ 1.0 micron[1] filter	✓	✓	x	x
≤ 0.3 micron[1] filter	✓	✓	!	x
Disinfection				
Iodine[2]	x	!	✓	✓
Chlorine	x	!	✓	✓
Chlorine dioxide	!	✓	✓	✓
Filtration + Disinfection	✓	✓	✓	✓

Key:

✓	**High effectiveness**
!	**Moderate-Low effectiveness**
x	**Not effective**

[1]Absolute pore size
[2]Water disinfected with iodine is not recommended for pregnant women, people with thyroid problems, those with known hypersensitivity to iodine, or continuous use for more than a few weeks at a time

Filtration

Treatment Method	Parasites		Bacteria	Viruses
	Cryptosporidium	*Giardia*	e.g., *E. coli*, *Shigella*	e.g., norovirus, rotavirus
Filtration				
≤ 1.0 micron filter	✓	✓	X	X
≤ 0.3 micron filter	✓	✓	!	X

Key:

✓	**High effectiveness**
!	**Moderate-Low effectiveness**
X	**Not effective**

- **Absolute pore size, microorganism size, and charge influence effectiveness of filter**
- **Always follow manufacturer instructions regarding use and maintenance**

Chemical Disinfection

- Effectiveness depends on:
  - Disinfectant concentration
  - Contact time
  - Water temperature
  - Turbidity (cloudiness)
  - pH
- Always follow manufacturer instructions regarding dosing and wait times

Chemical Disinfection

Treatment Method	Parasites		Bacteria	Viruses
	Cryptosporidium	*Giardia*	e.g., *E. coli*, *Shigella*	e.g., norovirus, rotavirus
Disinfection				
Iodine	X	!	✓	✓
Chlorine	X	!	✓	✓
Chlorine dioxide	!	✓	✓	✓

Key:

✓	**High effectiveness**
!	**Moderate-Low effectiveness**
x	**Not effective**

- **Iodine is not recommended for pregnant women, people with thyroid problems, those with known hypersensitivity to iodine, or continuous use from more than a few weeks at a time**

Considerations When Using Chemical Treatment

- Check the product's expiration date or use by date after opening – throw away any expired product
- If water is collected with the same bottle it will be drunk in, disinfect the threads
- Carry two water bottles
  - One with already treated water to drink immediately, one with water in the process of being treated

Filtration Followed by Disinfection

Treatment Method	Parasites		Bacteria	Viruses
	Cryptosporidium	*Giardia*	e.g., *E. coli*, *Shigella*	e.g., norovirus, rotavirus
Filtration + Disinfection	✓	✓	✓	✓

Key:

✓	**High effectiveness**
!	**Moderate-Low effectiveness**
x	**Not effective**

- Used together, filtration followed by disinfection is highly effective against all types of microorganisms
- Shorter contact time is required because filter will remove *Giardia* and *Cryptosporidium*

Boiling

Treatment Method	Parasites		Bacteria	Viruses
	Cryptosporidium	*Giardia*	e.g., *E. coli*, *Shigella*	e.g., norovirus, rotavirus
Boiling	✓	✓	✓	✓

Key:

✓	**High effectiveness**
!	**Moderate-Low effectiveness**
x	**Not effective**

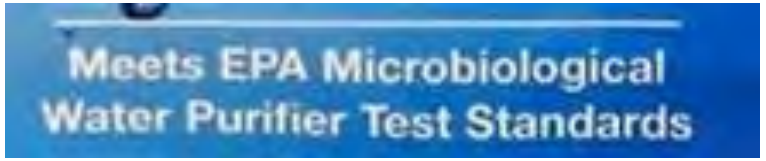
- Most effective method to remove pathogens
- Bring water to a rolling boil then:
  - Continue to boil for 1 minute OR
  - Remove from heat but keep container covered for several more minutes
- If water is muddy, let it stand to allow silt and debris to settle then pour of clear water for boiling

Ultraviolet (UV) Light

- If used correctly, can be effective against all types of pathogens
- Often requires pre-filtering because low water turbidity is needed to be effective
- Proper agitation of water required
  - Use wide mouth water bottle
- Correct power delivery and contact times
- Bring back-up batteries or a solar charger

Microbiological Water Purifiers

- Purifiers remove all classes of microorganisms: bacteria, viruses, protozoan parasites
- Includes certain filters, UV light, and chemical treatments
- EPA microbiological water purifier standards:
  - Bacteria: 99.9999% reduction
  - Viruses: 99.99% reduction
  - Protozoa (*Cryptosporidium* and *Giardia*): 99.9% reduction

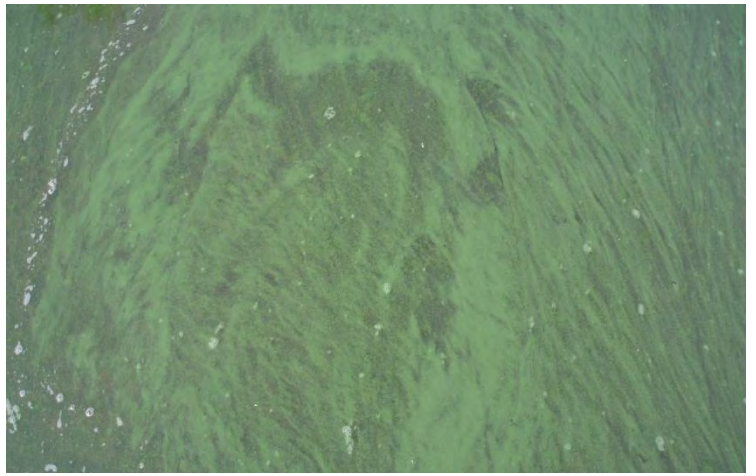


General Recommendations

- Always bring at least one backup treatment method in case the primary method fails
- Treatment specifications may vary between products; manufacturer instructions should always be followed
- When purchasing a product use the label as your guide (instead of marketing materials)

Harmful Algal Blooms (Blue-green Algae)

- **Thrive in nutrient-rich, warm water**
- **Blooms usually occur in the summer and fall and are found everywhere in MN**
- **Look like pea soup or spilled paint but can sometime cover small areas with little visible algae present**
- **Produce cyanotoxins that can make people and animals ill**
- **No way to tell if a bloom is toxic or not by looking at it**



Harmful Algal Blooms (Blue-green Algae)

- **Boiling will not destroy toxins and can increase toxin levels**
- **Water treatment devices designed for the backcountry are not able to destroy the toxins**
- **AVOID using the water source for drinking and swimming!**

Other Best Practices to Prevent Illness

Grey Water Disposal

- Protect your drinking water source
- Dispose of grey water 200 feet (~80 adult paces) away from the water source
  - Broadcast if in remote area
  - Bury in shallow hole
- Never clean dishes or bathe directly in the water source

Handwashing

- Wash your hands!
  - After using the bathroom
  - Before preparing or eating foods
- Use clean water and soap if possible
  - Do not reuse water in a bucket for handwashing

Handwashing with Hand Sanitizer

- Hand sanitizers are not effective against all pathogens
- Sanitizers with an alcohol concentration between 60–95% are most effective
- Works best with hands free of dirt and grease
  - Wipe off hands before applying using a cloth, water, or excess hand sanitizer
- Apply size as directed on package label
- Continue rubbing hands until they have dried

Illness Exclusion

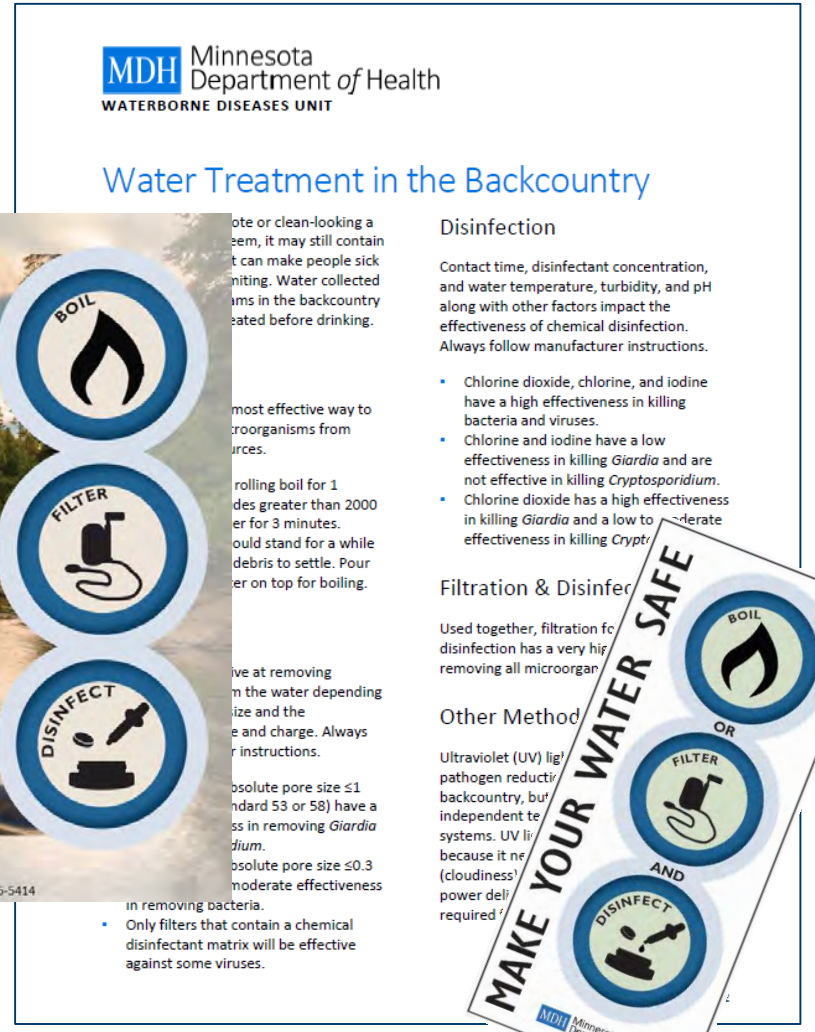
- Exclude ill campers and staff from backcountry trips
  - Vomiting: two or more vomiting episodes in a 24 hour period
  - Diarrhea: three or more loose stools in a 24 hour period
- If someone gets sick during the trip
  - Exclude the ill individual from cooking duties, water collection, communal water treatment duties, and swimming
  - Reinforce good handwashing practices with everyone

Print Materials and More Information

Online resources:

MDH Website:
http://www.health.state.mn.us/divs/idepc/dtopics/waterborne/prevention/backcountry.html

CDC Yellow Book:
https://wwwnc.cdc.gov/travel/page/yellowbook-home



Save the Date: Healthy Camps Workshops 2018

- Two free workshops for camp directors, nurses, and other staff
  - Thursday, April 12 from 1:00pm to 4:30pm in Duluth
  - Tuesday, April 17 from 8:30am to 12:00pm in St. Paul
- Topics include: general illness control, vectorborne diseases, rabies and bats in cabins, healthy swimming tips, and backcountry water treatment
- Registration will open early February 2018: http://www.health.state.mn.us/divs/idepc/dtopics/animal/camp/
- Questions in the meantime: 651-201-5414

Thank You! Questions?

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