



Ecological and human health impacts of invasive species

September 8, 2023

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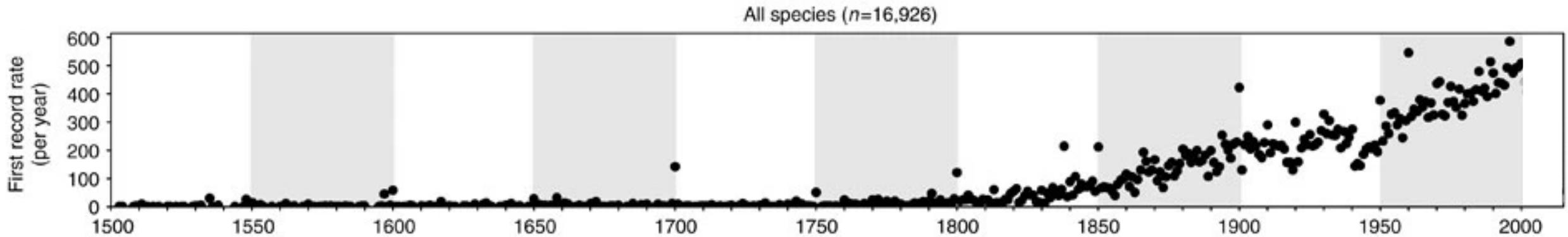


IECOLAB

Invasive species

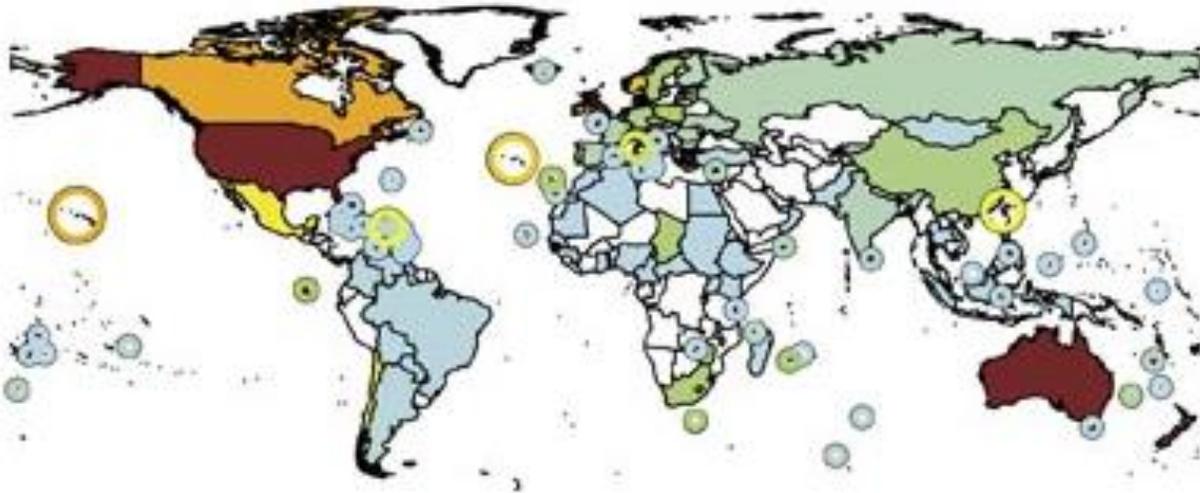
- A species that has been spread to a new area where it causes:
environmental,
economic, and/or
human and animal health impacts

Species introduction rates have been increasing over time



The United States is a hotspot for species invasions

Number of Invasive Plant Species

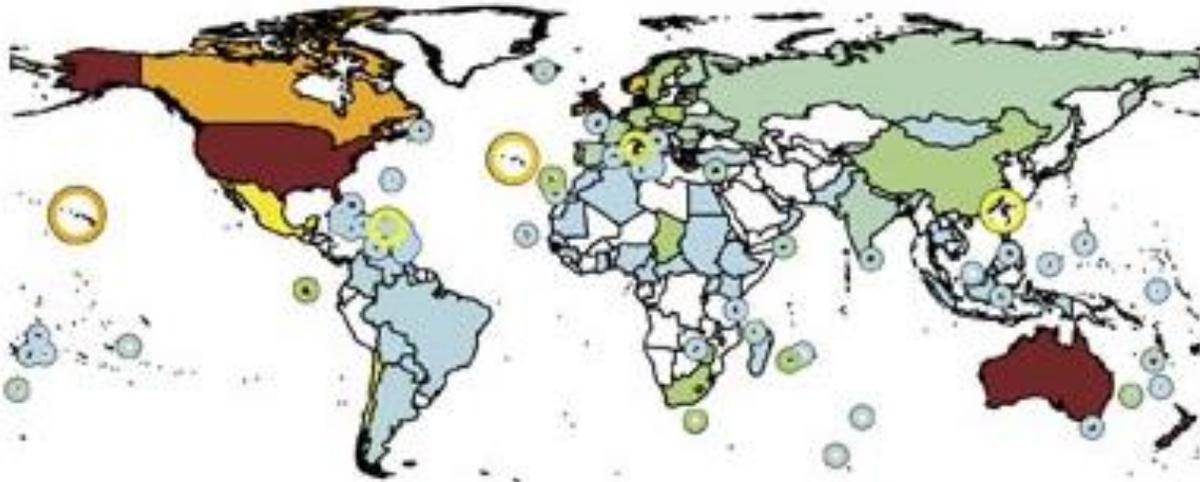


less species

more species

The United States is a hotspot for species invasions

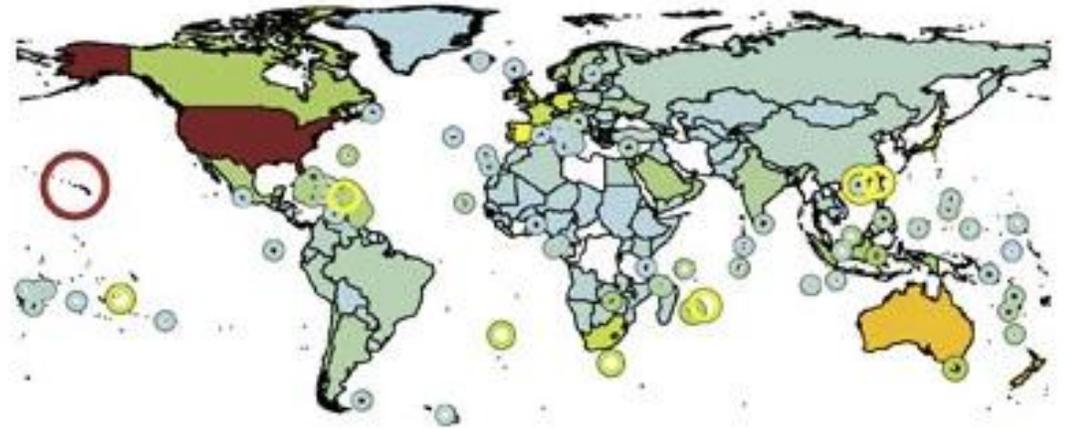
Number of Invasive Plant Species



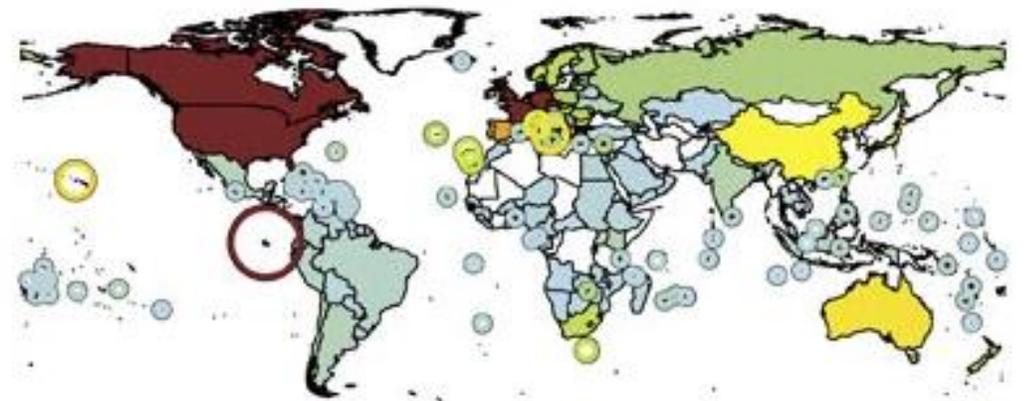
less species

more species

Birds



Insects



Effects of invasive species can be dramatic

Kudzu Vines



Zebra Mussels



Emerald Ash Borer



Not all invasive species cause obvious changes.

- Instead, changes can be subtle.
- But enough subtle changes to an ecosystem can trigger dramatic consequences.



Links between invasive plants and Lyme disease



Lyme Disease Ecology

Lyme Disease Ecology

Transmission of Bacteria that Cause Lyme Disease

 = Lyme disease bacteria, *Borrelia burgdorferi*



Lyme Disease Ecology



Tick larvae
and nymphs

Transmission of Bacteria that Cause Lyme Disease

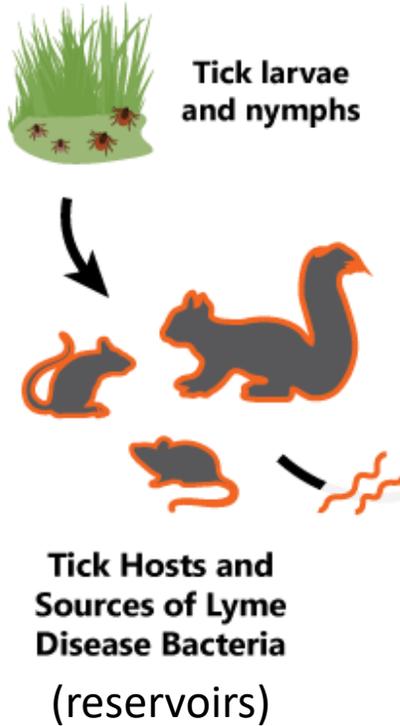
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Lyme Disease Ecology

Transmission of Bacteria that Cause Lyme Disease

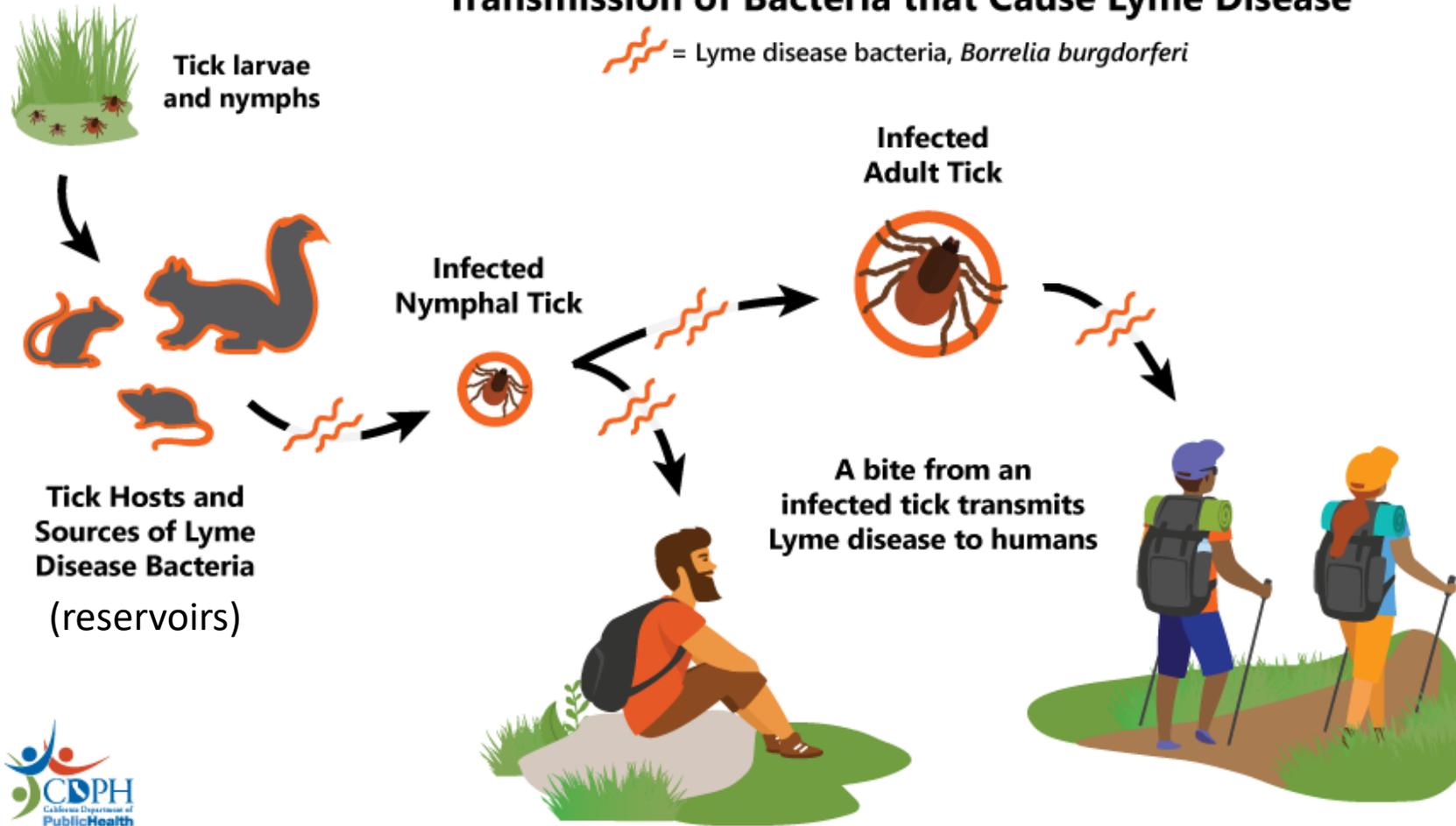
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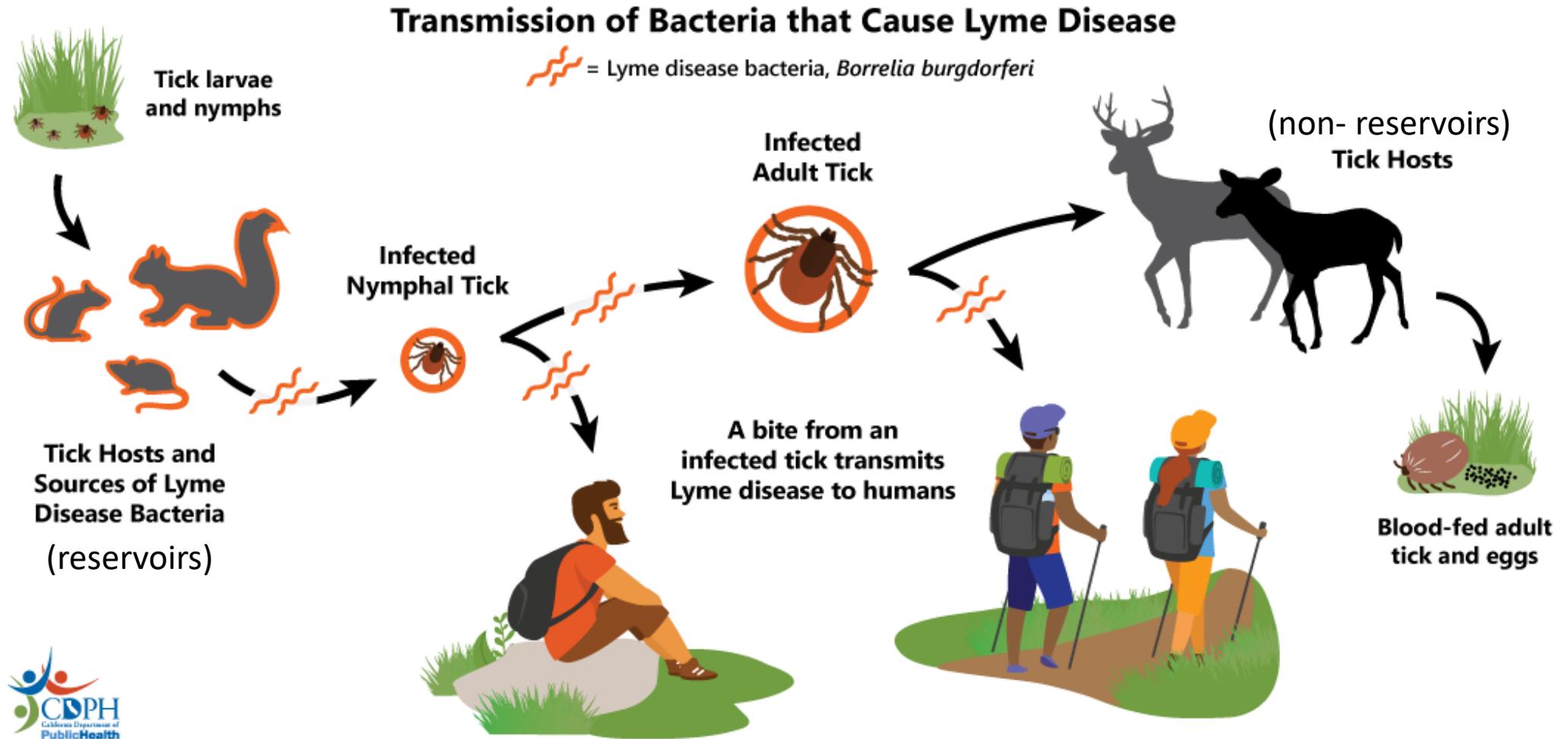
Lyme Disease Ecology

Transmission of Bacteria that Cause Lyme Disease

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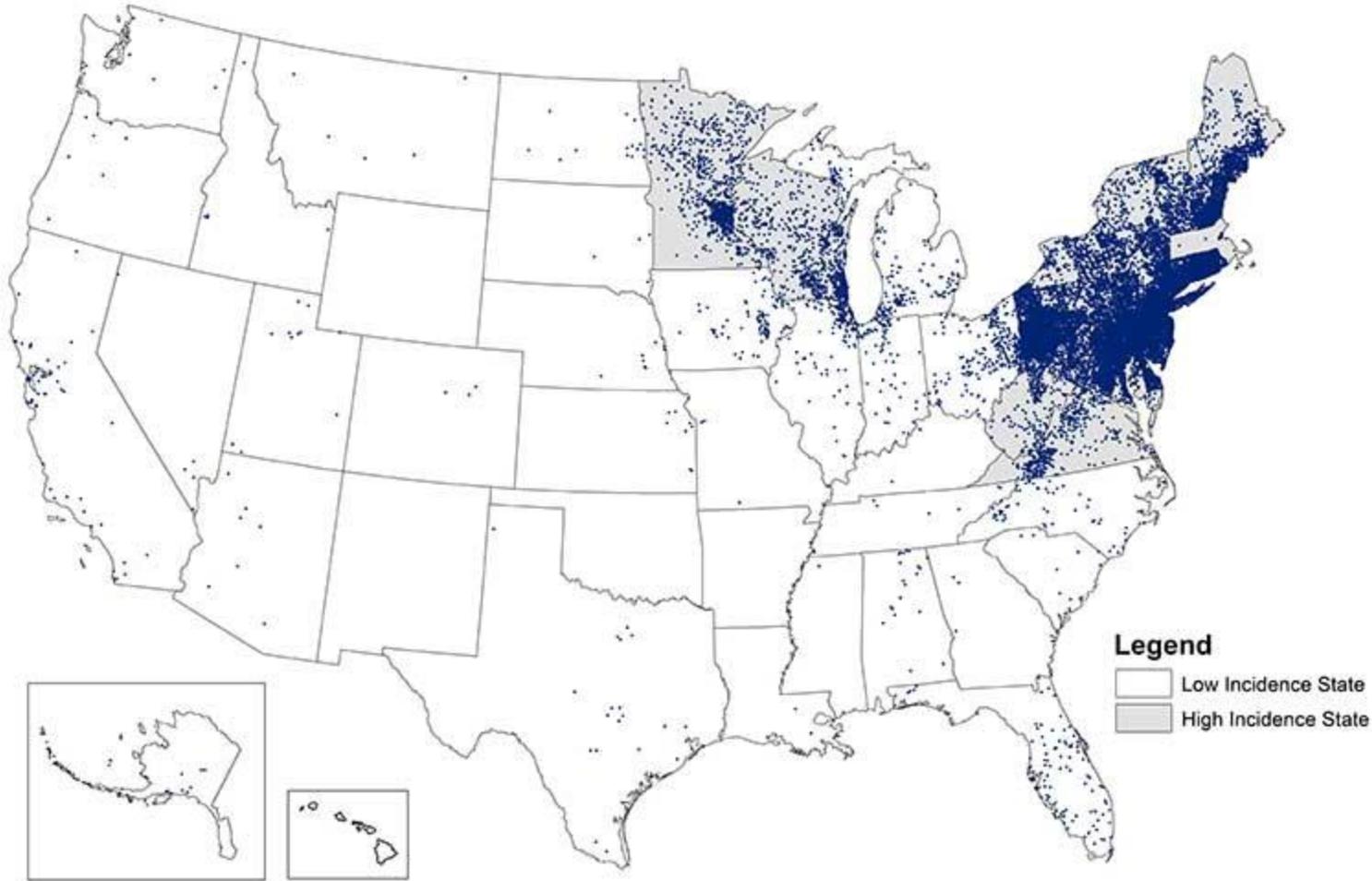


Lyme Disease Ecology



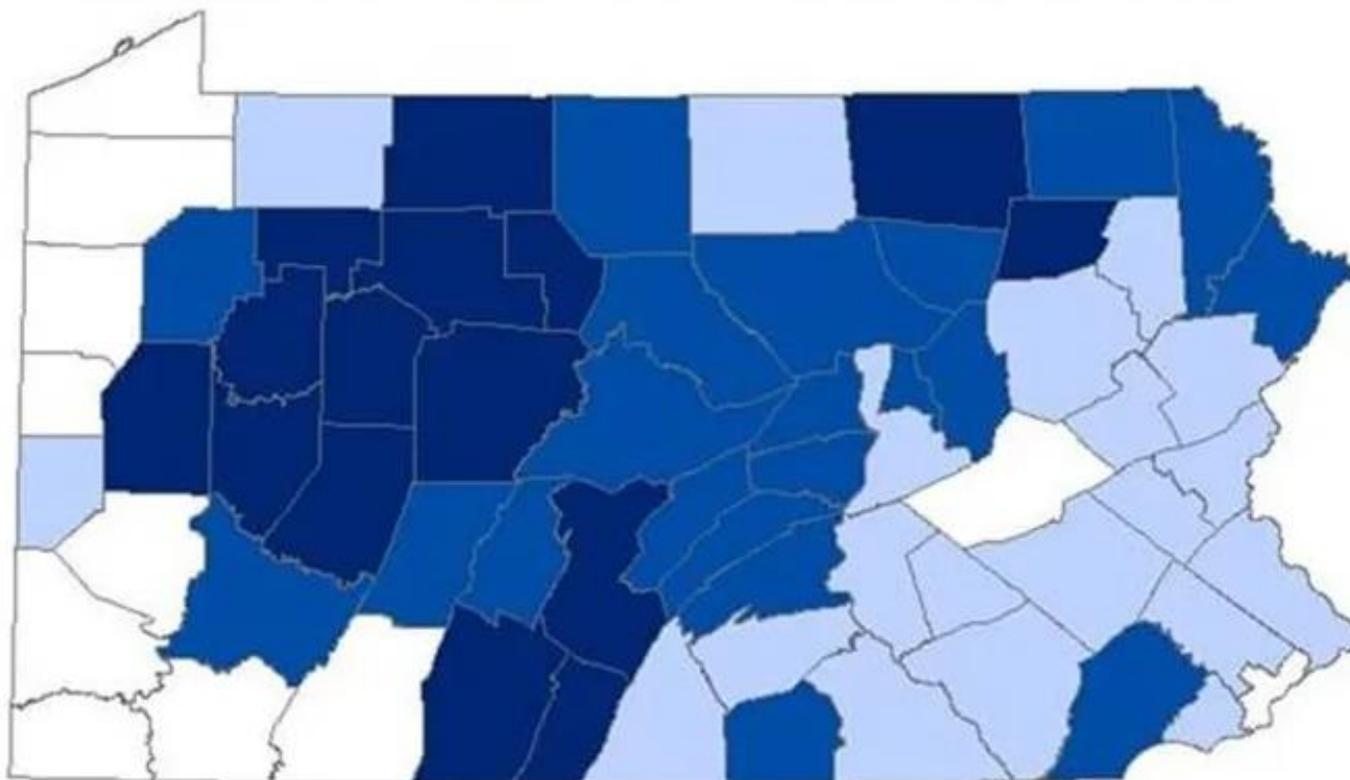
Lyme disease in the US

Costs nearly \$1 billion annually
for diagnosed
Lyme disease cases

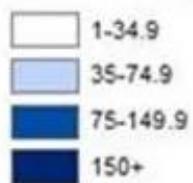


Lyme Disease Average Annual Incidence

Average Annual Cases per 100,000 Population, 2012-2016



Average Annual Number of Cases per 100,000 Population



Links between invasive plants and Lyme disease

Dense thickets of invasive understory shrubs

Invaded forest

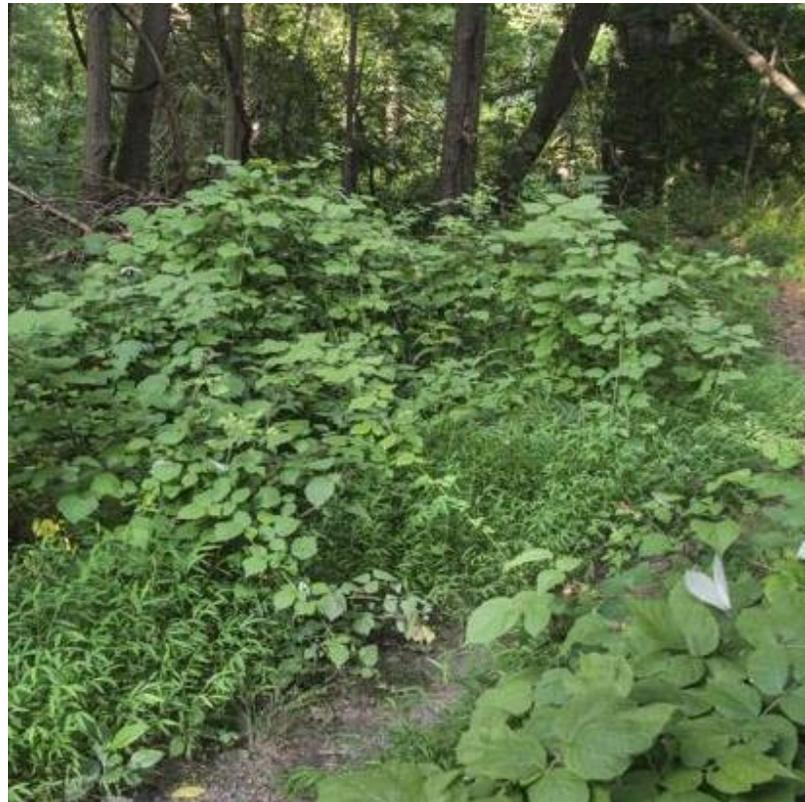


Uninvaded forest

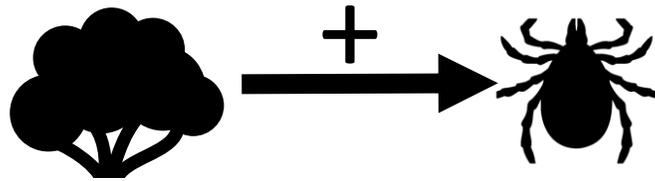


Links between invasive plants and Lyme disease

Focal invasive shrub: Wineberry



Links between invasive plants and Lyme disease



Invasive plants create ideal habitat for ticks



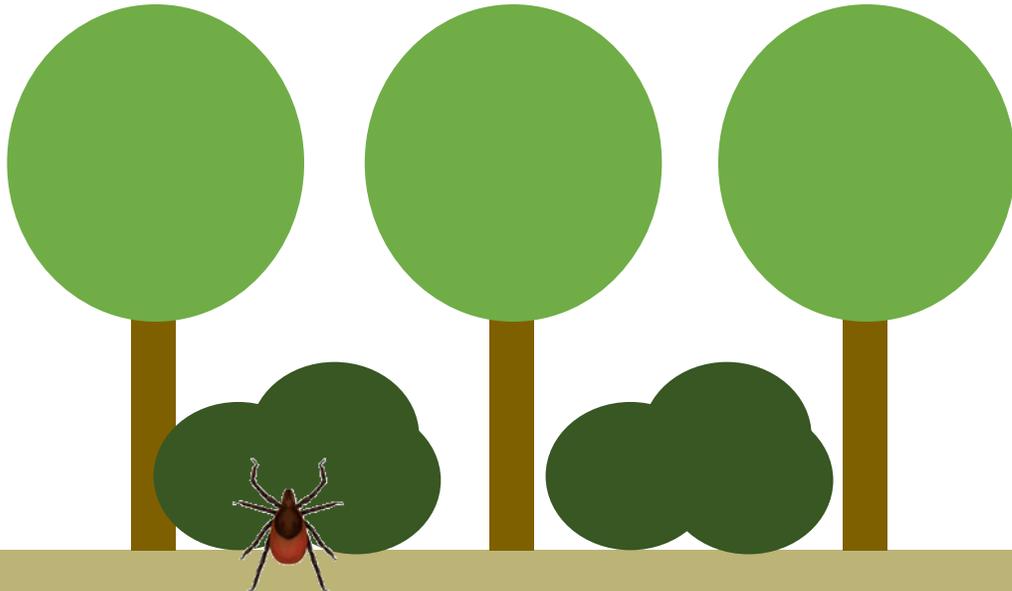
Black-legged tick: Main vector of Lyme disease

Invasive plants create ideal habitat for ticks

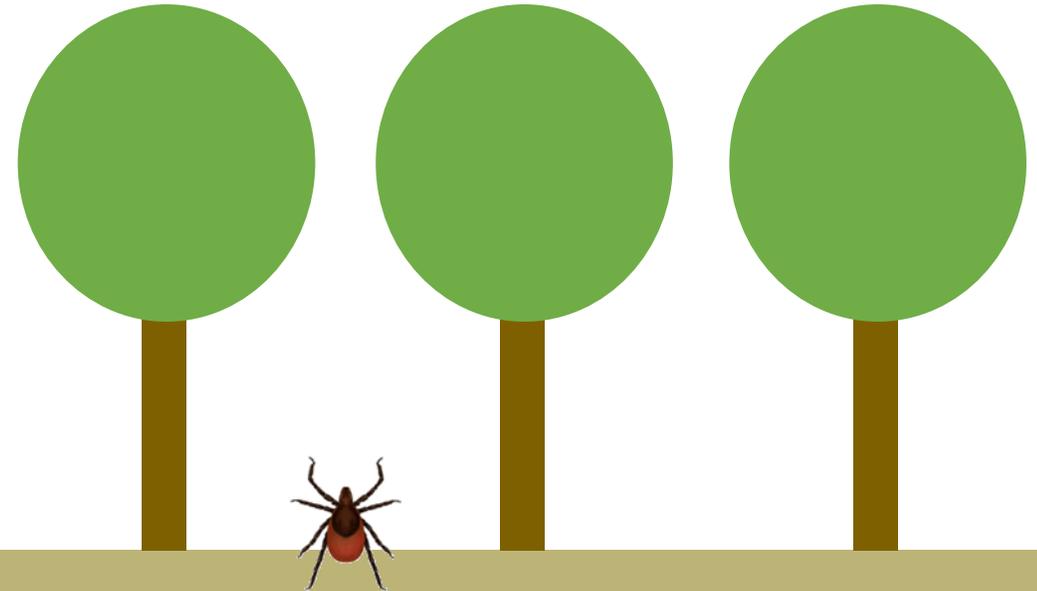


Black-legged tick: Main vector of Lyme disease

Invaded Forest
cooler, more humid



Uninvaded Forest
hotter, less humid

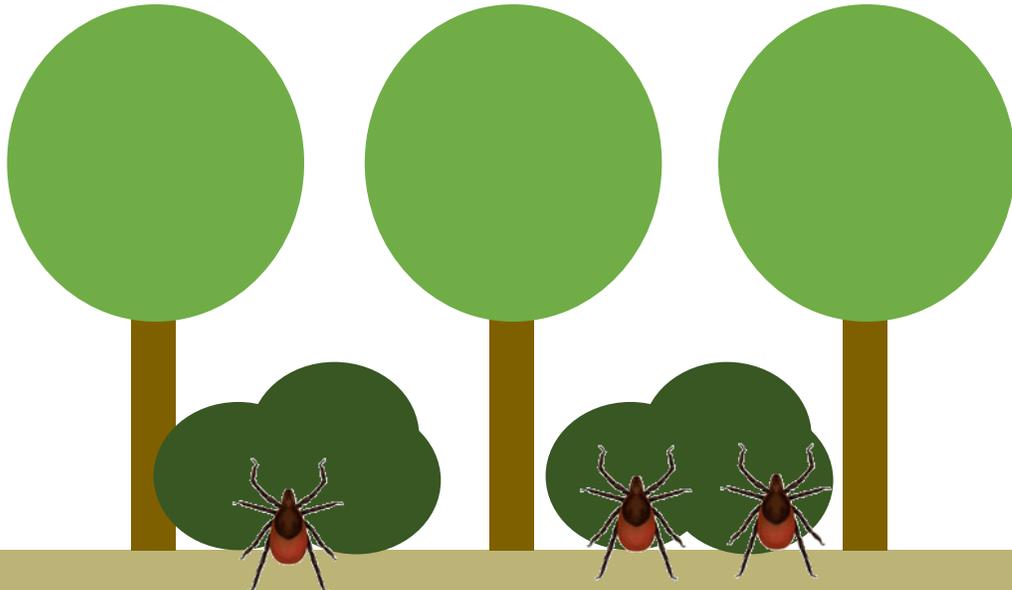


Invasive plants create ideal habitat for ticks

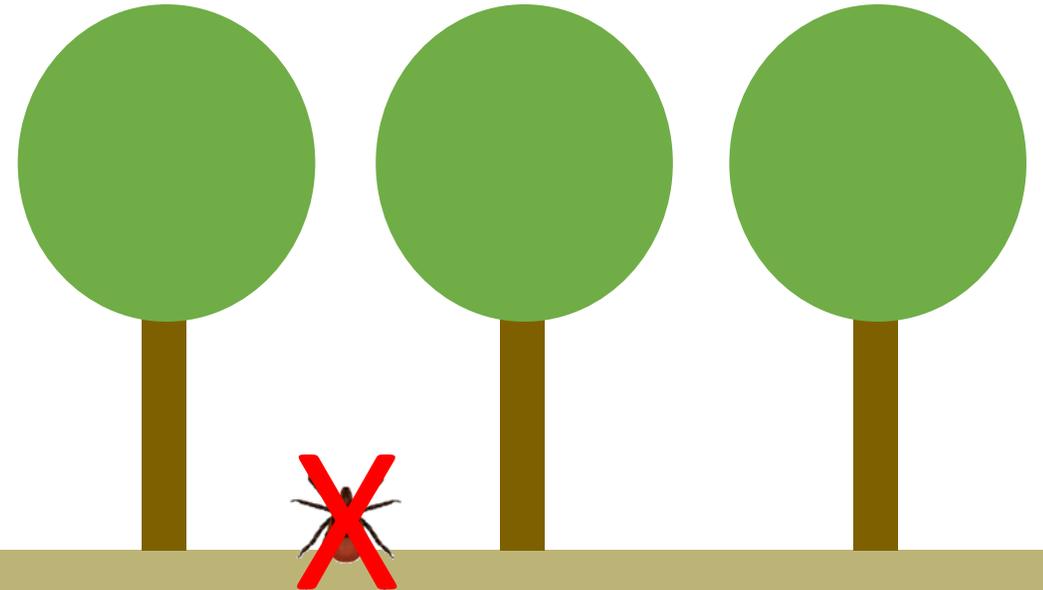


Black-legged tick: Main vector of Lyme disease

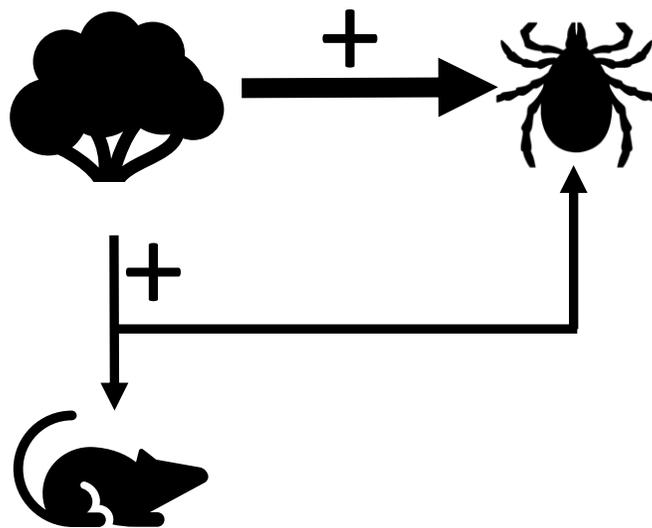
Invaded Forest
cooler, more humid



Uninvaded Forest
hotter, less humid



Links between invasive plants and Lyme disease



Invasive plants create ideal habitat for mice



White-footed mice: great reservoir for Lyme disease bacteria

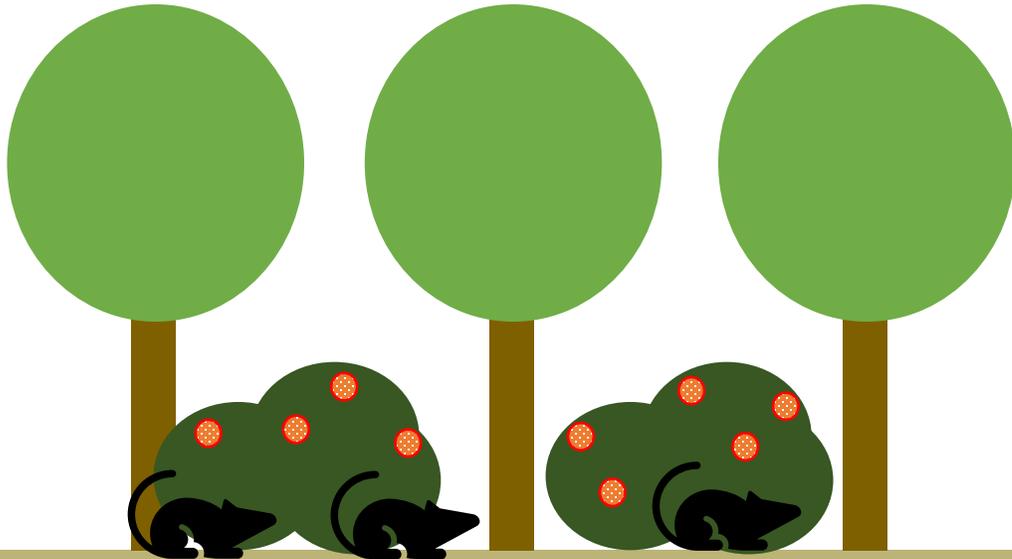
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White-footed mice: great reservoir for Lyme disease bacteria

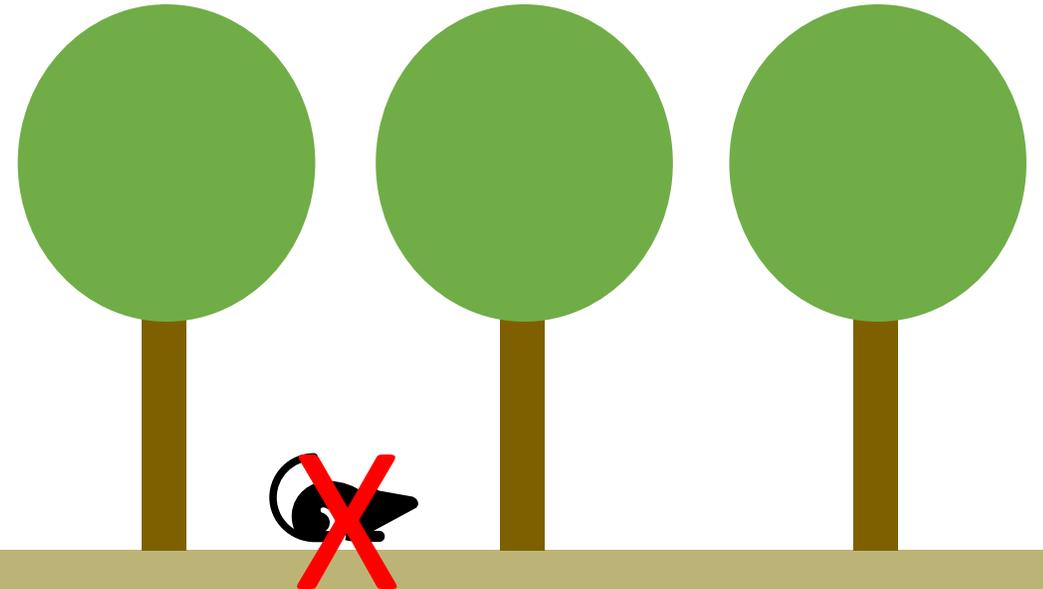
Invaded Forest

cooler, more humid, more snacks



Uninvaded Forest

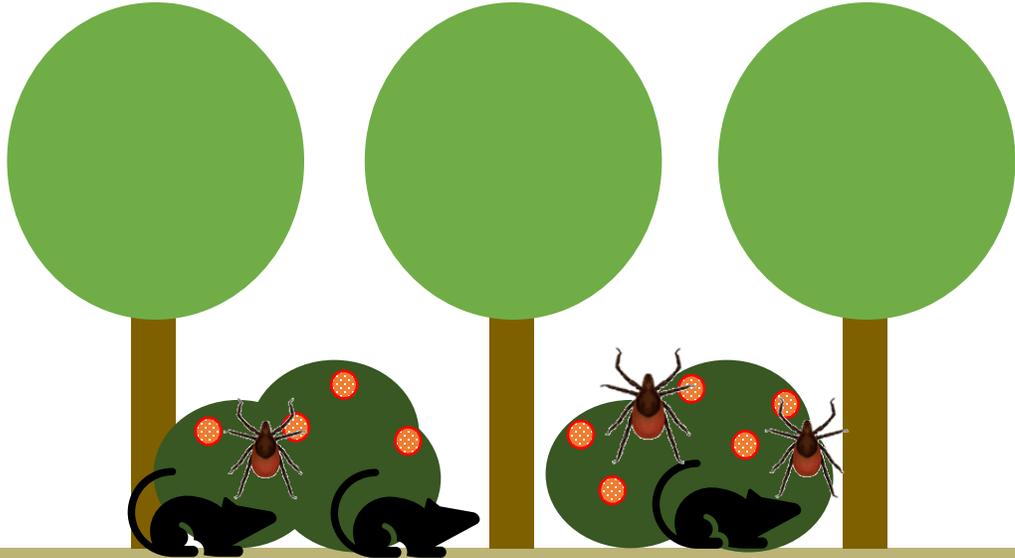
hotter, less humid, less snacks



Ideal habitat for ticks and mice increases tick-mice encounter rates

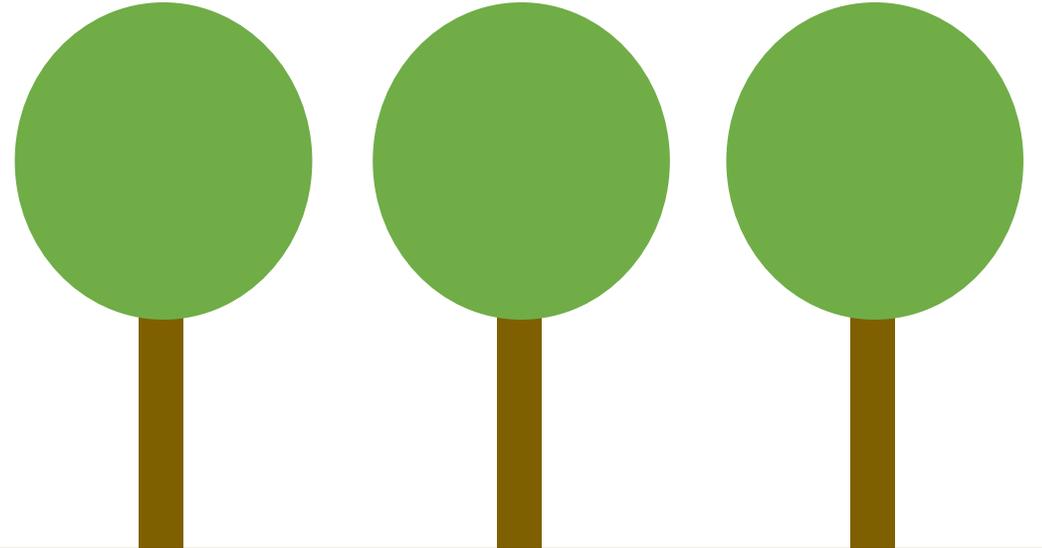
Invaded Forest

cooler, more humid, more snacks

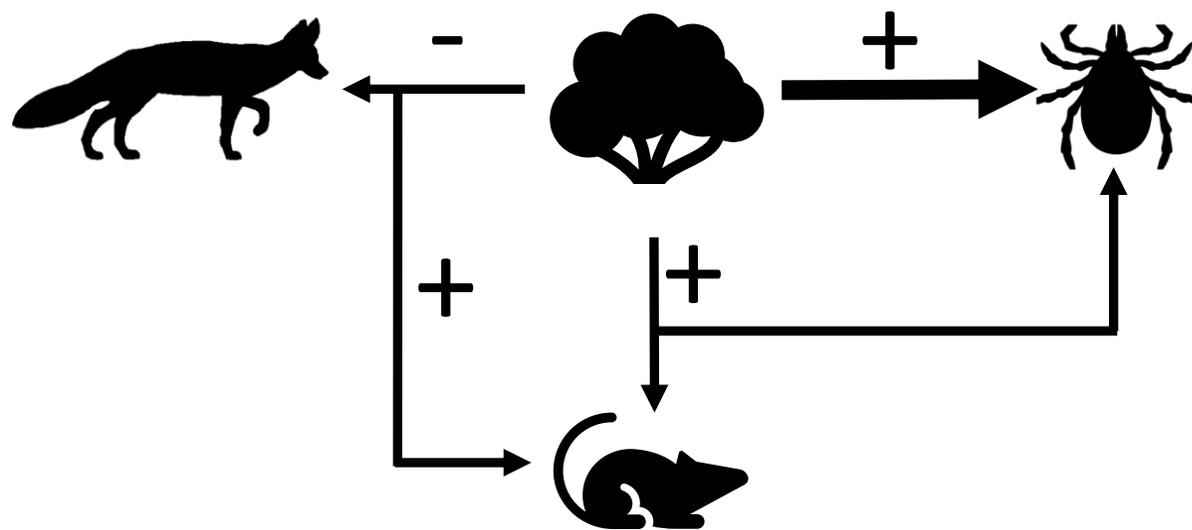


Uninvaded Forest

hotter, less humid, less snacks



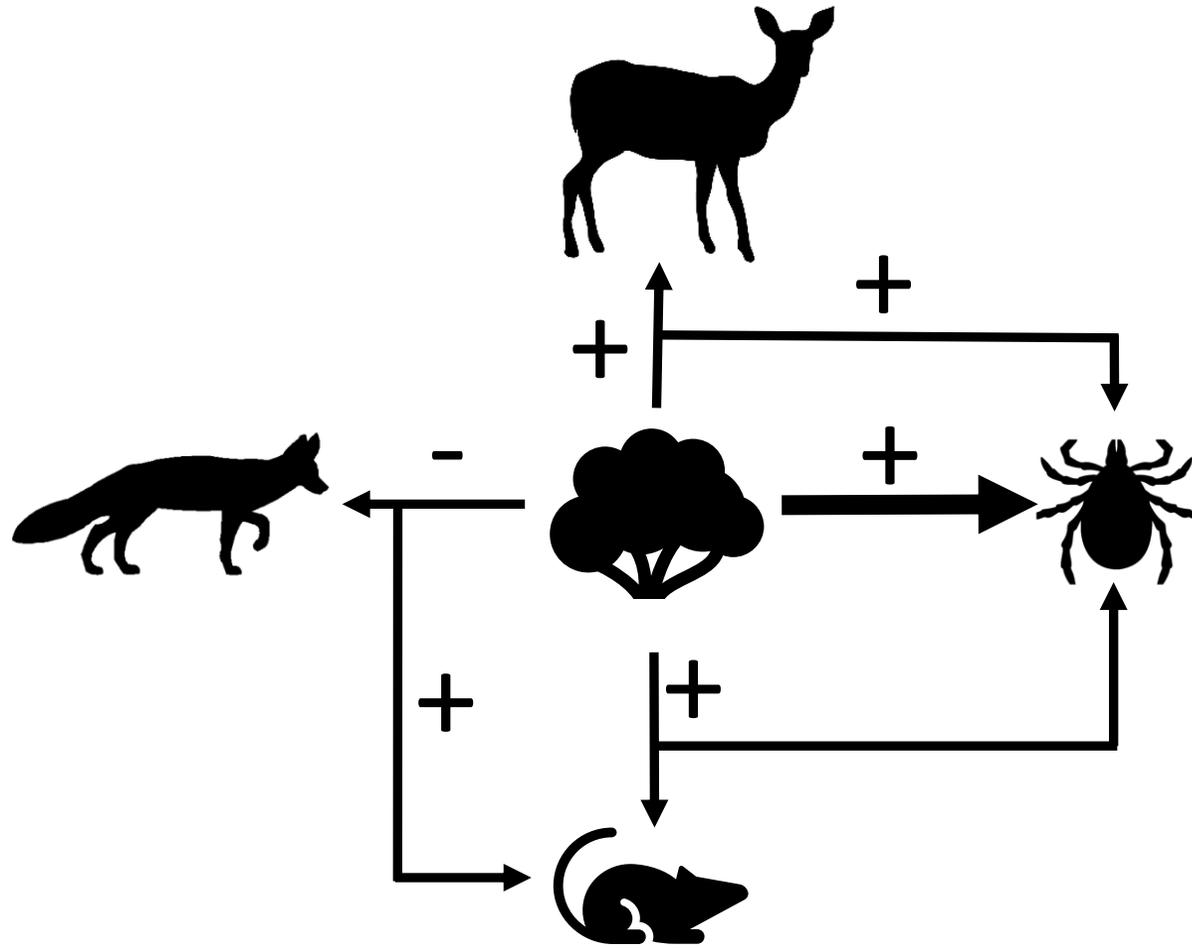
Links between invasive plants and Lyme disease



Invasive plants create predator-free environments and increase mouse populations



Links between invasive plants and Lyme disease



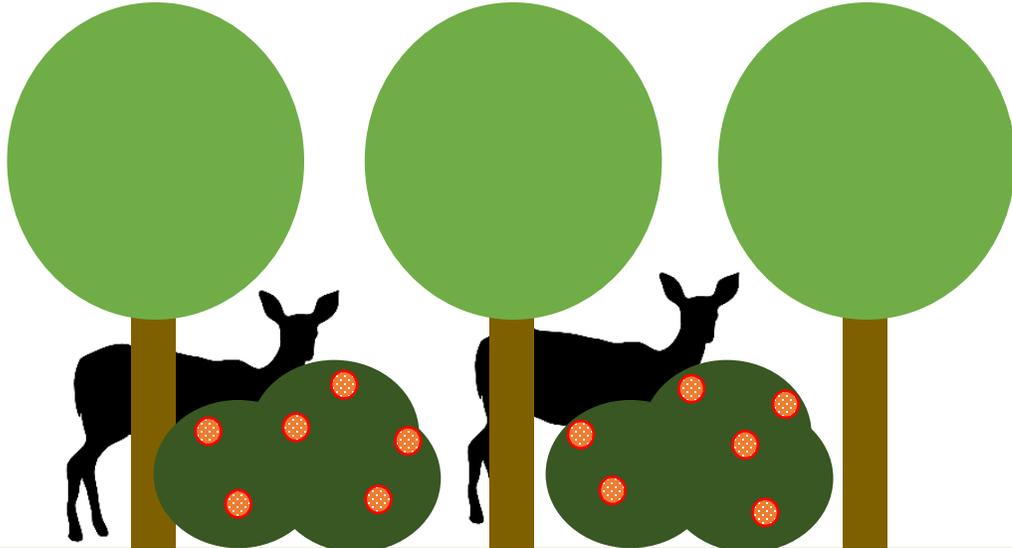
Invasive plants attract deer



White-tailed deer: Poor reservoir for Lyme disease bacteria

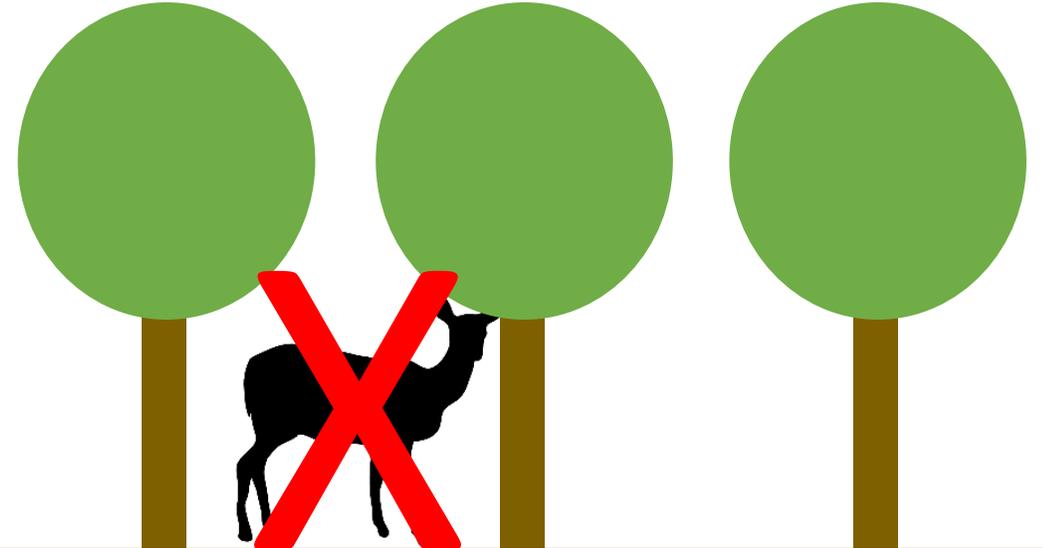
Invaded Forest

cooler, more humid, more snacks



Uninvaded Forest

hotter, less humid, less snacks



Deer are big and feed a lot of ticks,
increasing tick populations

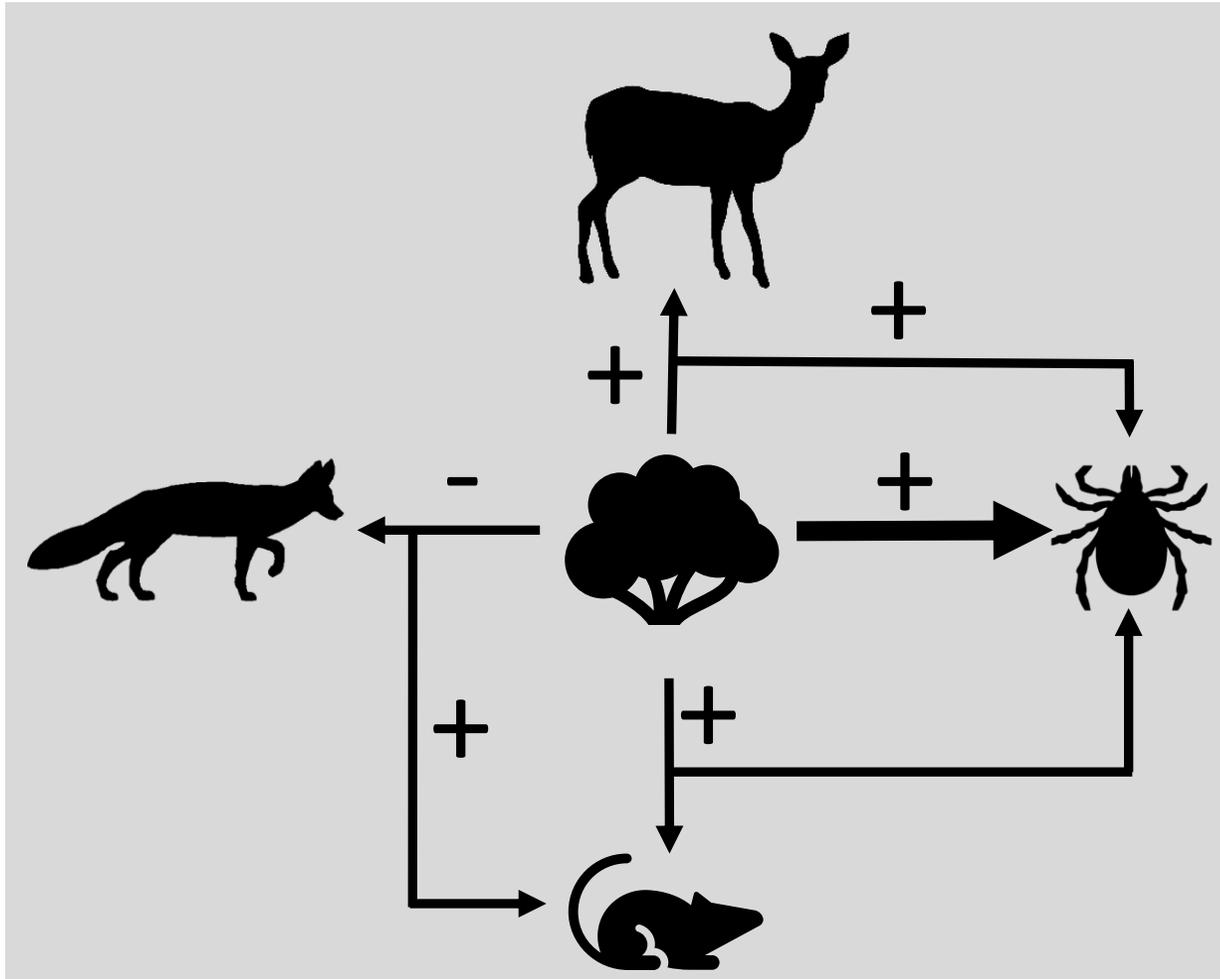


ticks on deer head

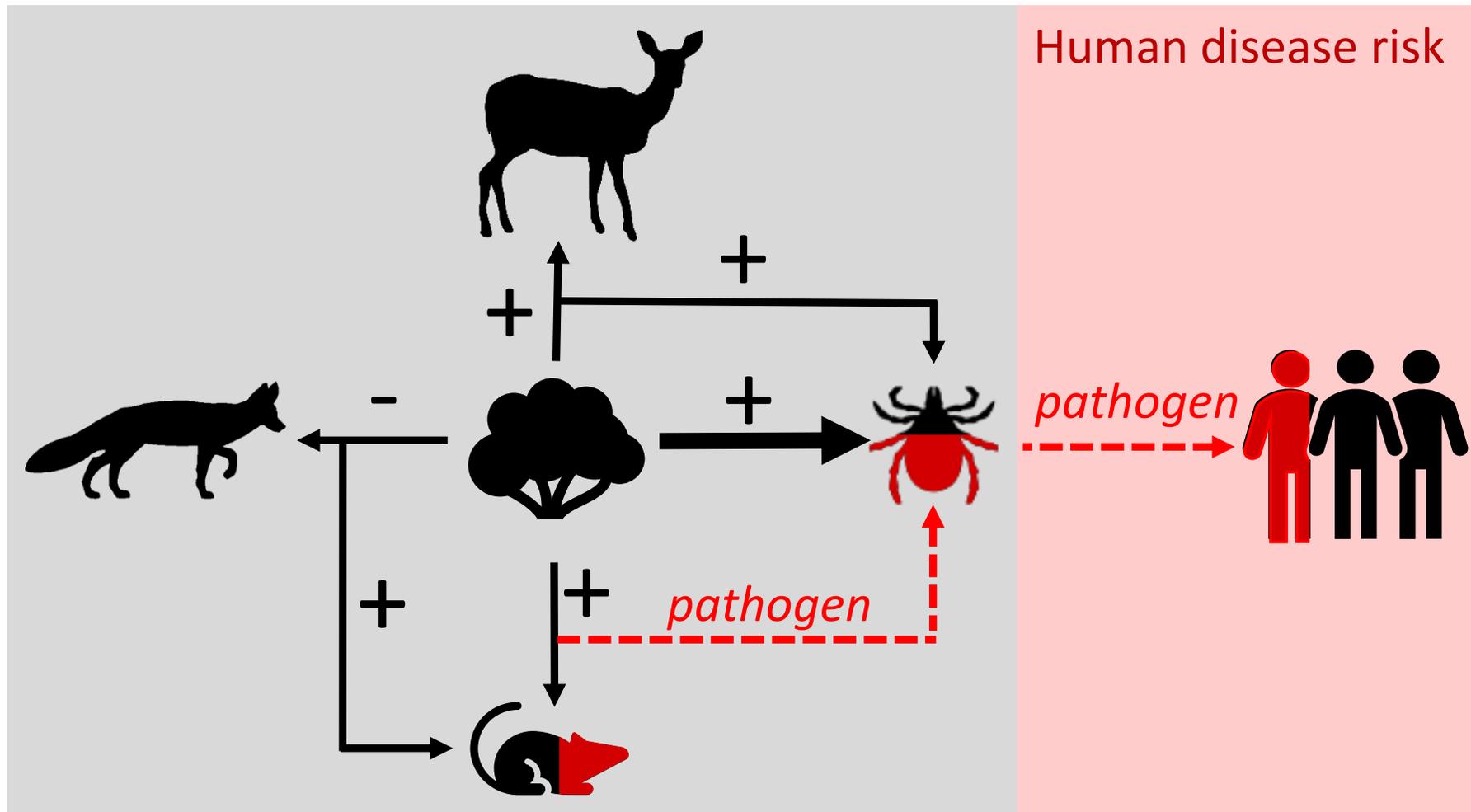


ticks on mouse ear

Links between invasive plants and Lyme disease



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