

Climate Change, Infectious Disease, and Total Worker Health

Peter Rabinowitz MD MPH, University of Washington
Oregon Institute of Occupational Health Sciences 2021 Spring Symposium,
Adapting to Climate Change for Total Worker Health 5/21/2021

Acknowledgments

- Elizabeth Dykstra - WA State Entomologist
- Cory Morin, Karin Bumbaco Climate modeling
- Northwest Center for Occupational Health and Safety
- UW Center for One Health Research

Outline

- How climate change (warmer, wetter, drier) can change infectious risks in our region
- Case examples
- Climate driven occupational infections and total worker health

Impacts of Climate Change – Western U.S.

- Warmer
 - Warmer summers
 - Milder winters
- Wetter
 - Wetter winters
 - Earlier stream flow peaks from snow melt
- Drier
 - Reduced snowpack
 - Drier summers

Workers at Risk for Climate Related Infection

- At risk workers:
 - Forest workers
 - Farm workers
 - Construction workers
 - Disaster responders
 - Animal workers (veterinarians, etc.)
 - Landscapers
 - Park employees



Warmer: Rash in a Forest Worker

- 58 year old forest worker maintaining trails in national forest
- Recent mild winter
- Notices circular rash on back
- Later develops chills, fever, headache



Lyme Disease

- Bacterial infection caused by *Borrelia burgdorferi* or related species
- Caused by bite of ixodes tick (vector) infected with the bacterium
- Can cause arthritis, heart disease, neurological problems

Ixodes pacificus: Lyme Vector



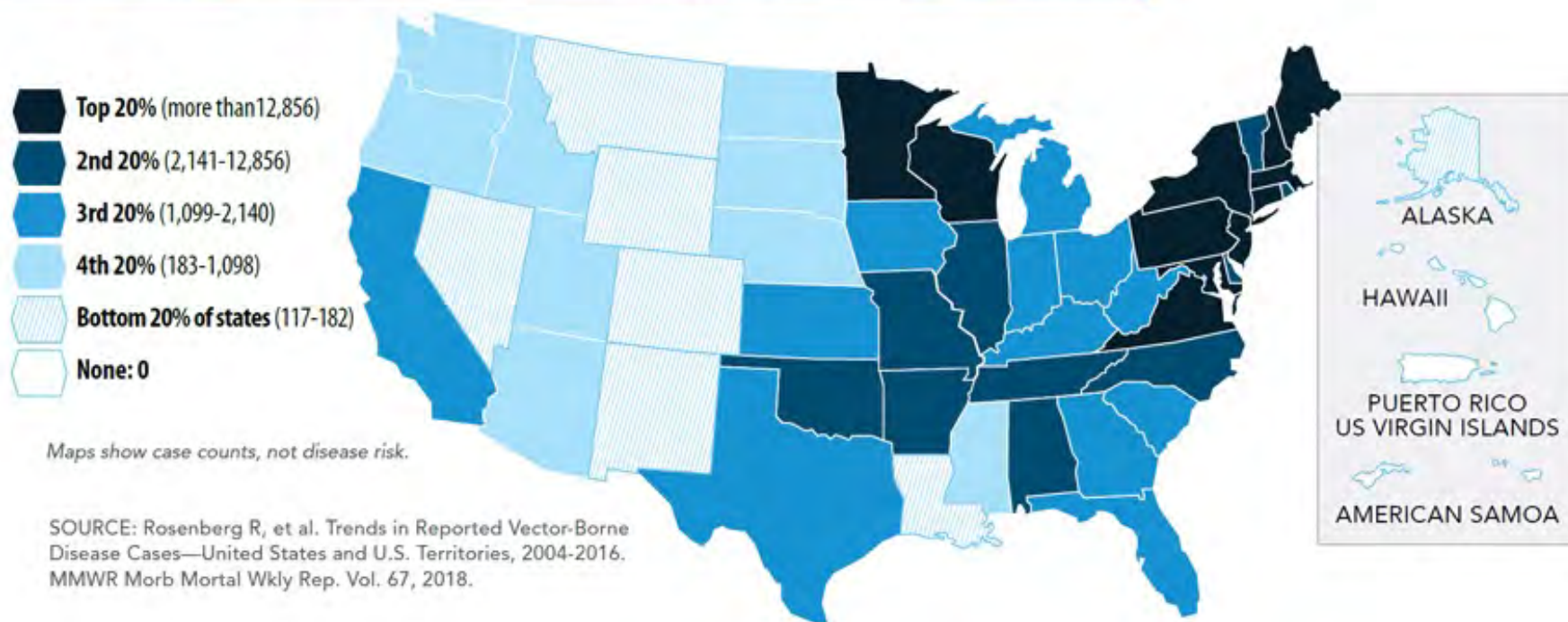
Tick life cycle: egg to nymph to adult, requires blood meals- often small mammals or lizards

Lyme Disease and Climate

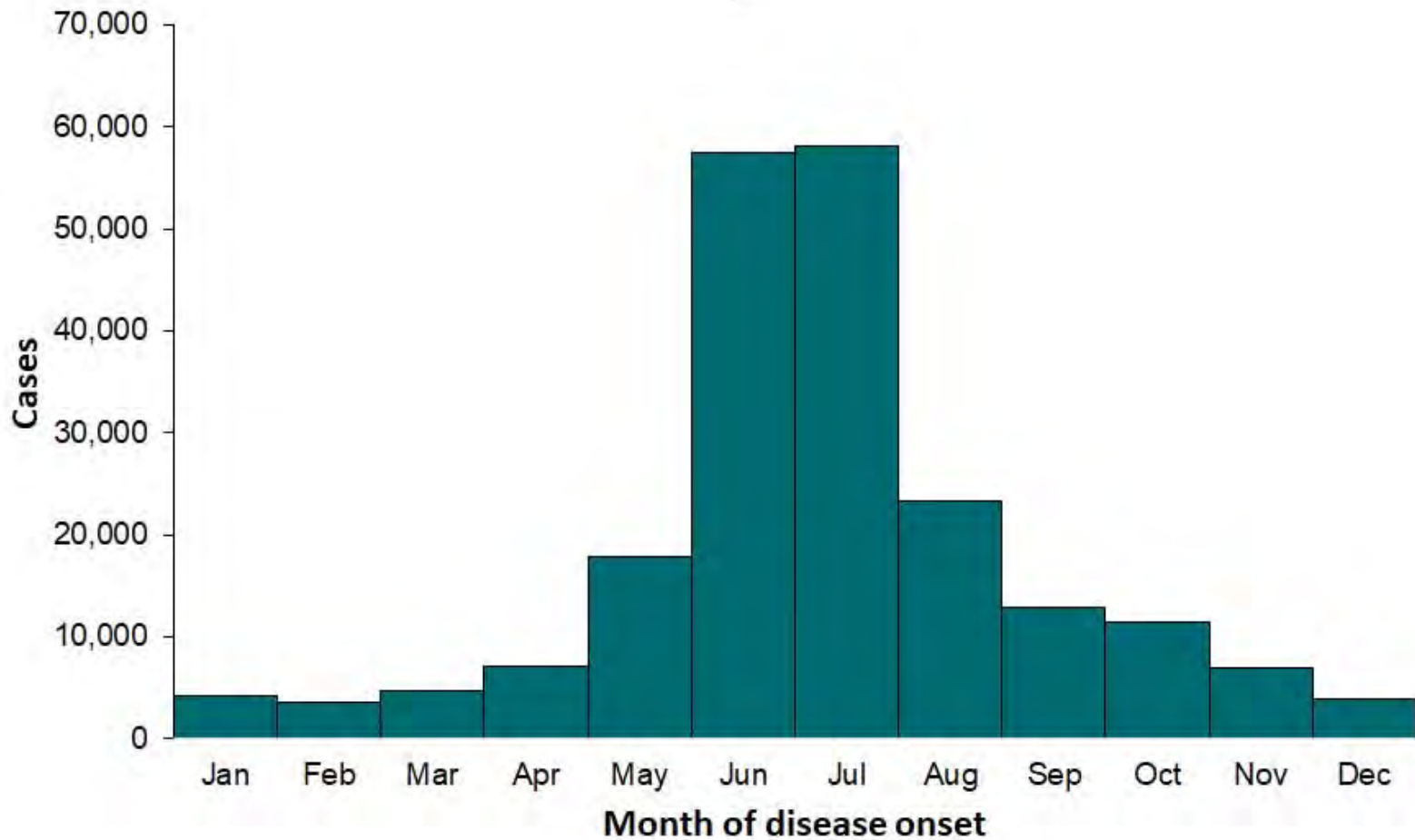
- Vector: warmer temperatures accelerate developmental cycle, increase egg production, increased population. Less tick die off in milder winters
- Animal host population may increase with climate change
- Lyme disease extending range (Canada, higher elevations)



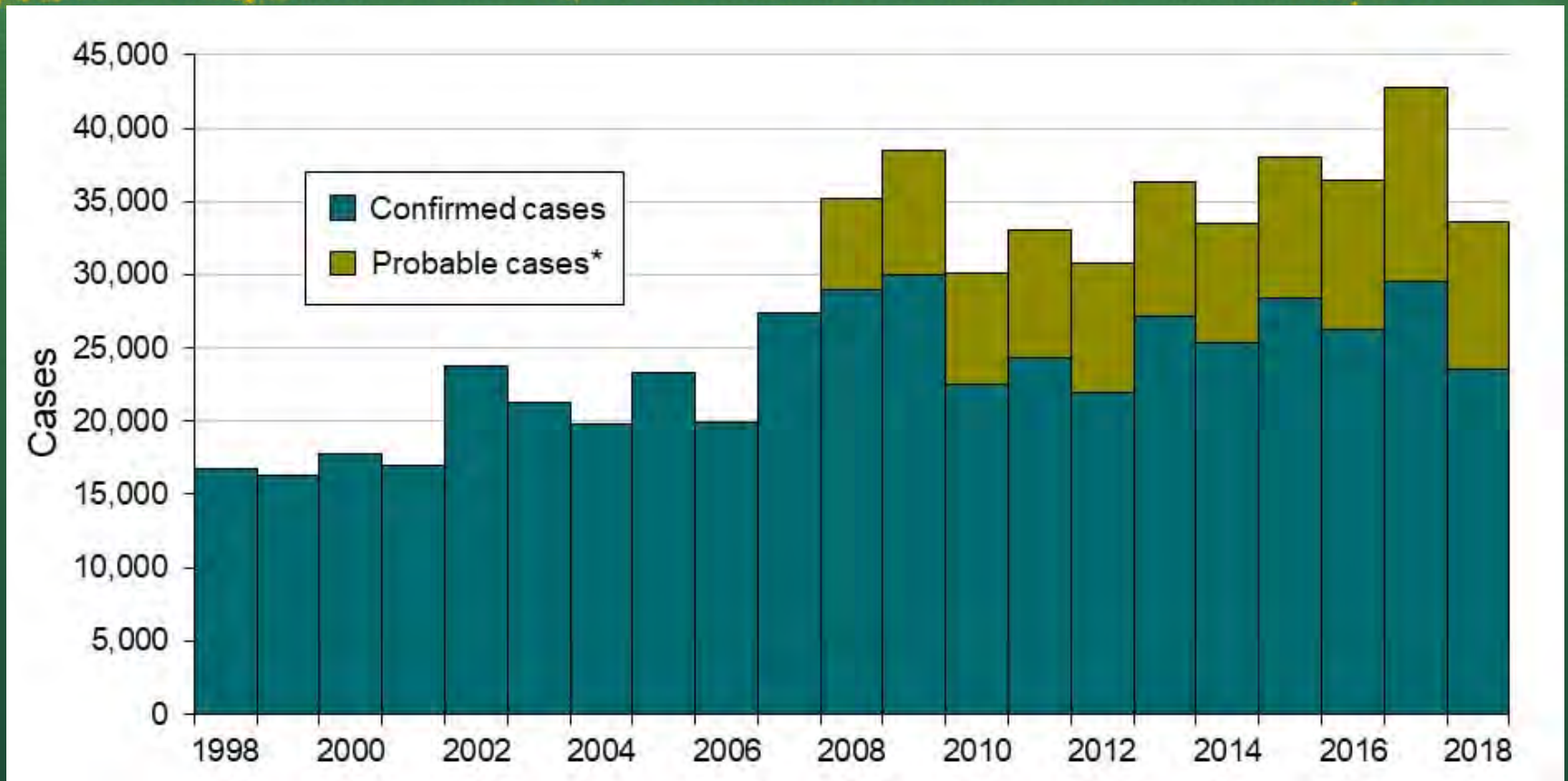
DISEASE CASES FROM TICKS (2004-2016, REPORTED)



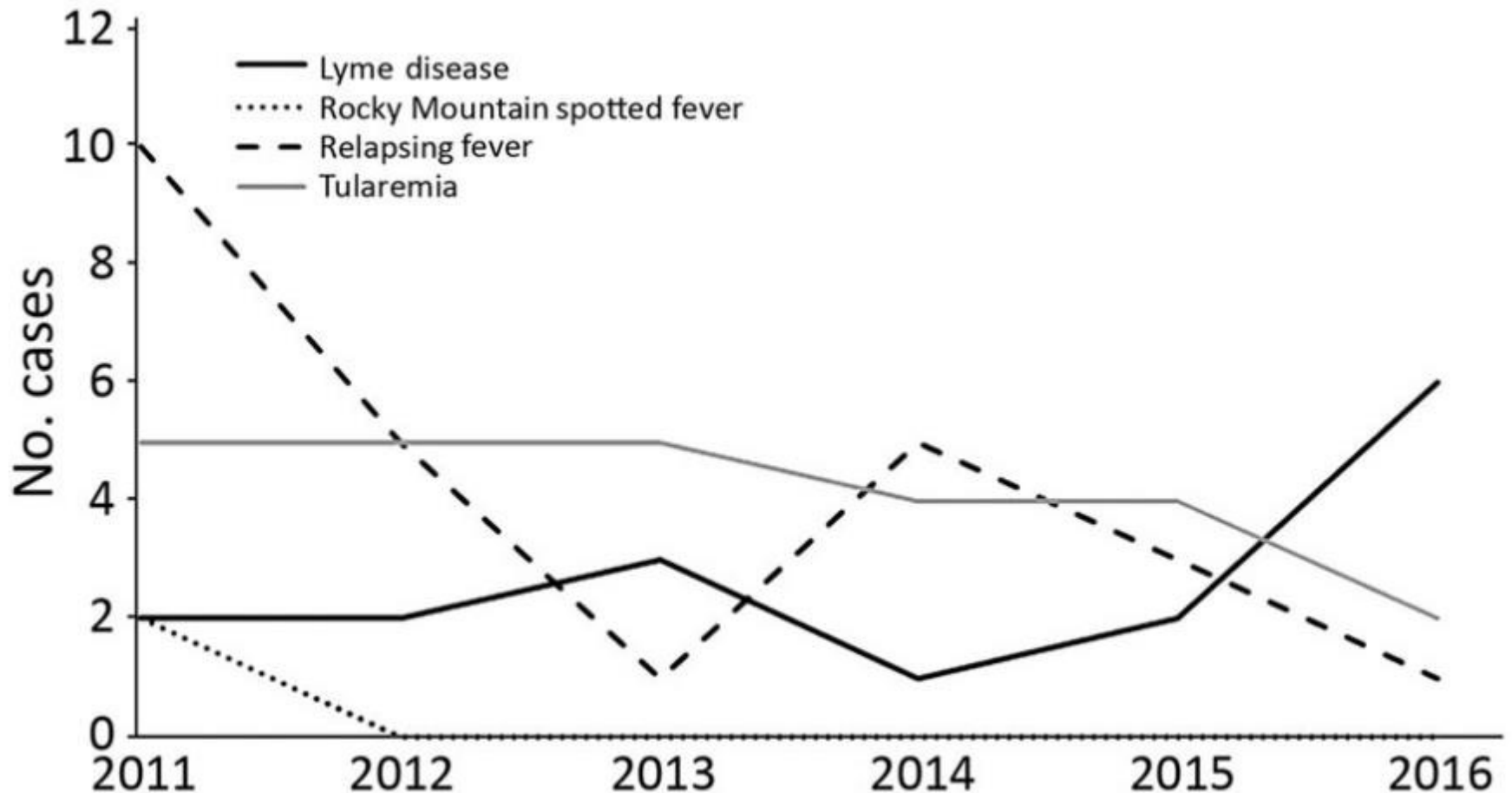
Seasonality of Lyme Disease



Lyme Disease Incidence: US



Tickborne Disease Reports Washington 2011-16



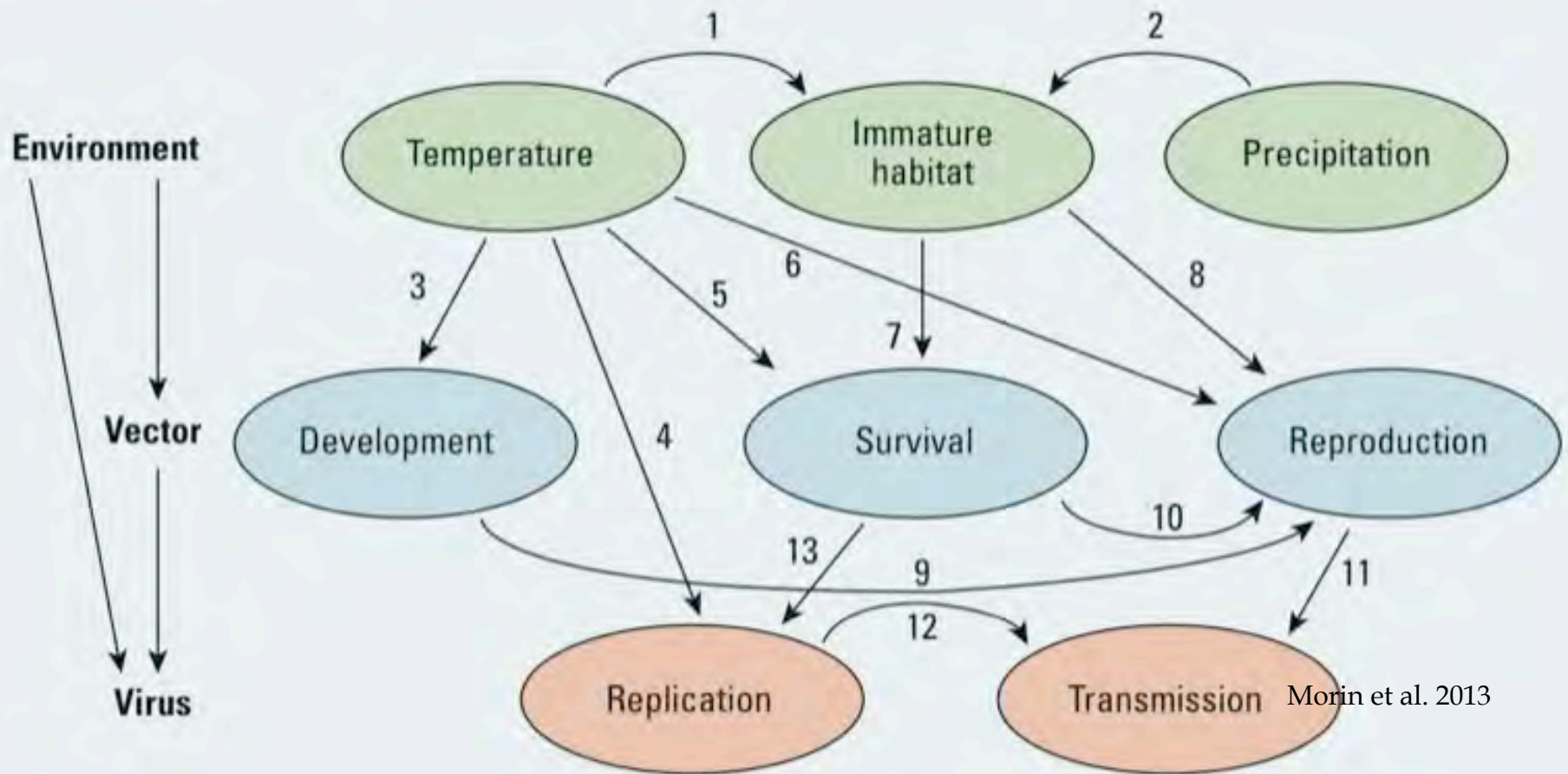
Warmer: Encephalitis in a Orchard Worker

- 25 yo female seasonal farmworker develops fever, disorientation
- Admitted to hospital with encephalitis
- She had been working in irrigated tree fruit orchard.

West Nile Virus

- Mosquito borne virus
- Causes fever, encephalitis (can be fatal)
- Seasonal outbreaks
- Irrigation of fields/orchards can promote mosquito habitat
- Mosquito lifecycle influenced by temperature

Climate Impacts on Mosquito-borne Diseases



Culex tarsalis

Encephalitis mosquito



- WNV, WEE and SLE vector
- Habitats include irrigation tailings, seeps, ditches.
- Increased temp – increased warmth of aquatic environment = increased *Culex tarsalis* abundance and development speed

Culex pipiens

Northern House Mosquito

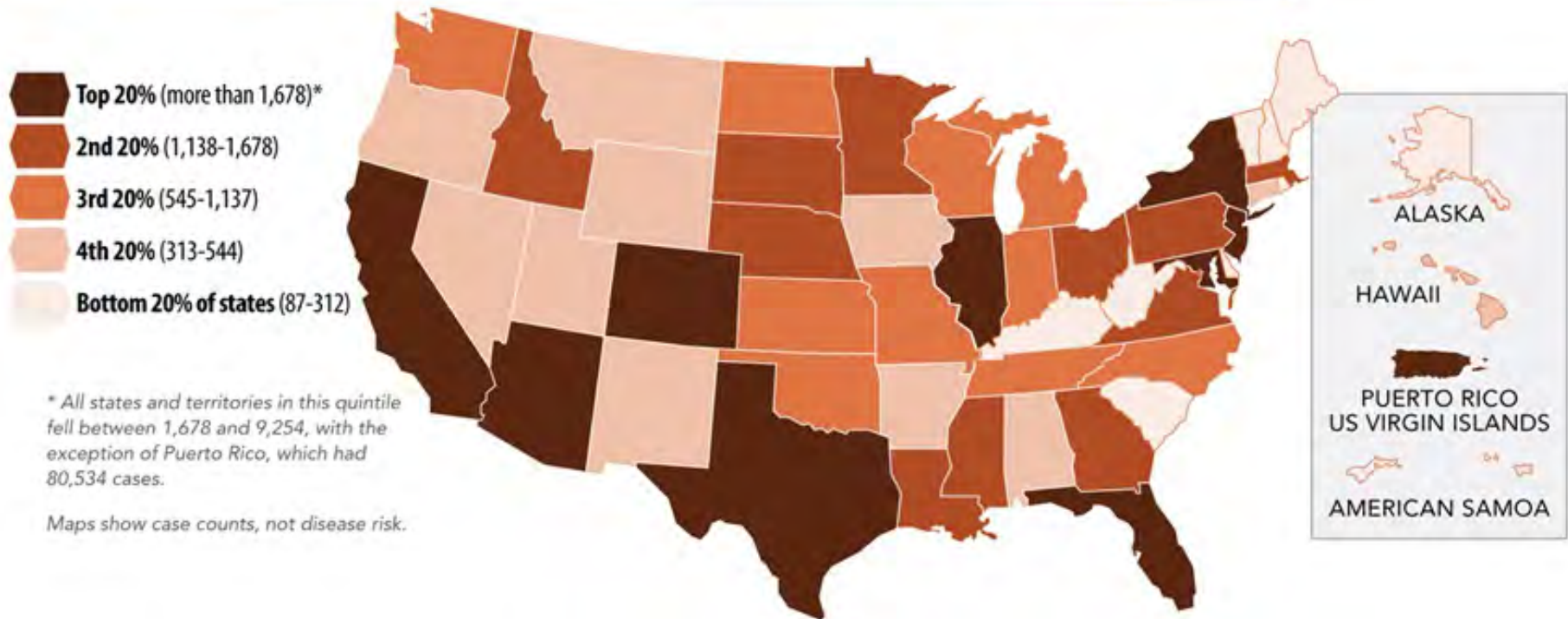


- WNV and SLE vector
- Habitats include artificial containers, storm water retention ponds and drains, and water with high organic content.
- Increased & prolonged water in storm retention ponds and drains = increased habitat for *Culex pipiens* mosquitoes
- High rainfall – can flush out storm drains & retention ponds



DISEASE CASES FROM MOSQUITOES (2004-2016, REPORTED)

Disease counts include both locally transmitted and travel-associated cases.

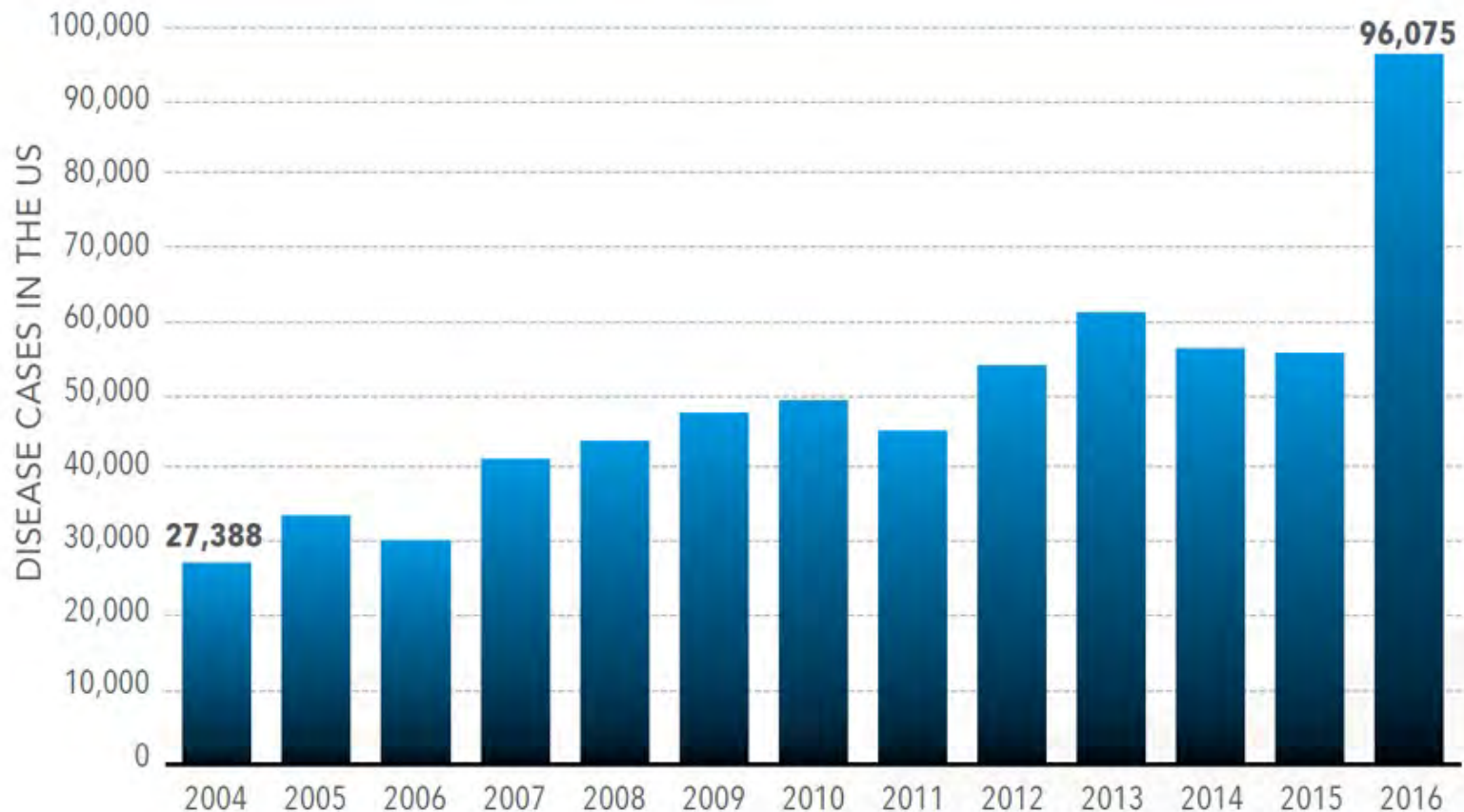


Vector-Borne Diseases

- Mosquito-borne
 - West Nile Virus (WNV)
 - Western Equine Encephalitis (WEE)
 - St Louis Encephalitis (SLE)
 - Malaria
 - Zika
 - Dengue
- Tick-borne
 - Lyme Disease
 - Rocky Mtn Spotted Fever
 - Tularemia
- Fleas
 - Bartonella
 - Plague
- Flies
 - Myiasis

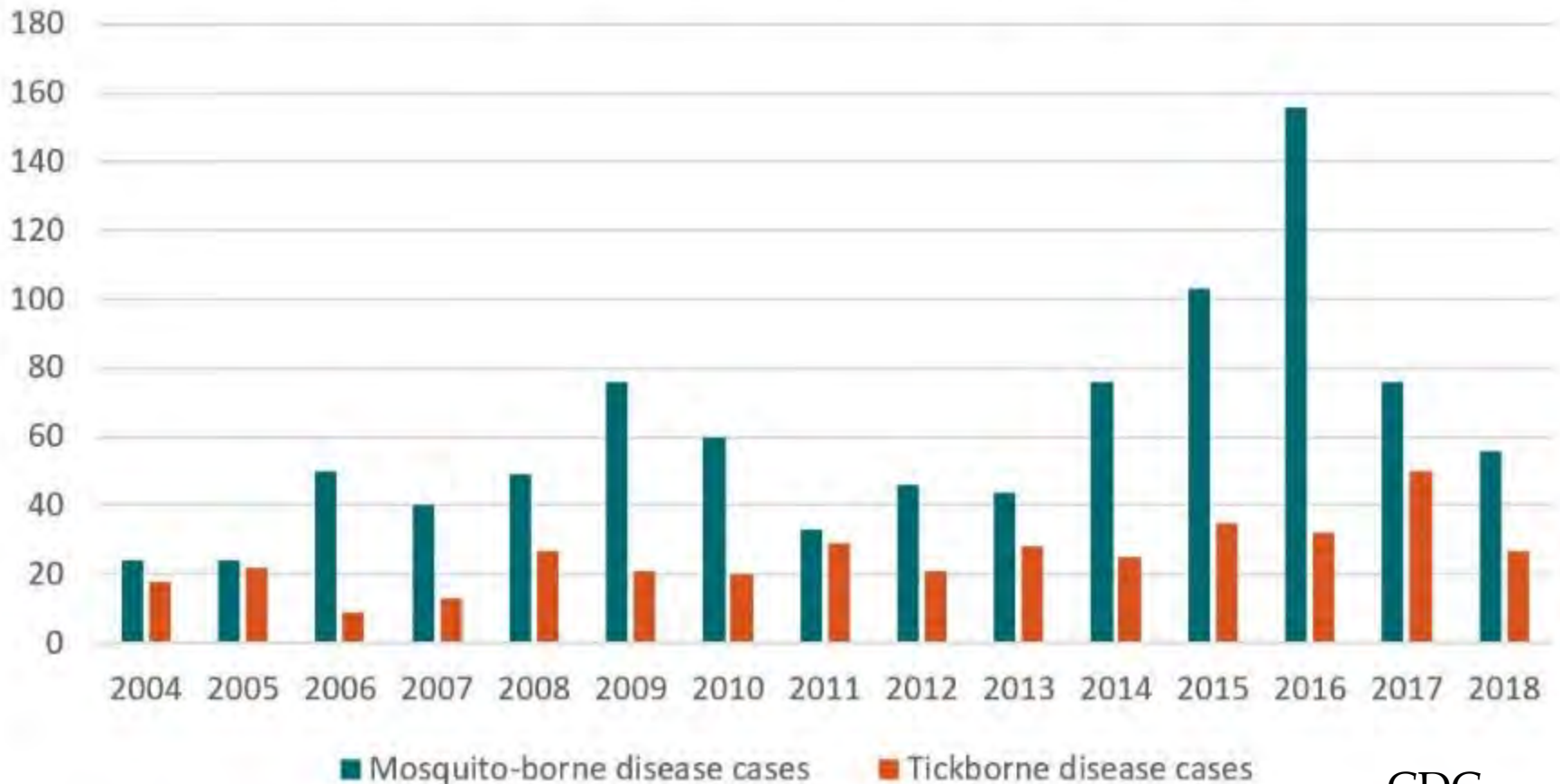
Vector-Borne Diseases Increasing Nationally

Disease cases from infected mosquitoes, ticks, and fleas have tripled in 13 years.



Vector-Borne Disease WA

Mosquito-borne and tickborne disease cases, 2004-2018



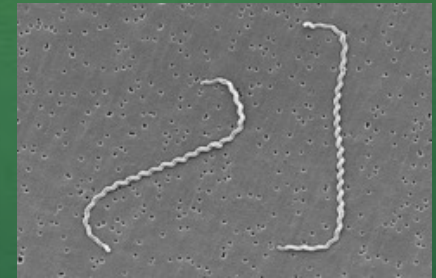
Wetter: Red eyes in a disaster (flood) responder



- 40 year old Firefighter responding to flooding
- Despite PPE, clothes getting soaked
- Develops fever, chills, red eyes

Leptospirosis

- One of the most common zoonotic diseases worldwide
- Spirochete bacterium
- Found in contaminated freshwater
- Increased incidence after flooding
- Can involve liver, kidney, blood other organs



Leptospirosis: Conjunctival Suffusion



Drier: Pneumonia Outbreak in Solar Farm Workers

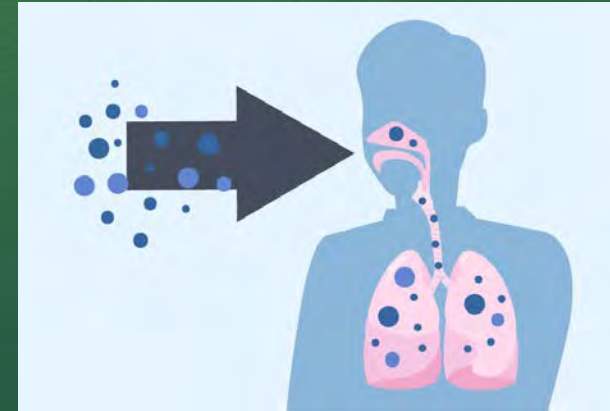
- 9 workers at Solar Farm construction site developed cough and fever
- Cases occurred during summer drought
- Lots of dust during construction operations
- Little use of respiratory protection



Laws et al 2018

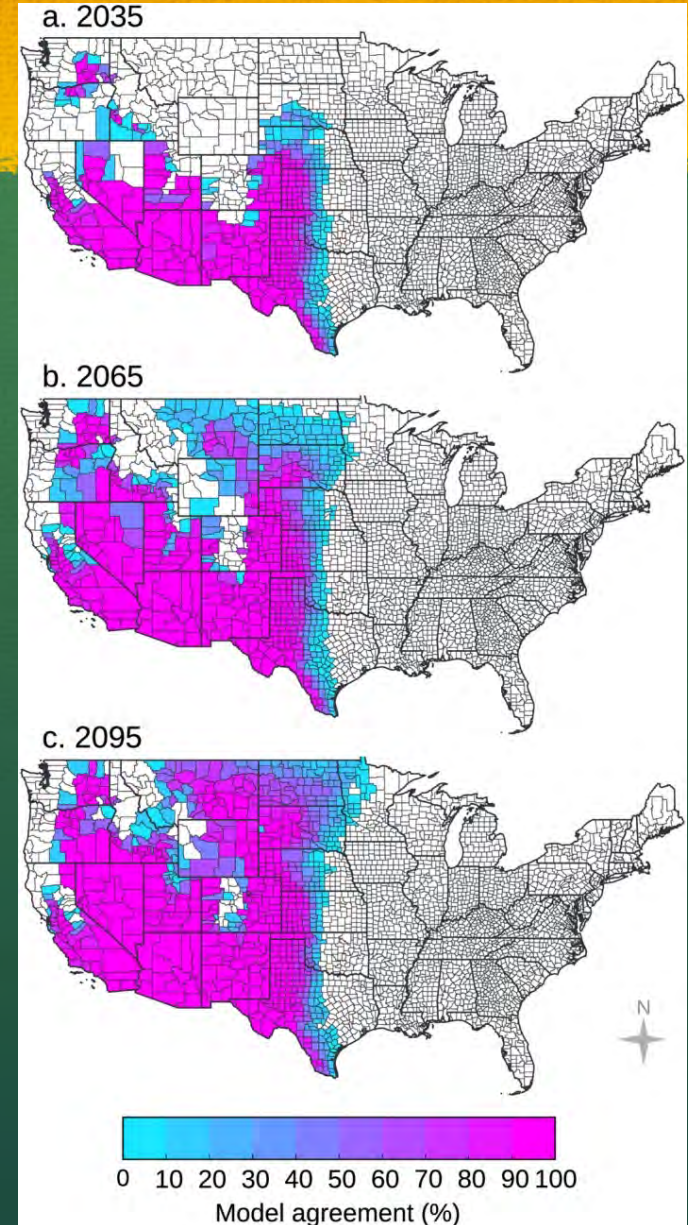
Coccidioidomycosis (Valley Fever)

- Fungal disease
- Causes pneumonia, other infection
- Transmitted through inhalation of spores in dust
- Endemic area is southwest USA
- Appears to be extending its range with climate change



Coccidioidomycosis Range Expansion with Climate Change

Gorris et al 2019



Approach to Climate Change Occupational Infection Risk

- Consider new risks
- Consider changes in occupational health practice
 - Hazard identification and risk assessment
 - Control methods
 - Screening of workers
 - Evaluation of sick workers

Contexts

Population
growth

Energy
policies

Local conditions and
socioeconomic circumstances

Urbanization/
deforestation

Global Climate Change

Hazards/ exposure

Vector-borne pathogens
and expanded habitats

Occupational health effects

Infectious diseases

Impact on occupational safety and health research and practice

Perform new research on climate
and occupational diseases

Identify numbers of workers
exposed

Develop new standard and
controls, early warning systems
and surveillance

Modify risk assessment methods

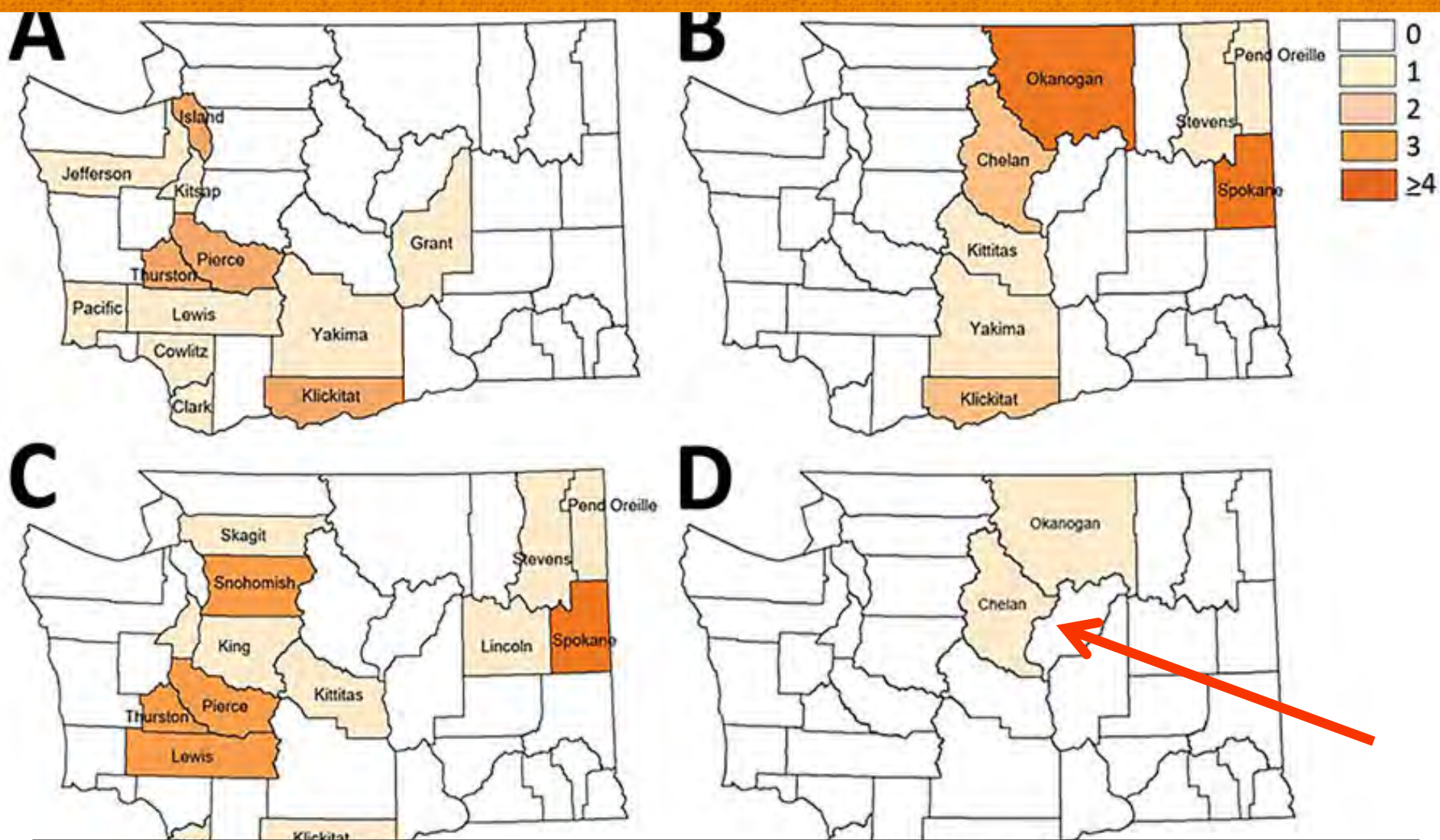
Develop indicators of climate-
potentiated health effects

Hazard Identification

- Warmer:
 - Vector borne diseases:
 - Lyme disease
 - Other tick borne
 - West Nile Virus
 - Other
- Wetter:
 - Water borne diseases
 - Leptospirosis
 - Mosquito borne disease
- Drier
 - Dust borne diseases
 - Coccidioidomycosis
 - Other soil and dustborne disease

Risk Assessment

- Number of workers exposed
- Public health data
- Sentinel cases- including animals



Counties of likely exposure for autochthonous human tickborne disease cases, Washington, USA, 2011–2016.

A) Lyme disease; B) tickborne relapsing fever; C) tularemia; D) Rocky Mountain spotted fever.

Dykstra et al EID 2020

Animal Sentinels for West Nile Virus: WA 2019

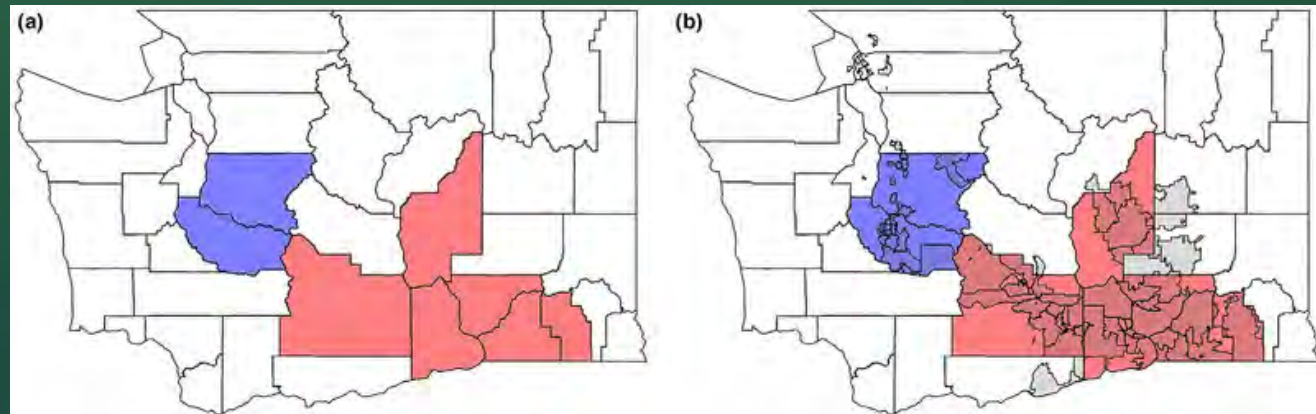


Humans



Horses, birds,
mosquitoes

Dogs as Sentinels for Coccidioidomycosis



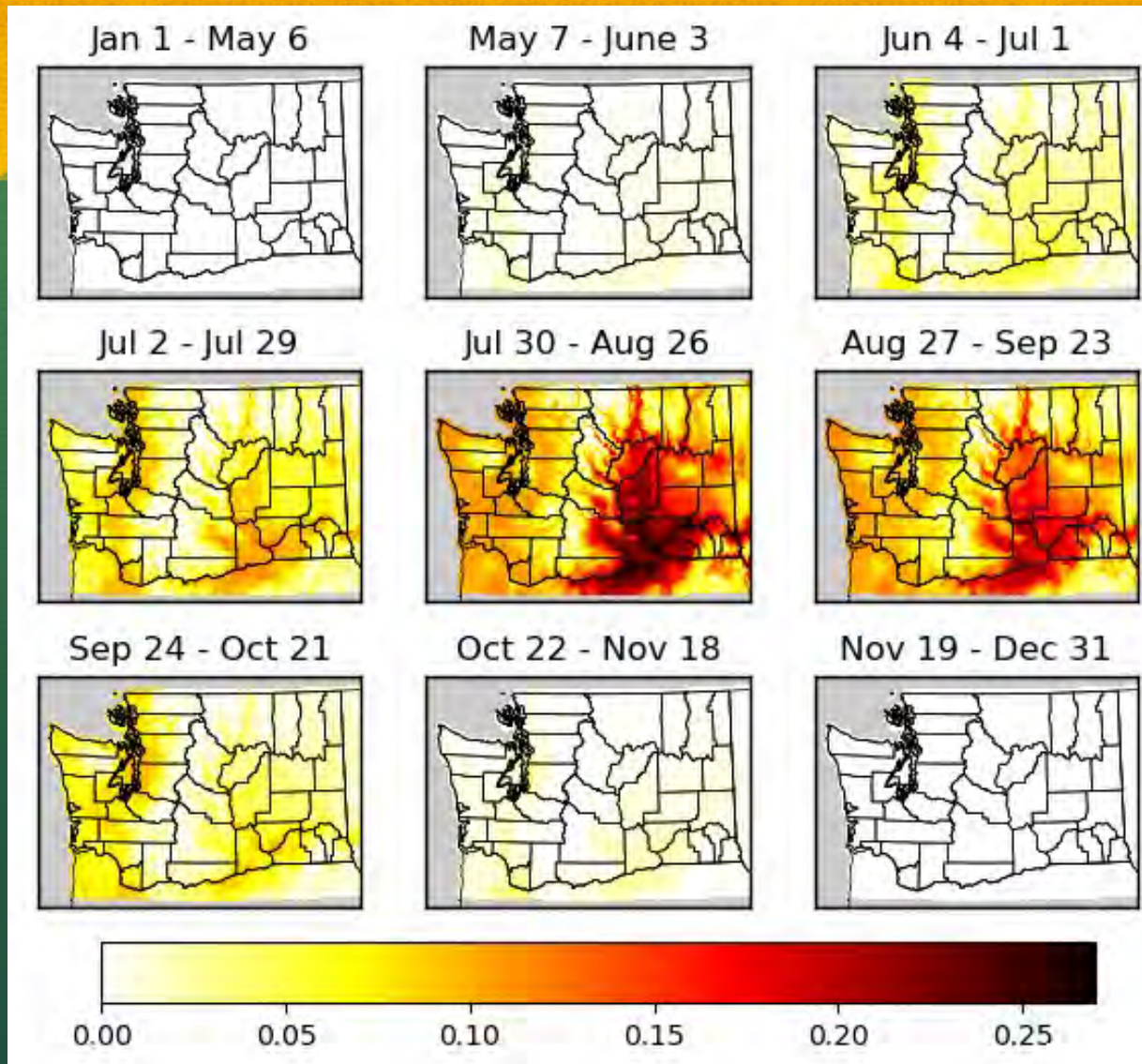
Control Strategies

- Engineering controls:
 - Landscape modification (mowing brush, etc.)
 - Remove standing water
 - Dust control
- Administrative controls
 - Training in protective measures and early recognition
- Personal protective equipment
 - Waterproof clothing for water exposures
 - Repellent impregnated clothing
 - Respirator for dusts

Total Worker Health

- Educate about disease risk
 - Use of weather and disease risk mapping (and cases in animals!)
 - Awareness of high-risk seasons and environments
- Educate about preventive measures
- Medical surveillance
- Consider work-related infection when workers are sick- educate medical providers

Suitability for West Nile Transmission



Thank you!

- peterr7@uw.edu
- UW Center for One Health Research
(<https://deohs.washington.edu/cohr/>)

