Mosquito/Arbovirus Surveillance

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Wildlife Health and Emerging Disease

Silent cycles of wildlife disease - enzootic

Flanders virus, trivitattus virus – mosquito-borne

Squirrel pox – squirrel to squirrel transmission

No impact other than to specific wildlife host

Minimal public health or veterinary importance

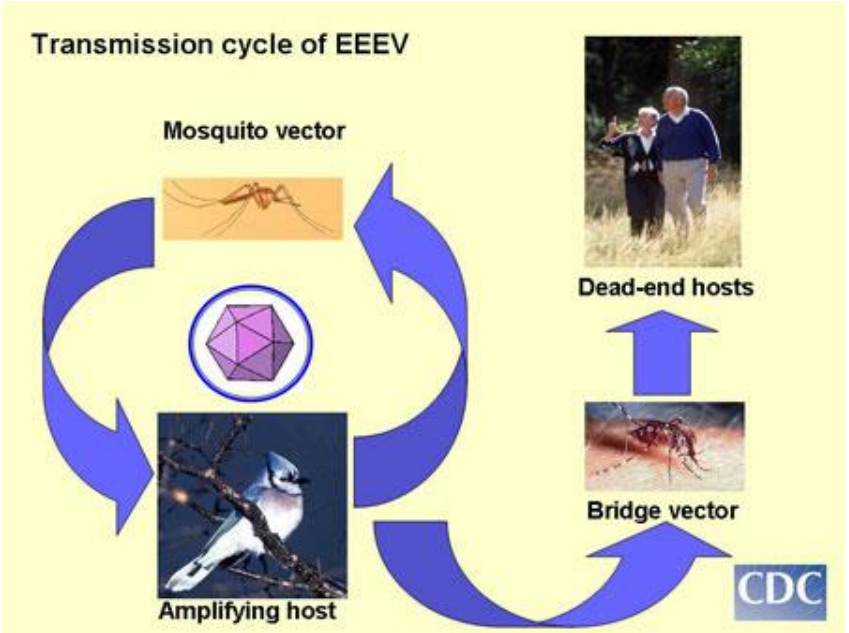
Wildlife Health and Emerging Disease

- *Epizootic or epidemic cycles of wildlife disease ("Jumping the species barrier")*
- West Nile virus, eastern equine encephalitis – mosquito-borne
- Lyme disease, Powassan encephalitis – tick-borne
- Chronic wasting disease – deer to livestock transmission

- -Human, veterinary, livestock, wildlife health issues
  - Non-target spillover of disease (accidental hosts)

Arboviral cycle

- Reservoirs
  - Avian species
- Arthropod vectors (ticks/mosquitoes)
  - Seasonality of disease
  - Host preference
    - 'Dead End' Hosts



Mosquito Vectors - EEE

- Enzootic vectors
  - Genus Culiseta
    - Ornithophillic
    - Habitat – forested wetlands
- Bridge vectors
  - Genera Coquillettiddia, Aedes (Ochleratutus),Culex
    - Catholic feeders'
    - Habitat – variable, but wetland associated

Mosquito Vectors – WNV/SLE

- Enzootic vectors
  - Genus Culex
    - Ornithophillic
    - Habitat – container breeders (nutrient rich water source)
      - Urban vs natural areas (Rochlin et al 2008)
- Bridge vectors
  - Genera Coquillettiddia, Aedes (Ochleratutus),Culex
    - Catholic feeders'
    - Habitat – variable, but wetland associated

Mosquito Habitat

- *Cs melanura* (EEE)
  - Red maple swamps or other acidic forested wetlands
  - Open forested uplands (eastern hemlock)
  - Oftentimes low visibility of disease activity (it takes a dead horse to see it!)

Mosquito Habitat

- *Culex pipiens/Cx restuans* (WNV)
  - Artificial container breeding, with high nutrient content
    - Tires
    - 'Kiddie pools'
    - Buckets
    - Cemeteries
  - Suburban or urban environments
  - Disease activity may be highly visible
    - "There's a dead crow on the lawn, honey!"

Mosquito Habitat

- *Aedes vexans*(EEE & WNV)
  - Temporary waterbodies following rainfall
- *Aedes canadensis*(EEE & WNV)
  - Permanent woodland (shaded) pools
- *Aedes sollicitans*(EEE & WNV)
  - Saltmarshes
- *Cq perturbans*(EEE & WNV)
  - Cattail marshes

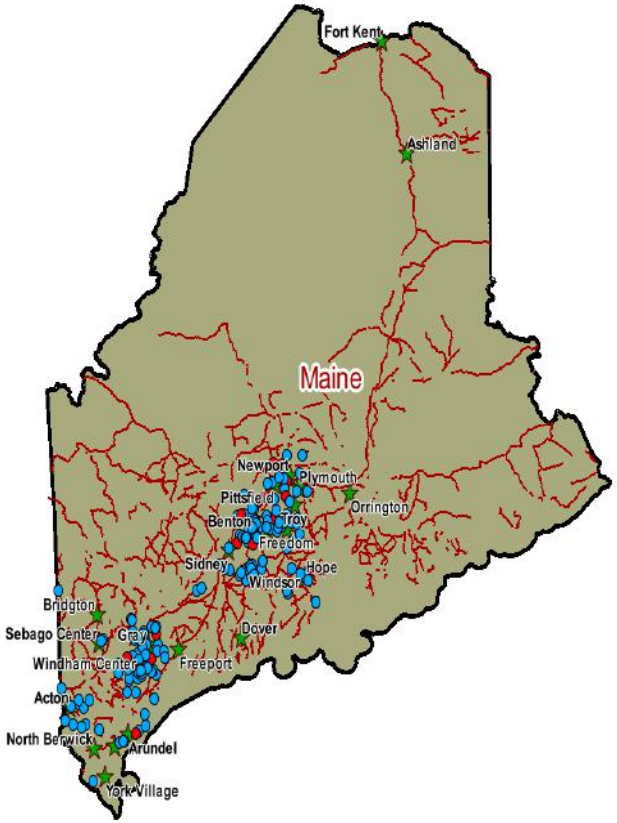
Deer Sero-surveys

AIM: evaluate the potential for using deer sero surveys to track and map the distribution of EEEV in the state of Maine.

The overall aim is to develop a comprehensive EEEV surveillance system based on detailed information of EEEV regional distribution and focal locations within the state of Maine.

Tracking Disease

- Use of cervids to look for EEE activity
  - ~7-12% antibody + animals across Maine



Deer Sera Tested = 226

EEE Positive = 16

% Positive = 7.1%

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Tracking Disease

- Large samples to look for clusters spatially and temporally

EEE Ab+ Animals

Both WTD and Moose, 2009-2014

High clustering of positivity in northern Maine

3 sites in Aroostook County

Kennebec County

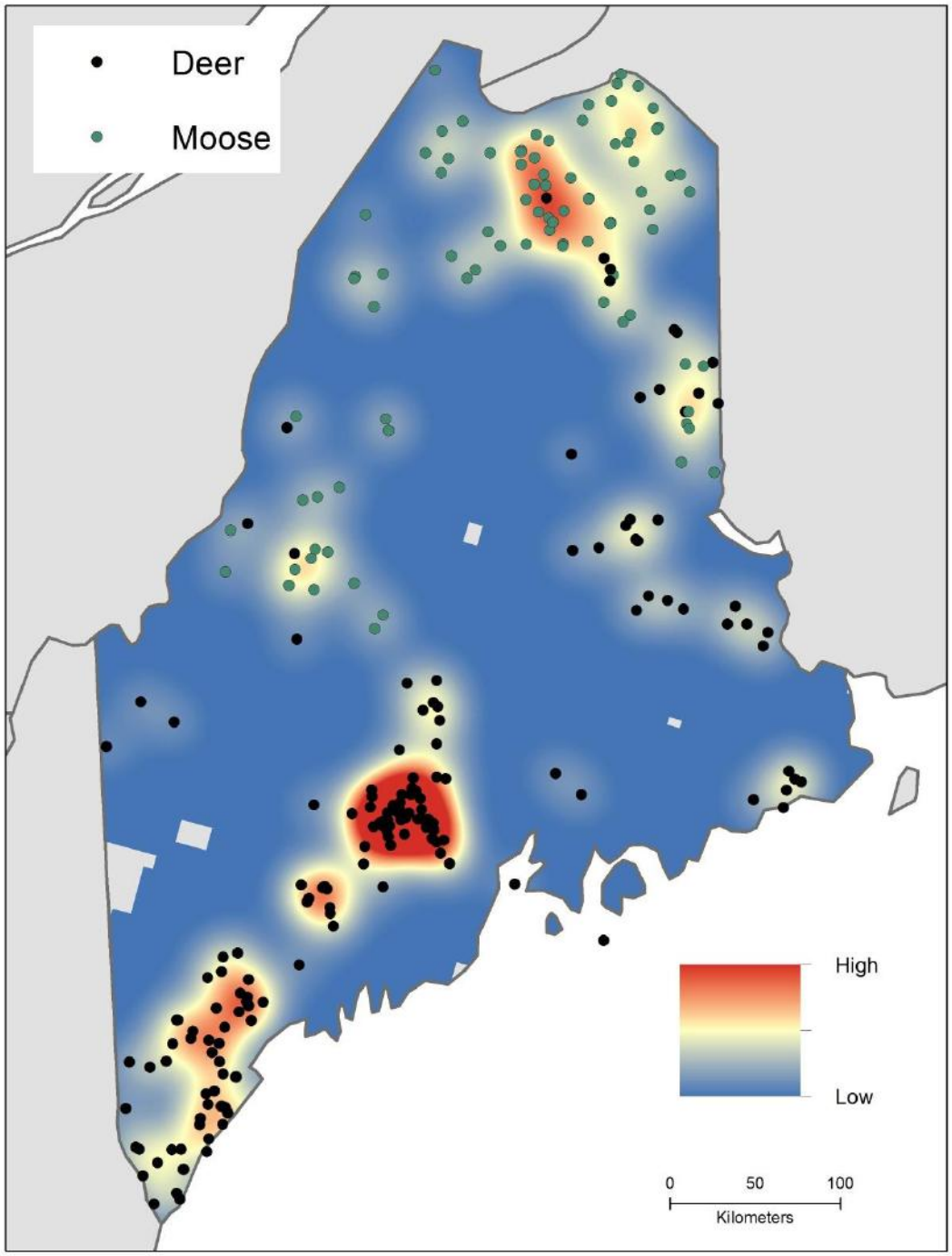
Lower Clustering of Positives

Piscataquis County

Interior York County

Washington County

Lower Penobscot County



Tracking Disease

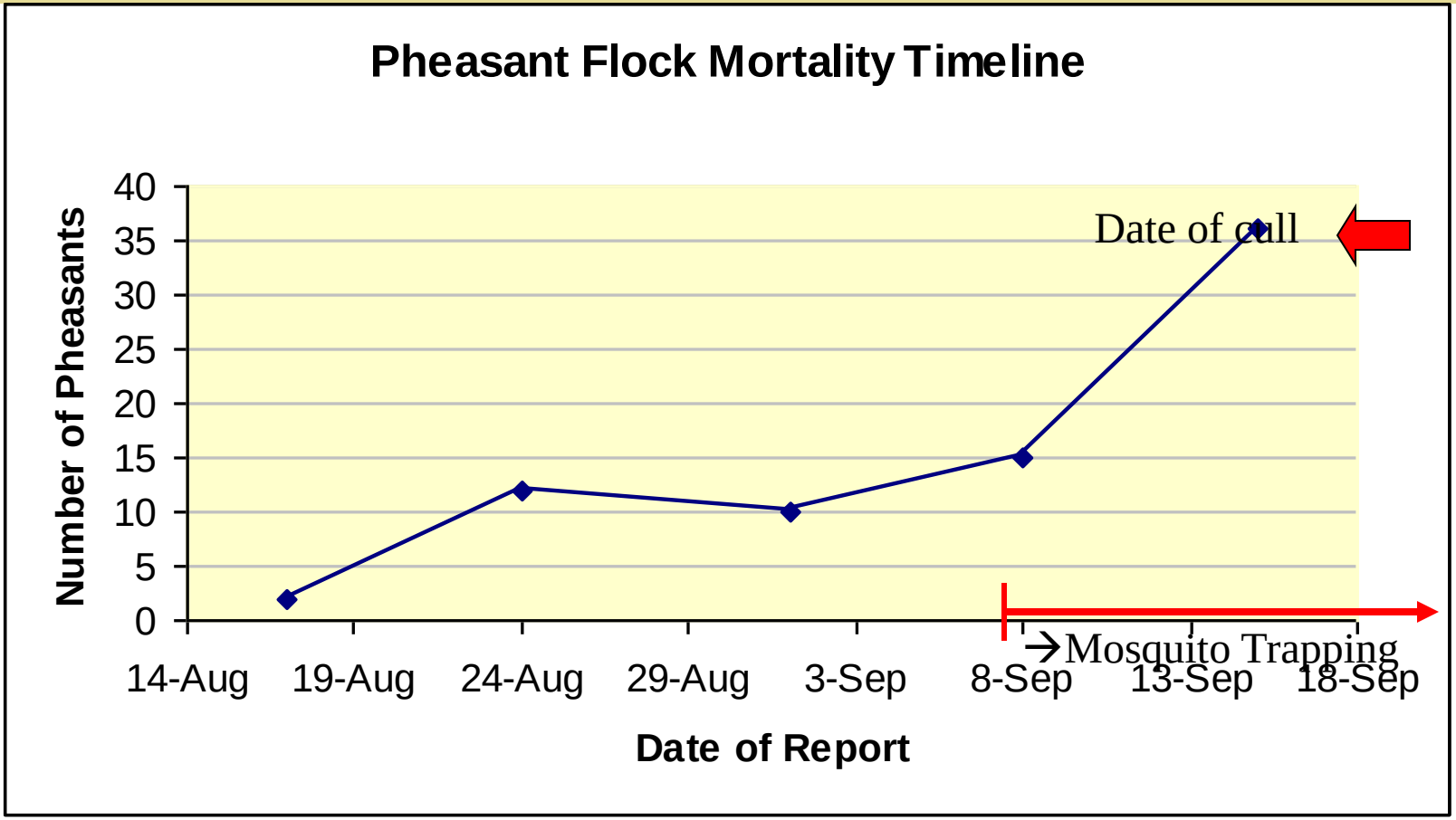
- Entomologic Surveillance (mosquito trapping)
  - 30 sites across Maine
  - Collaborative effort between MMCRI, MECDC and ME DACF

Tracking Disease

- Veterinary/public health surveillance
  - Rapid response investigation at site of activity (sick horse)
    - Mosquito collection and testing

Summer 2012 - Pheasant Outbreak

- Captive pheasant flock (Lebanon, ME), reports of sudden deaths occurring in flock
  - *Original flock size of 75 birds; one dead bird tested positive for EEEV*



- Of the original 75 birds:
  - *39 birds died suddenly, as reported by landowner*
  - *36 birds were euthanized*

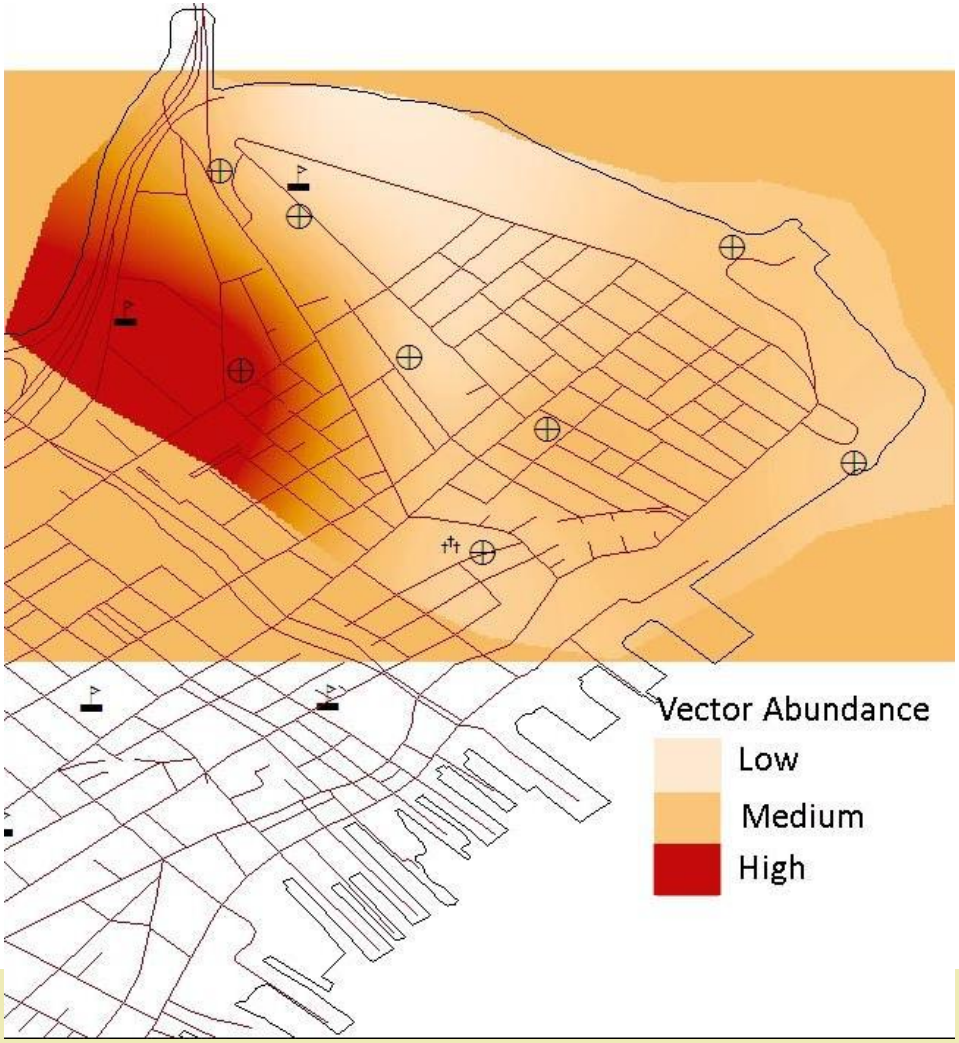
Rapid Response - Methods

- Rapid response mosquito trapping on site (Lebanon)
- Two light traps placed in forested wetlands near flock enclosure
  - *Red maple swamp*
  - *Hemlock swamp*
- September 7 - September 30

Predicting Disease

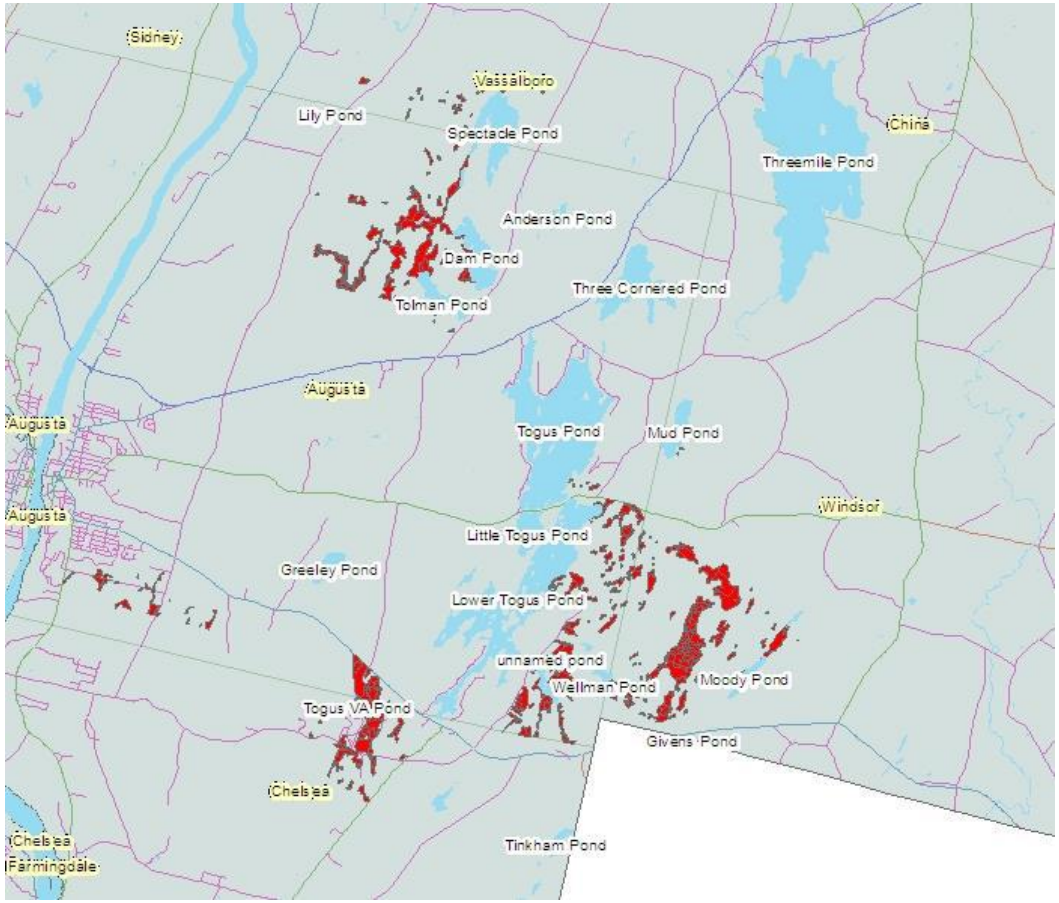
- Models created with geographic information systems (GIS)
  - Adding biologic data with environmental data to predict where either vectors or disease may concentrate

WNV model – urban mosquitoes



EEE model v2– across rural counties, targeting small locations

- Created to improve mosquito surveys but also emergency response



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The New Kid on the Block - Zika

- How to track, where to look?
  - Use of emergent cups to collect Ae albopictus/Ae egypti larvae
  - Concentrations on port districts with incoming ship traffic in southern Maine (Portland, Kittery)
- Urban environments
  - Search for artificial containers that may act as breeding habitat for vectors
  - GIS model for urban Culex sampling