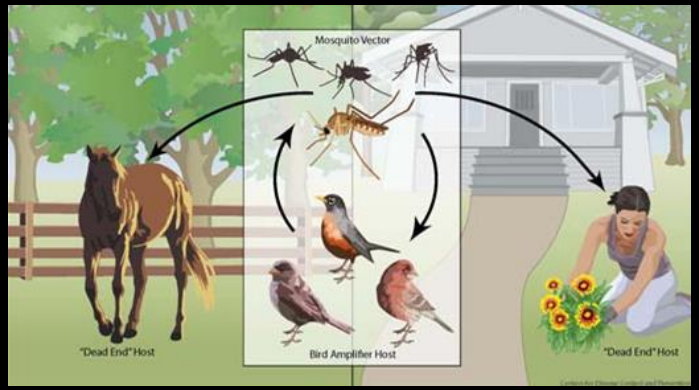
Do Chicago's Cryptic *Culex* Ruin West Nile Virus Forecasts?

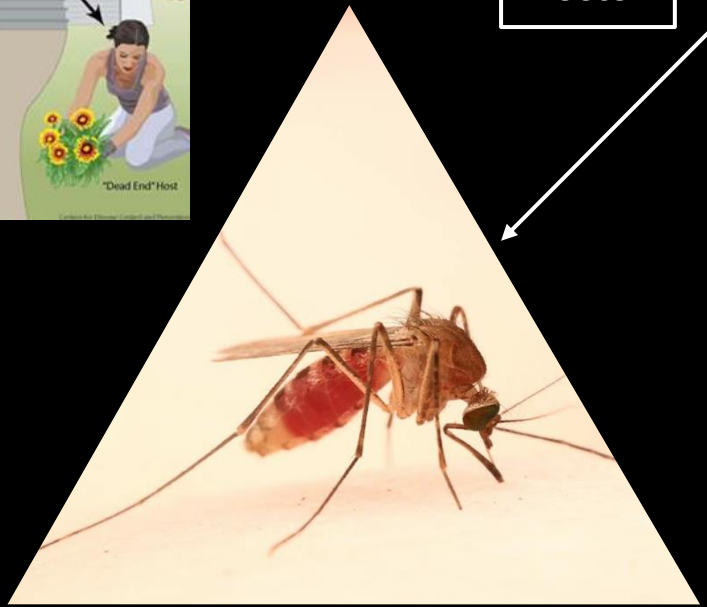
Ben Burgunder

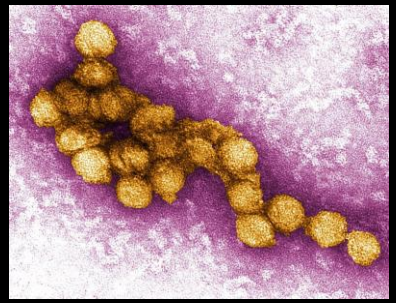
Background



Host

Vector



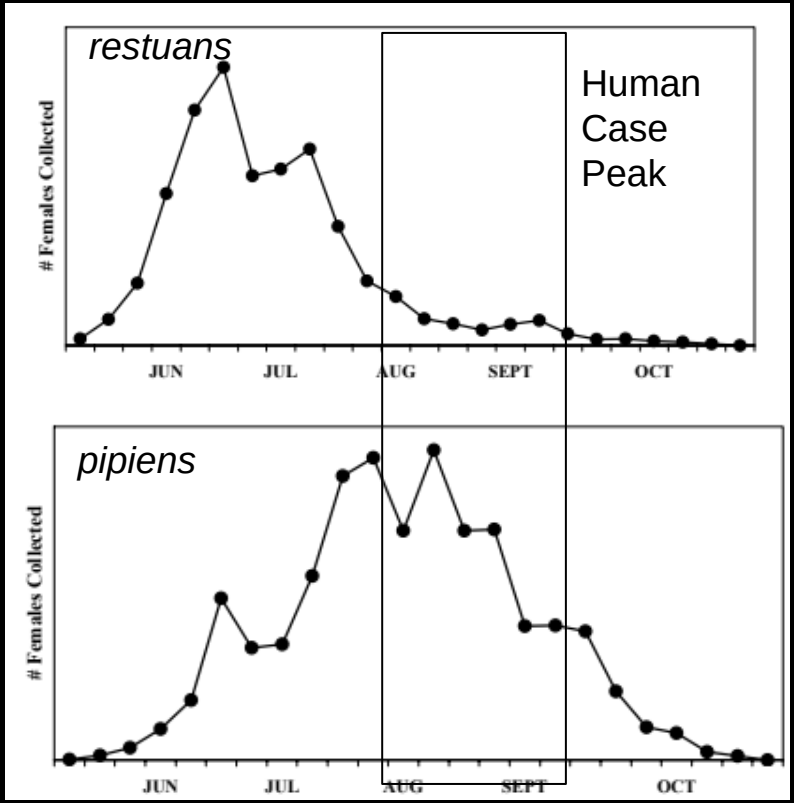


Pathogen

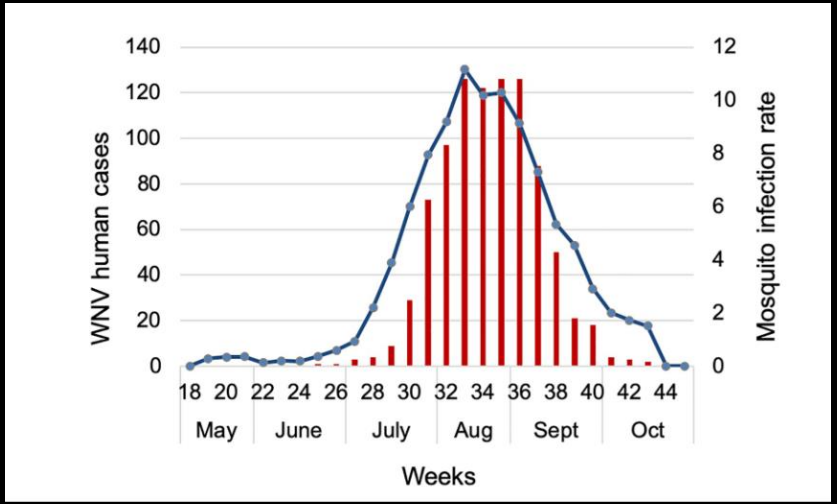
Environment

Image Credit: CDC.gov; Goldsmith, Cynthia; Harrington and Poulson 2008, Hayes et al. 2005

Vectors: *Cx. restuans* vs. *pipiens*



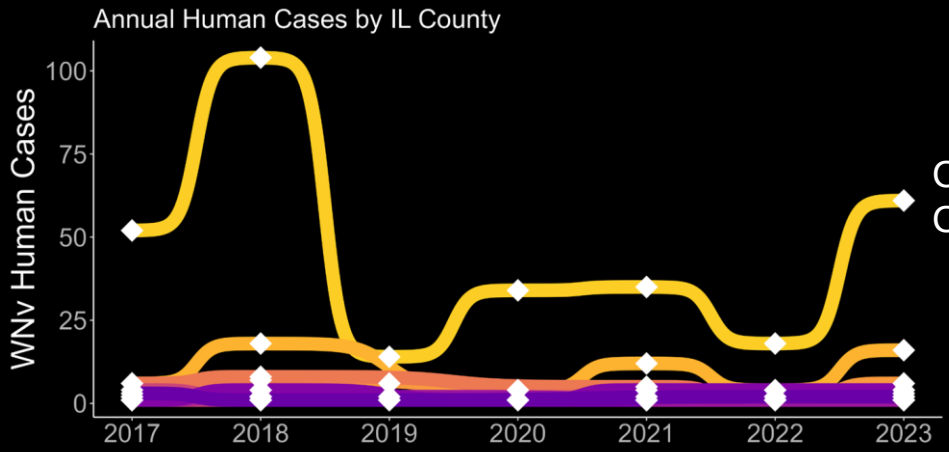
- *Restuans* early-season enzootic amplifier
- *Pipiens* incriminated as bridge vector, 2008



Karki et al. 2020

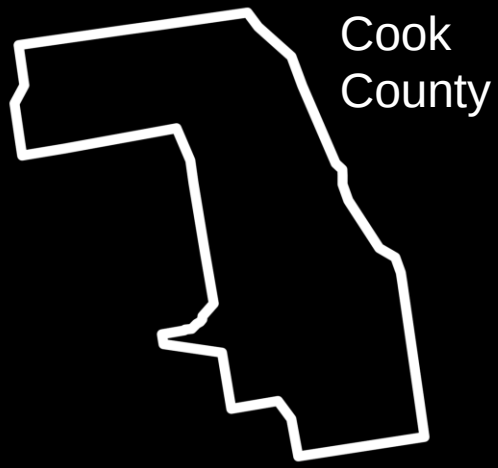
Andreadis, 2012; Andreadis et al., 2005; Harrington and Poulson, 2008; Reiskind and Wilson, 2008; Rochlin et al., 2019)

Background

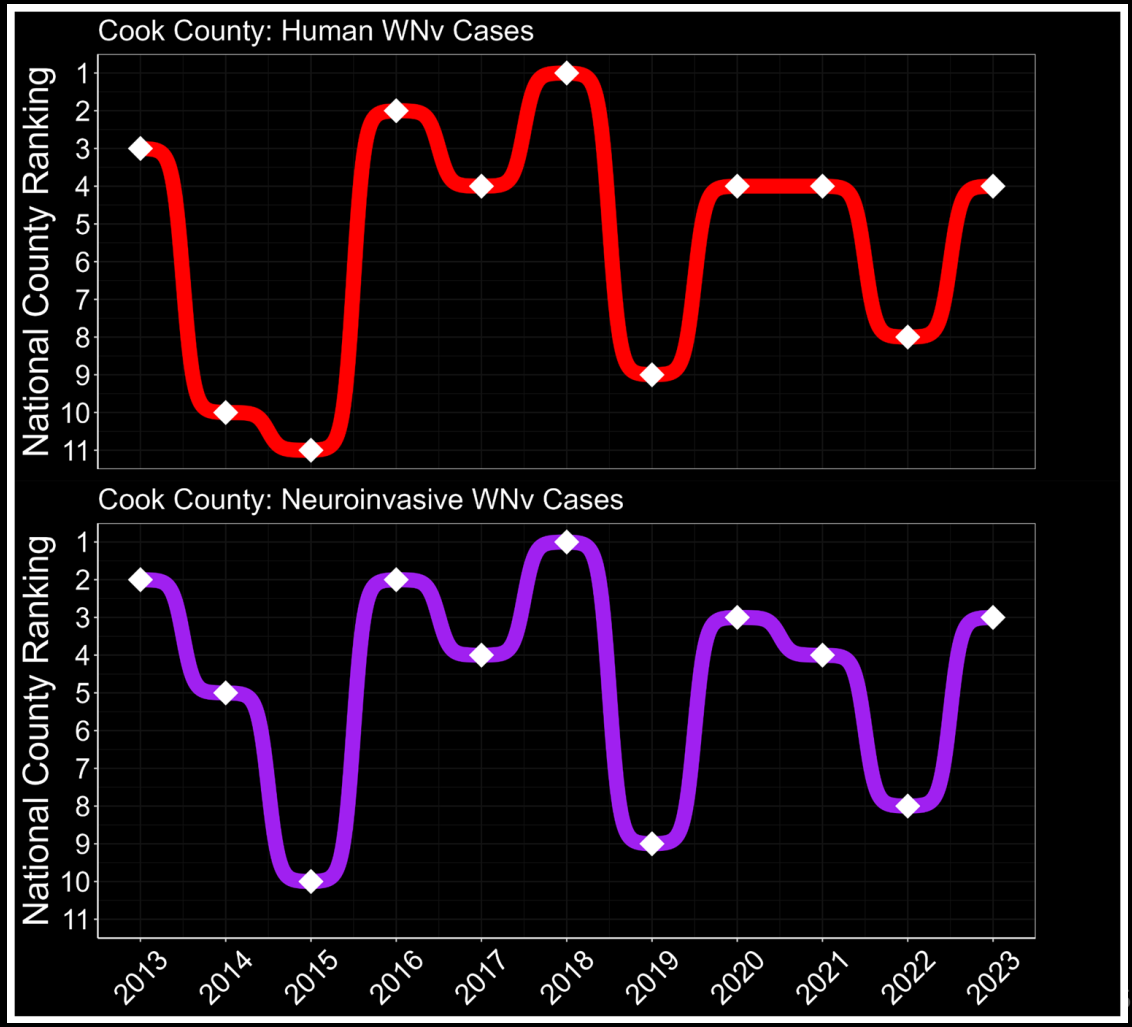


Source: IDPH

Background



Source: CDC



Aim 1: Community composition of two medically important species of *Culex* in the Greater Chicago Area

Methods

Aim 1: community composition of two medically important species of *Culex* in the Greater Chicago Area

Karki et al. 2020 subset

- grouped species

Methods

Aim 1: community composition of two medically important species of *Culex* in the Greater Chicago Area

Equal Cases
human cases were well-predicted

Lower Cases
human cases were lower than predicted

Higher Cases
human cases were higher than predicted

21 Total Sites

Methods

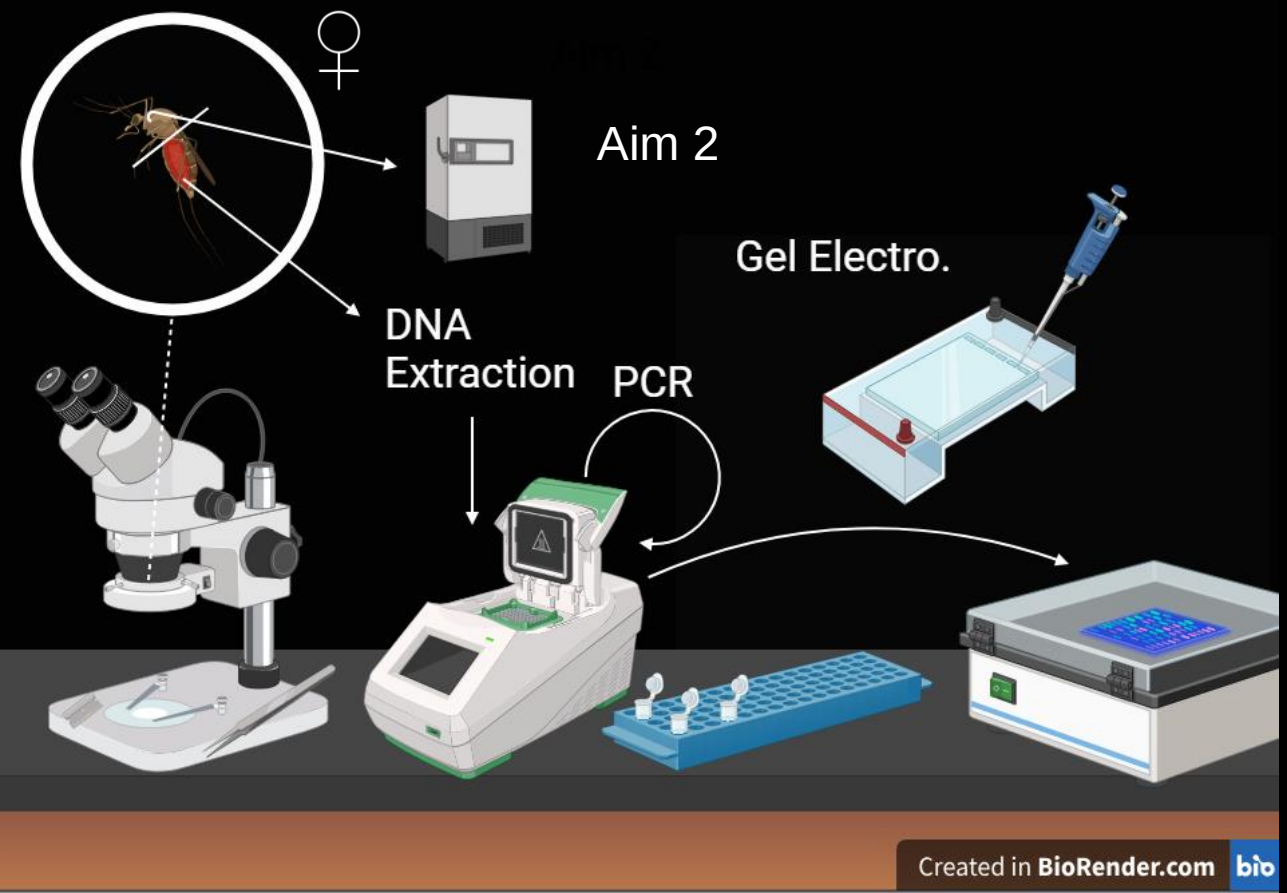
Aim 1: community composition of two medically important species of *Culex* in the Greater Chicago Area

Data Collection

- Karki et al. 2020 site subset
- Gravid traps w/ *Culex*-biased ovi. mixture
- 24-hr interval
- 1 week of sampling in Jul, Aug of 2021, 2022
- No true species abundances

Methods

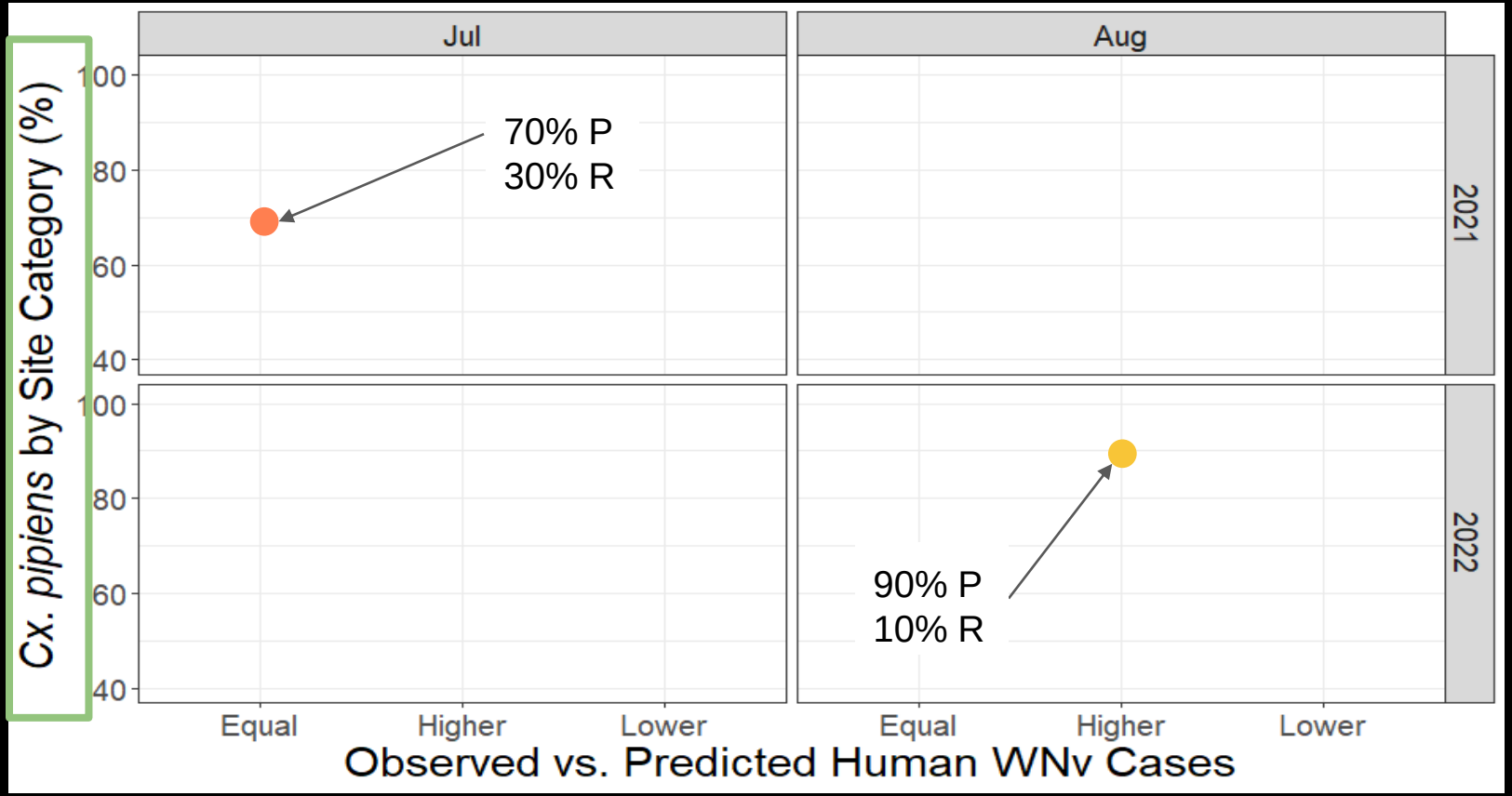
Aim 1: community composition of two medically important species of *Culex* in the Greater Chicago Area



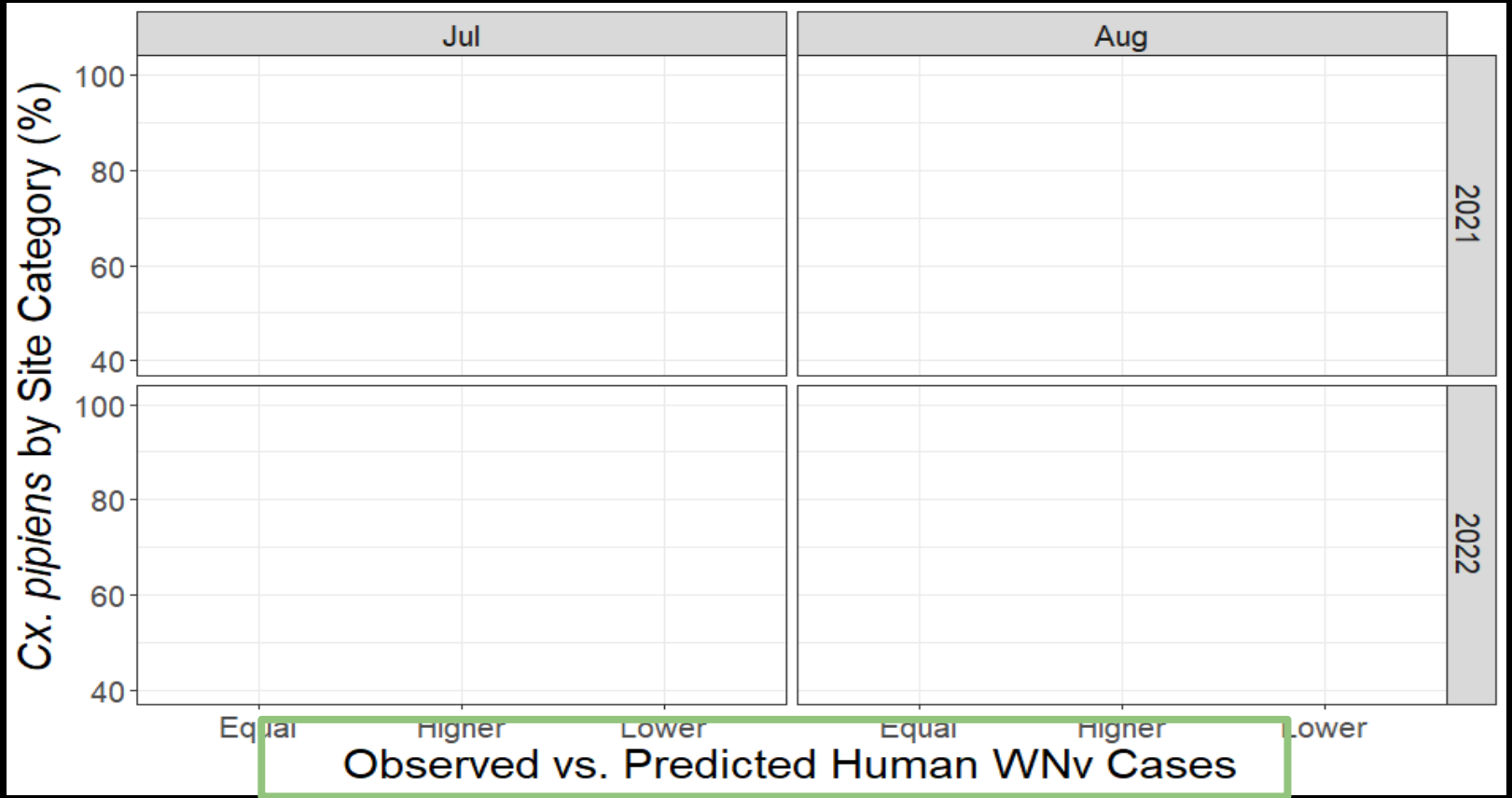
3000+ mosquitoes ID'd to *Cx. restuans* or *pipiens*

7.1% *restuans*
92.9% *pipiens*

Results


Jul
Aug
2021
2022
Cx. pipiens by Site Category (%)
100
80
60
40
70% P
30% R
90% P
10% R
Equal
Higher
Lower
Observed vs. Predicted Human WNv Cases

Results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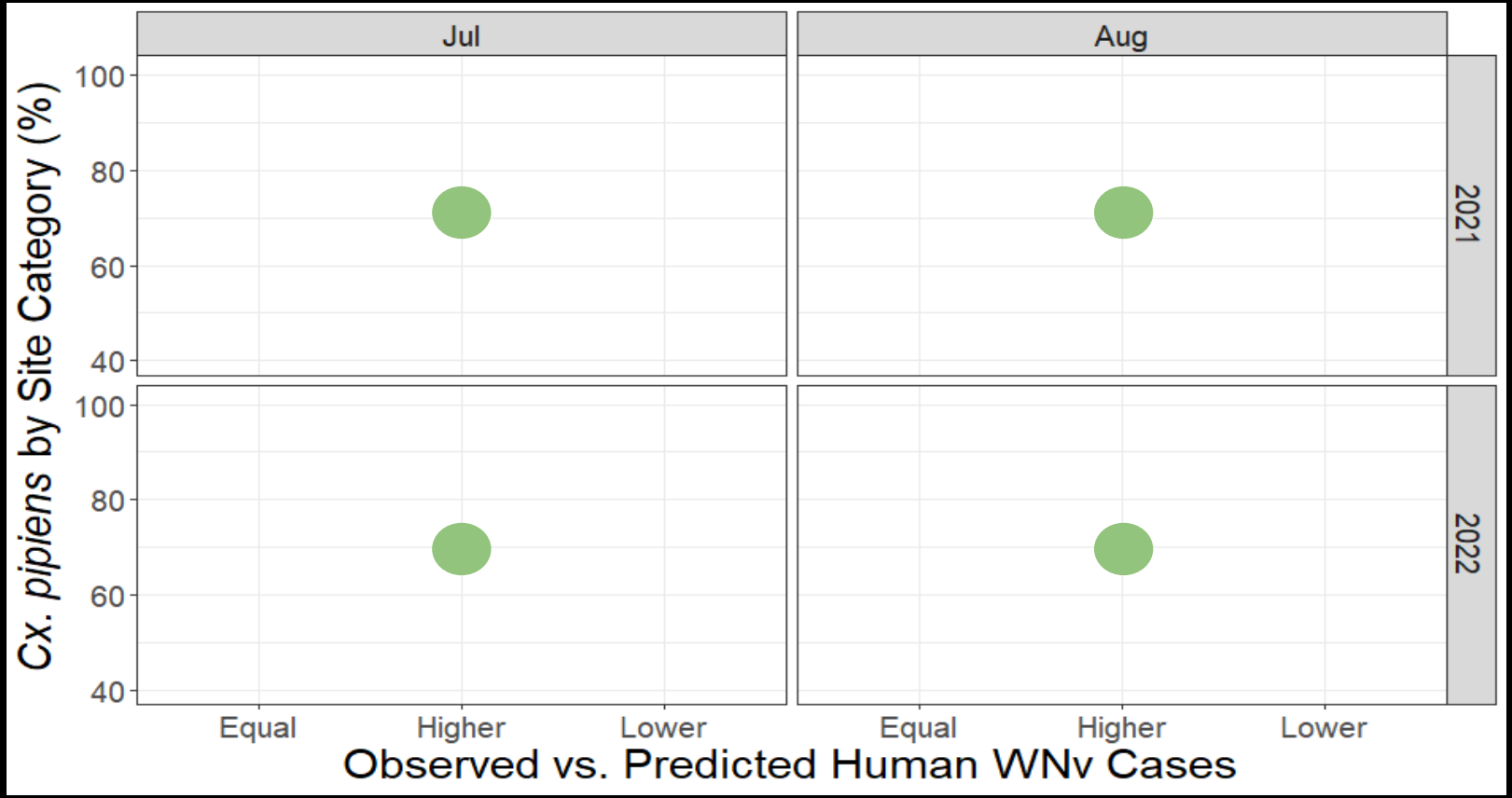
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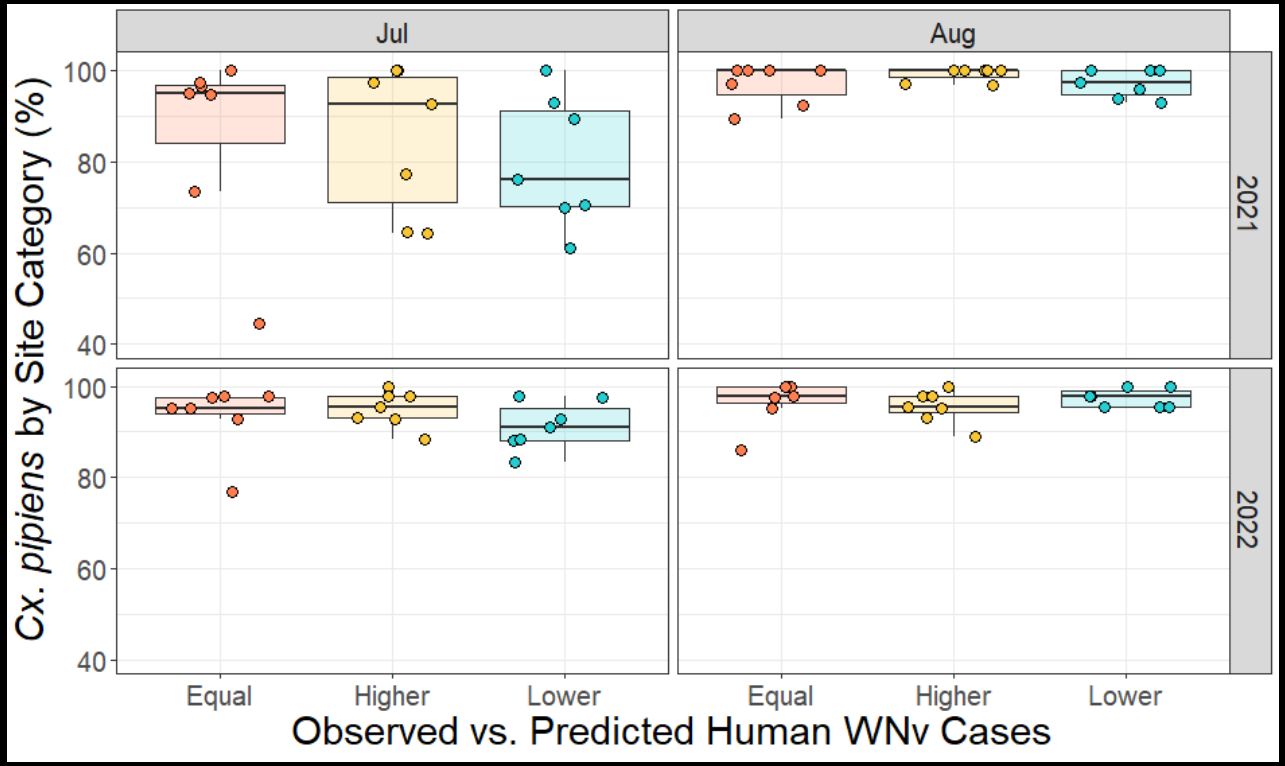
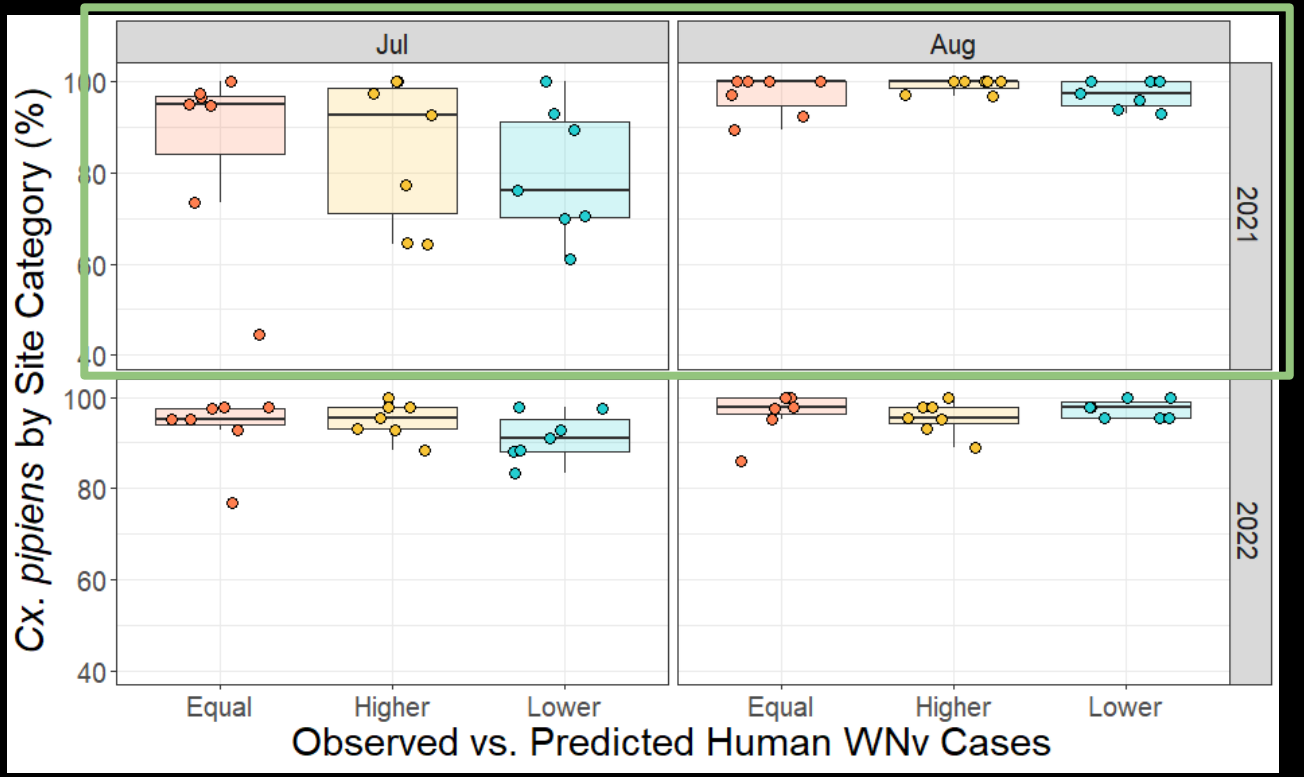

Jul
Aug
2021
2022
100
80
60
40
Cx. pipiens by Site Category (%)
Equal
Higher
Lower
Observed vs. Predicted Human WNv Cases

Results

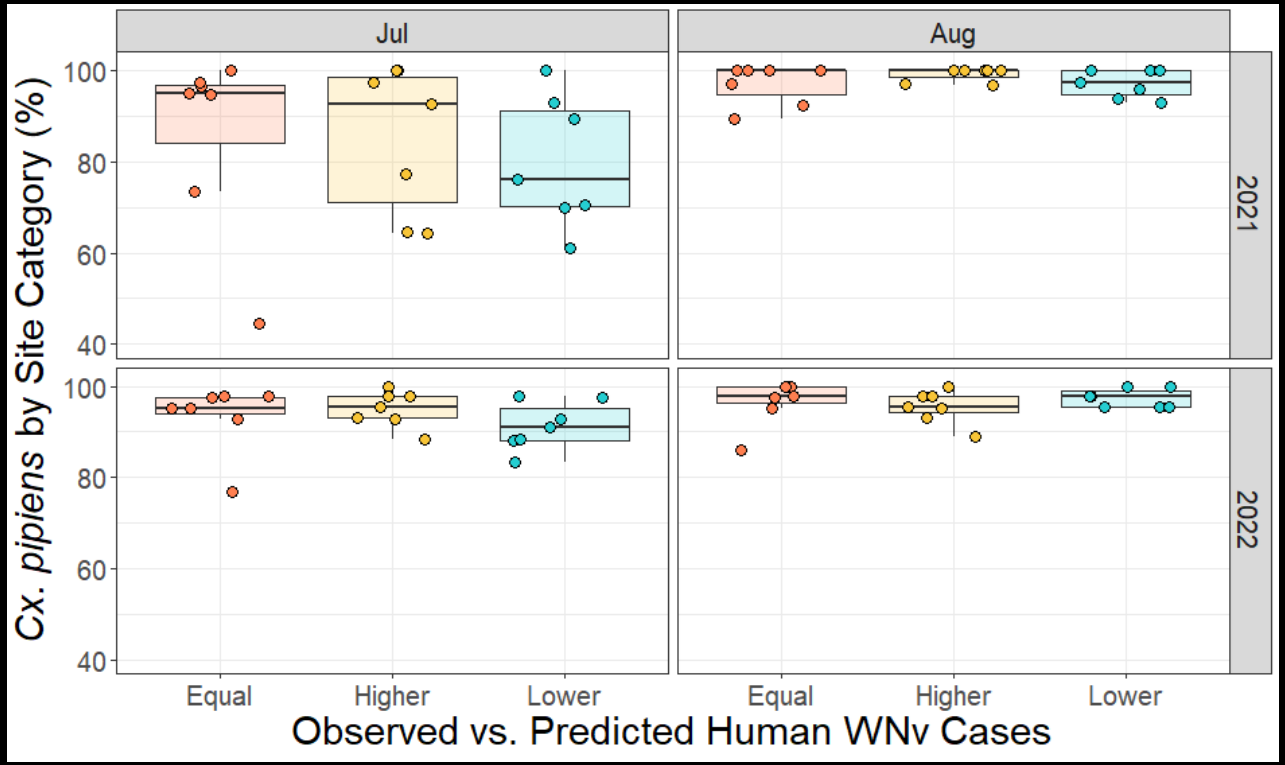
- Community comp. varies by month
  - *Restuans* are higher in Jul.



df = 1, $\chi 2$ = 962.59, $p < 0.001$

Results

- Site category does not predict species composition
  - Some trend of lower sites w/ lower % of *pipiens*

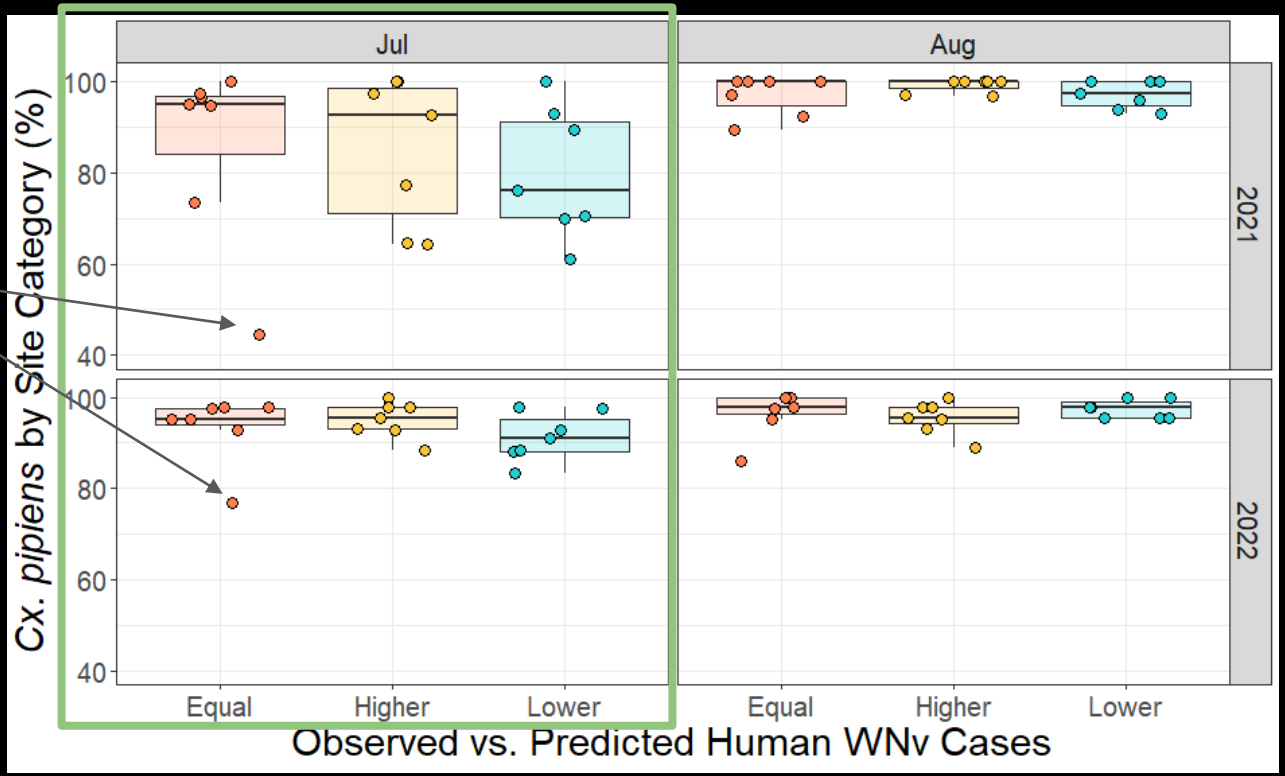


df = 2, χ2 = 2.02, p = 0.37

Results

- Jul 2021 vs. 2022

Site EG1



- Community comp. shifts; can influence WNv burden
  - (Tokarz and Smith, 2020)

df = 1, $\chi 2 = 32.37$, $p < 0.001$

Conclusions and Future Directions

Site community composition does not explain model accuracy.

Community composition of Chicago West Nile virus vector communities is dynamic

Grouping *Cx. restuans* and *pipiens* in transmission research may not blunt epi accuracy since *Cx. restuans* is nearly absent during peak zoonotic transmission

Conclusions and Future Directions

Aim 2:

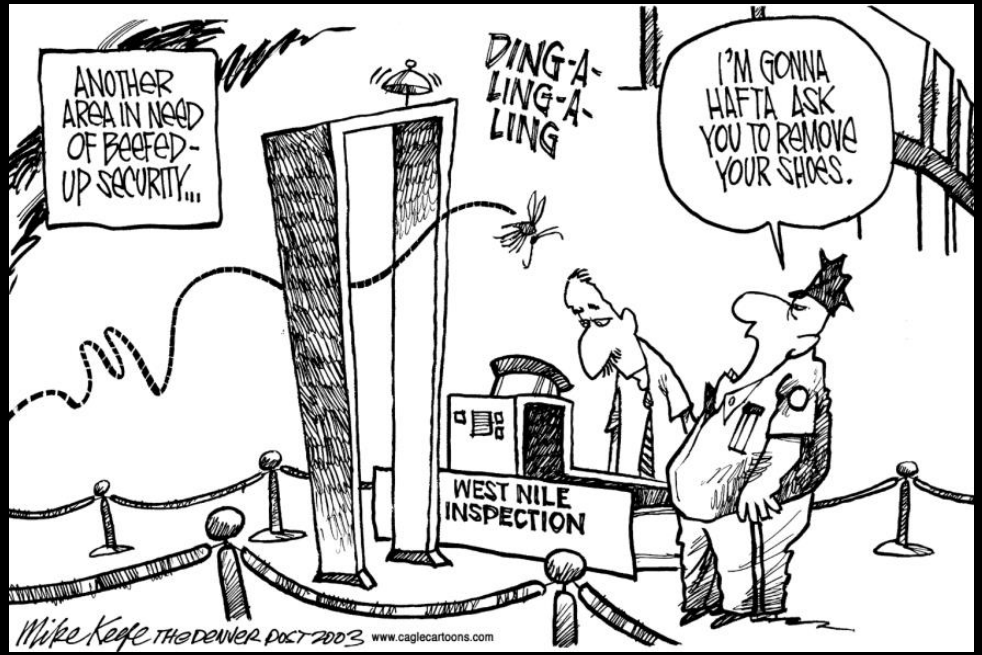
qRT-PCR viral detection of WNv

Return to Aim 1:

July 2023 → Climatic variables

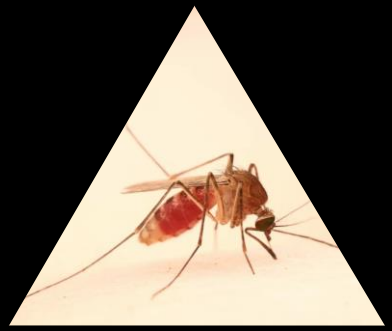
Bonus:

Developing GIS collaboration



Cartoon from caglecartoons.com

Conclusions and Future Directions



Pathogen

Host

Vector

Enviro

Aim 2

Aim 1

Collaboration

Acknowledgements

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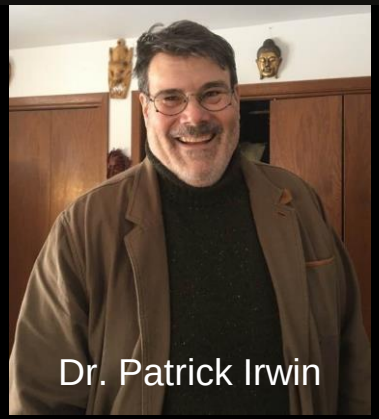
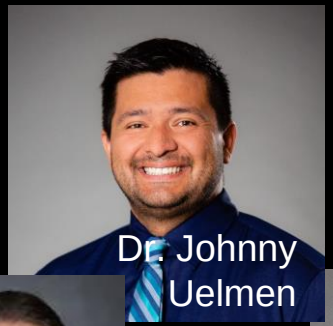
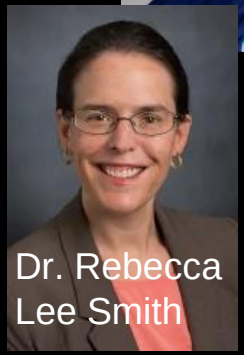
NORTHWEST MOSQUITO ABATEMENT DISTRICT


Dr. Patrick Irwin


Dr. Johnny Uelmen


Dr. Rebecca Lee Smith


Dr. Marilyn O'Hara Ruiz

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Created with BioRender.com

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Any Questions??

♂ *Culex* sp. feeding on rotting pumpkin juices