

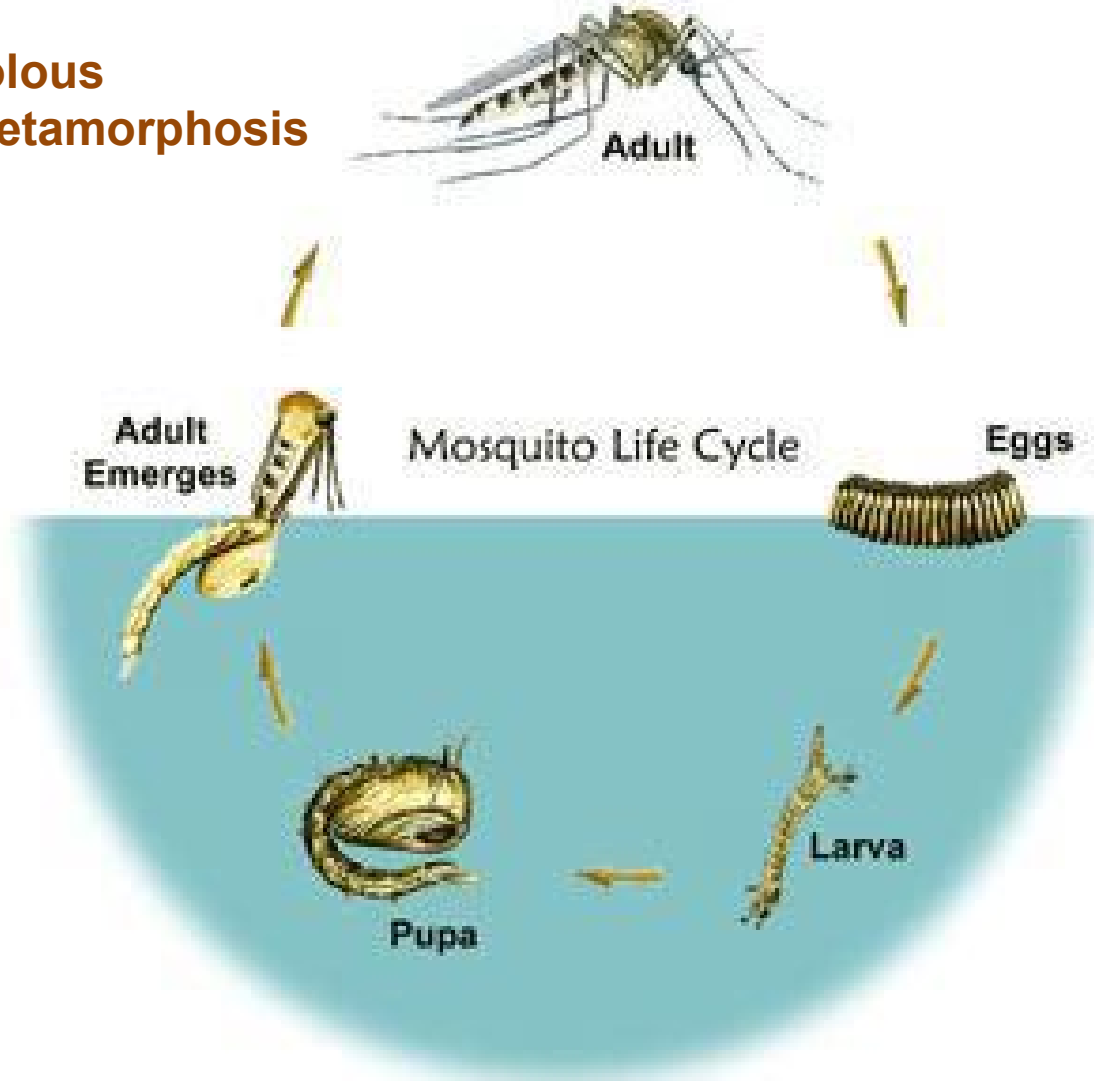
MANY MOSQUITO SPECIES

- **>3,500 species world-wide**
- **>175 in North America**
- **50 – 60 species in Tennessee**
- **Each species has its own biology, behavior, ecology**
- **Implications**
 - **No single control can be expected to work for all mosquitoes**
 - **Need to understand which species that you're facing**



GENERIC MOSQUITO LIFECYCLE

Holometabolous
complete metamorphosis

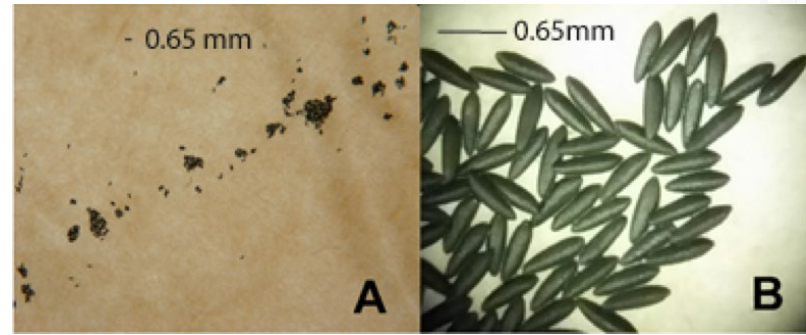


Hatch from egg & Emerge from pupa

www.youtube.com/watch?v=wFfO7f8Vr9c

(1) EGGS

- Oviposition – female lays eggs
- Eggs vary by genus
 - *Anopheles* mosquitoes lay them singly on top of the water with floats
 - *Aedes* mosquitoes lay clustered
 - *Culex* mosquitoes lay as rafts, stale water



<https://www.youtube.com/watch?v=VwlqGbhq4T8>

Anopheles



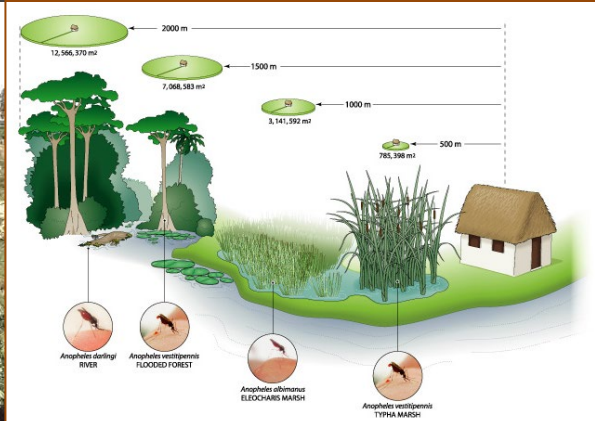
Aedes



Culex



MOSQUITO HABITATS & ECOLOGY



Species specific – not in Antarctica (yet) or the ocean

RUNNING / FLOWING WATER



- *Anopheles quadrimaculatus*
- *Culex territans*
- *Uranotaenia sapphirine*



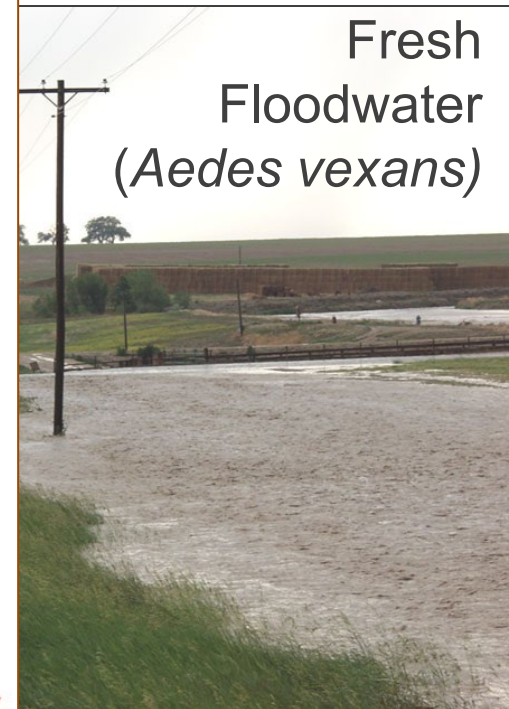
TRANSIENT WATER

- Flooded areas, snow pools, & ditches
- Transient water generally show water quality changes

Harmless but annoying gallinipper mosquitoes following Hurricane Florence

Krisztian Magori summarizes the recent media coverage of large swarms of mosquitoes in the Carolinas following flooding post-Hurricane Florence.

[Krisztian Magori](#) 5 Oct 2018



WETLANDS: SWAMPS / SALT MARSHES

- Regularly flooded
- High salinity
- Diverse plants & animals



Coquillettidia perturbans



STAGNATE WATER

- Motionless water (permanent/semi-permanent)
- Freshwater swamps, polluted water
- Different species like different conditions
 - acidity, organic matter, oxygen, etc
 - *Anopheles*, *Culex*, *Culiseta*, *Coquillettidia*, & *Uranotaenia*



Polluted water - *Culex pipiens*

CONTAINERS



- Motionless water
- Evaporation levels
- Desiccant tolerant-eggs



MAIN GENERA OF INTEREST

- ***Aedes***
- ***Anopheles***
- ***Culex***
- ***Psorophora***
- ***Other***
 - ***Coquillettidia, Culiseta, Mansonia, Uranotaenia, Wyeomyia***
 - ***Orthopodomyia, Deinocerites, Toxorhynchites***



BIOLOGY OF TWO COMMON GENERA



Aedes

Daytime – early evening
Oviposit singly
adjacent to water
Overwinters as eggs
Daytime resting sites
< 10 ft (bushes)



Culex

Late night – early morning
Oviposits in rafts on water surface
Overwinters as adult or immature
Daytime resting sites
> 10 ft (trees)



IMPORTANT SPECIES

Anopheles gambiae species complex

Culex pipiens species complex

Aedes aegypti

Aedes albopictus

Aedes japonicus

Aedes triseriatus

Aedes vexans

Neat Species

Toxorhynchites species

Uranotaenia species

Wyeomyia & *Mansonia* species



NEAT SPECIES



Toxorhynchites species



Uranotaenia
species



Mansonia species

© 2002 Dept. Medical Entomology, ICPMR



Wyeomyia species



ANOPHELES GAMBIAE SPECIES COMPLEX



- **Vector: *Plasmodium falciparum***
- **6 different complex members**
 - **Separated into Molecular and Chromosomal forms that differ by ‘landscape / behavior’- assortative mating**
- **Eggs are laid flat singly on water**
- **Hosts: Mammals**
- **Feeds: at night**



CULEX PIPIENS SPECIES COMPLEX – HOUSE MOSQ.



Medical Importance

Bancroftian Filariasis

Veterinary Importance

Avian Malaria

Avian Pox Virus

Dog Heartworm

Medical & Veterinary Importance

Eastern Equine Encephalitis

Rift Valley Fever Virus

St. Louis Encephalitis

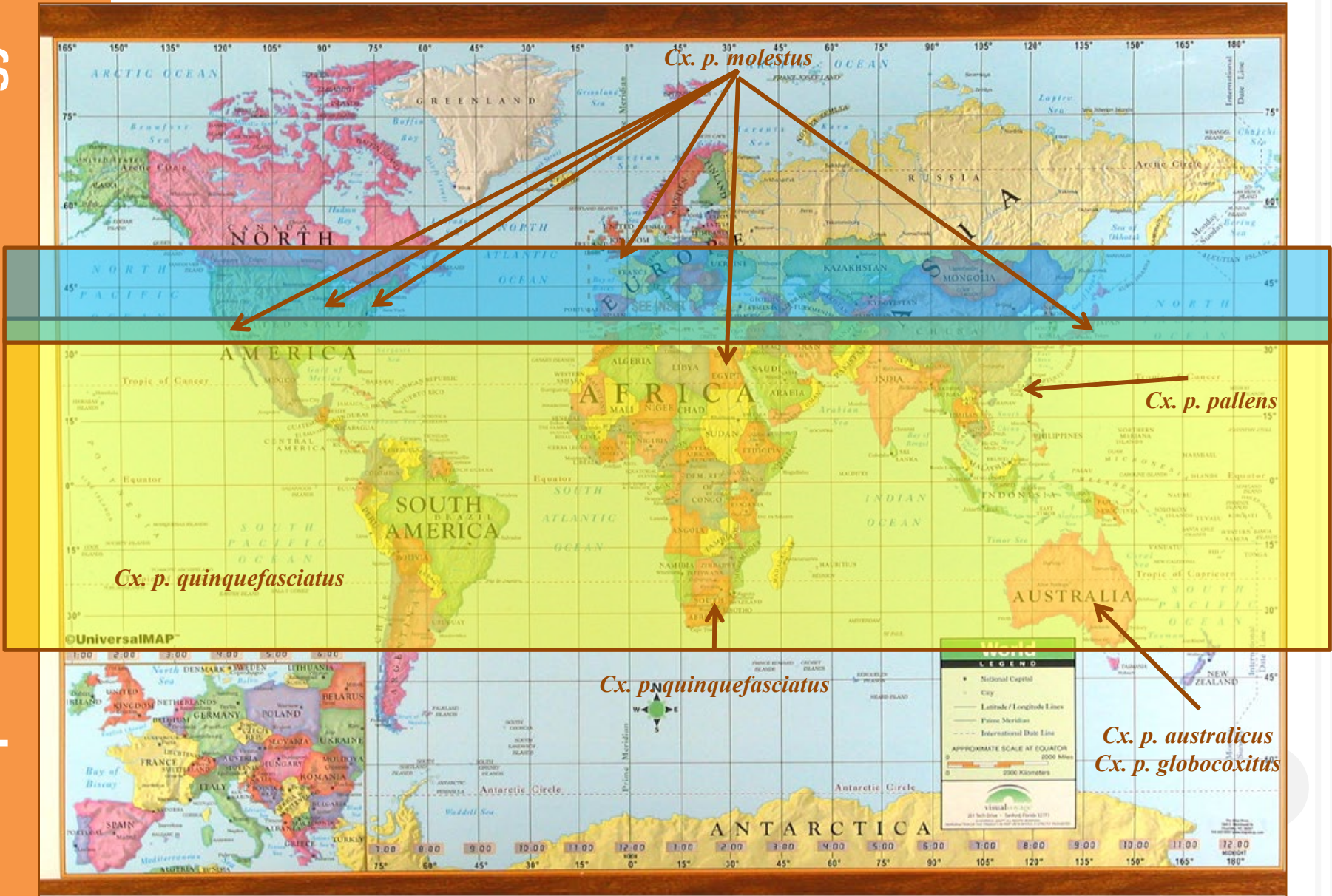
Western Equine Encephalitis

West Nile Virus

***PLUS...they bite**



CULEX PIPIENS SPECIES COMPLEX – HOUSE MOSQ.



CULEX PIPIENS SPECIES COMPLEX – HOUSE MOSQ.

Phenotype	<i>Culex quinquefasciatus</i>	<i>Culex pipiens</i>	<i>Culex molestus</i>
Oviposition Site	Epigeous (above ground)	Epigeous (above ground)	Hypogeous (below ground)
Mating	Stenogamous (confined spaces)	Eurygamous (open spaces)	Stenogamous (confined spaces)
Host Preference	Mammals/Birds	Birds	Mammals
Egg Production	Variable	Anautogenous (require bloodmeal)	Autogenous (do not require blood meal)
Life Cycle	Variable	Heterodynamic (winter diapause)	Homodynamic (no winter diapause)



“little brown mosquito”

Northern / Southern house mosquito

Nuisance in Africa



***Aedes Aegypti* – Yellow Fever Mosq.**

- **Biological vectors of....**
 - **Yellow fever, Dengue fever, Chikungunya virus, Zika, & more**
- **Eggs are desiccant tolerant & oviposited in containers**
- **2 subspecies**
 - ***A. a. aegypti* (urban)**
 - ***A. a. formosa* (sylvatic)**
- **Hosts: Mammals**
- **Feeds all day**



Aedes vexans

- Transmits: *Dirofilarial* nematodes, rabbit virus, WEE, EEE, & Rift Valley fever virus
 - livestock > humans (!)
- Eggs desiccant tolerant & oviposited in or near floodwater areas
- North American native species
- Hosts: Mammals
- Feeds: at dusk



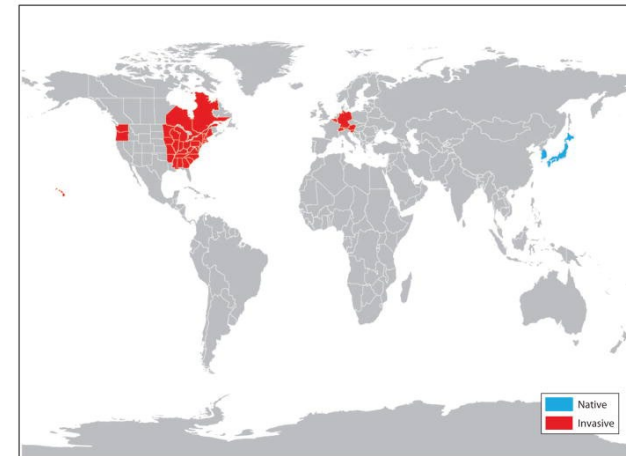
***Aedes albopictus* – ASIAN TIGER MOSQ.**

- **Biological vectors of....**
 - **Yellow fever, Dengue fever, Chikungunya virus, bridge vector of La Crosse virus, filarial nematodes, *Dirofilaria***
- **Desiccant tolerant eggs oviposits in artificial & natural containers**
- **Introduced to Texas in tires**
- **Hosts: Mammals**
- **Feeds: all day**
- **Presence is predicted by:**
 - **Increasing temperature & 14d cumulative precipitation, *Aedes triseriatus* counts**



***Aedes japonicus* – ROCK POOL MOSQ.**

- Biological vector of Japanese encephalitis
- “Decent” Biological vectors
 - Yellow fever, Dengue fever, Chikungunya virus, bridge vector of La Crosse virus, filarial nematodes, *Dirofilaria*
- Desiccant tolerant eggs oviposited in/or near rock pools & containers
- Introduced to New York
- Hosts: Mammals
- Feeds: crepuscular (dawn/dusk)
- Presence is predicted by increasing canopy cover



***Aedes triseriatus*- EASTERN TREE HOLE MOSQ.**

- **Biological vector of La Crosse virus and**
 - **< Yellow fever, Dengue fever, Chikungunya virus, filarial nematodes, *Dirofilaria***
- **Desiccant tolerant eggs oviposits in/near tree holes & containers**
- **North American native species**
- **Hosts: Mammals**
- **Feeds: all day (dawn to dusk)**
- **Presence is predicted by**
 - **NDVI (*potentially*),**
 - ***Ae. albopictus* counts**
 - **Site Type**
 - **Cemeteries > parks > imperviousness space**



AEDES OF OUR INTEREST LIKE CONTAINERS



- Motionless water
- Evaporation levels
- Desiccant tolerant-eggs



LA CROSSE VIRUS EPIDEMIOLOGY & ECOLOGY



Asian tiger
Aedes albopictus



Eastern treehole
Aedes triseriatus



Asian bush
Aedes japonicus



Sciurid Reservoirs

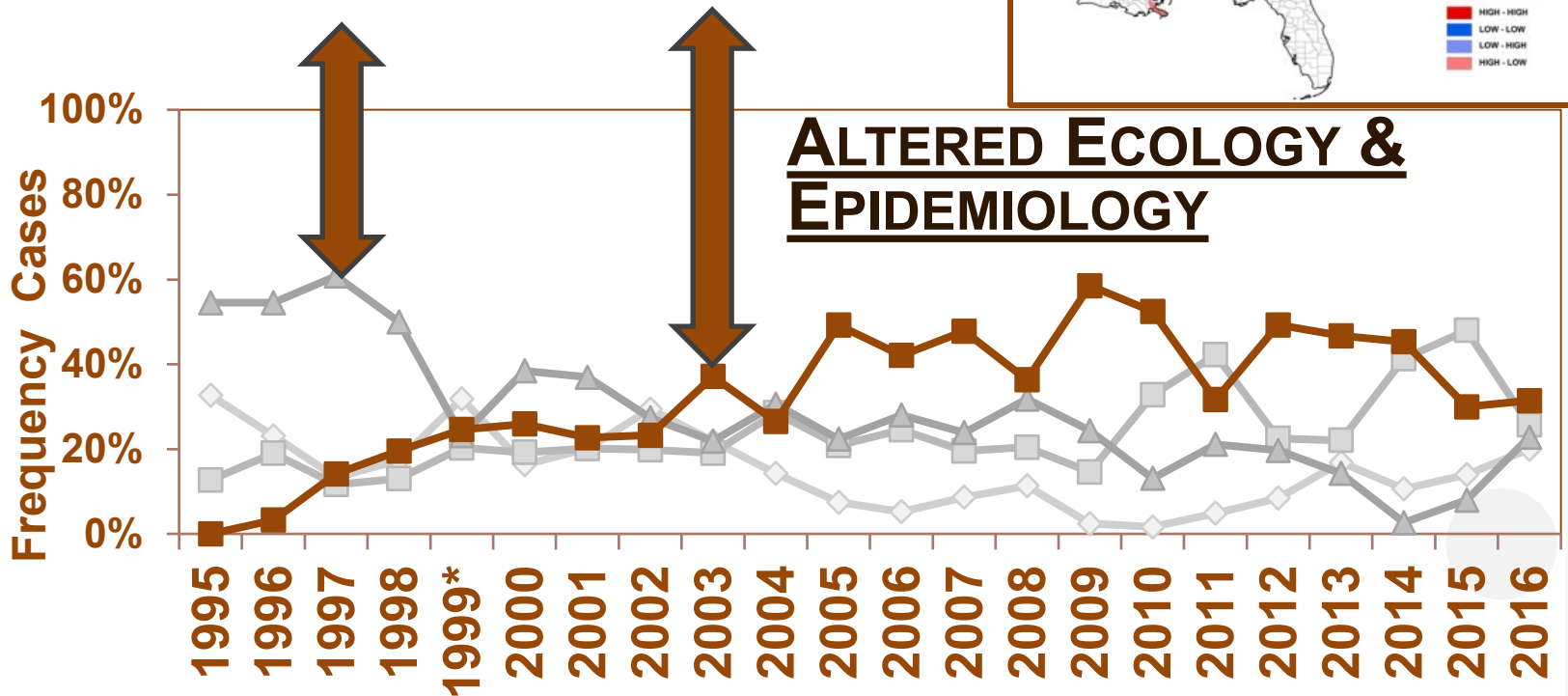
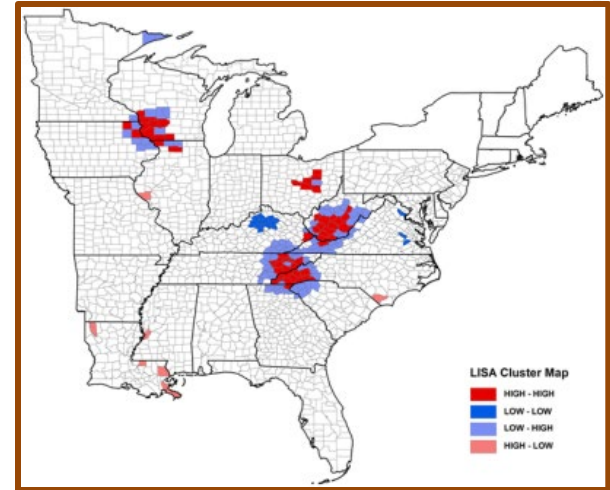
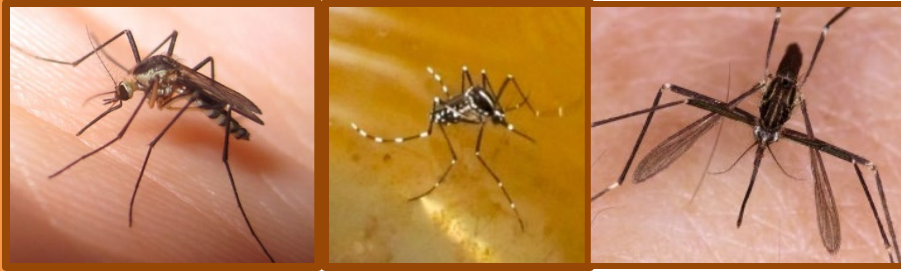


Immature
Habitats



LA CROSSE ENCEPHALITIS CASE STATISTICS

- ◇ Upper Mid-West
- ▣ Mid-West
- ▴ Northern Appalachia
- Southern Appalachia



IDENTIFY WHERE EACH GENERA WILL LAY EGGS AROUND YOUR HOME.

MARK AN A (*AEDES*), N (*ANOPHELES*), C (*CULEX*)



**IDENTIFY WHERE EACH GENERA WILL LAY EGGS
AROUND THIS HIGH SCHOOL.**

MARK AN A (*Aedes*), N (*Anopheles*), C (*Culex*)



“GOOGLE MAPS” YOUR SCHOOL:

**IDENTIFY WHERE EACH GENERA WILL LAY EGGS
AROUND YOUR SCHOOL.**

MARK AN A (*AEDES*), N (*ANOPHELES*), C (*CULEX*)

