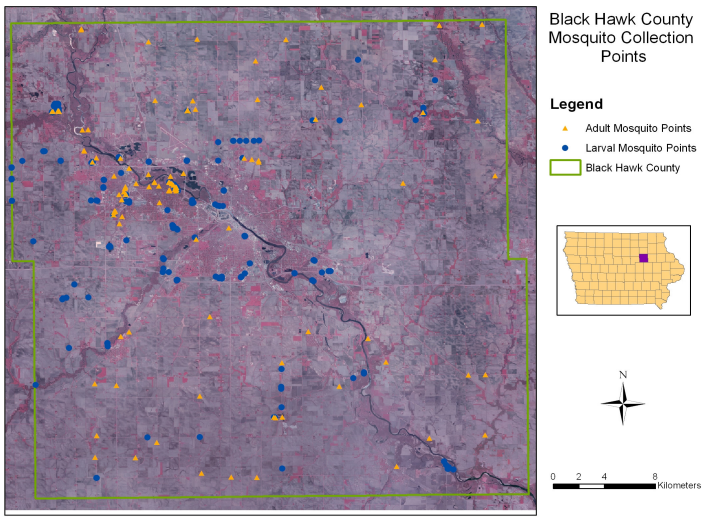
Investigation of mosquito abundance and West Nile Virus dynamics at a local and regional scale

Goal

The goal of the project is to investigate the spatial and temporal dynamics of individual mosquito species and also West Nile virus (WNV) incidence at both a local (county) and a regional (state) scale.



Black Hawk County, Iowa 2003 mosquito collection points

Objectives

1. Identify landscape and climatic influences on local mosquito dynamics through analysis of spatial and temporal data in relation to local mosquito collections (Black Hawk County, Iowa).

2. Develop a Geographic Information System based set of modeling tools for spatially and temporally predicting local mosquito dynamics based on findings of Objective 1.

3. Test outputs from the developed model vs. collected mosquito local mosquito data (Buchanan and Black Hawk Counties).

4. Investigate statewide spatial (landscape) and temporal (climatic, remote sensing) datasets in relation to mosquito abundance data (from Iowa State Medical Entomology Laboratory) and WNV incidence data (from Iowa Department of Public Health).
5. Develop a spatio-temporal predictive model of WNV dynamics at a regional or state level.

Methods

A wide range of spatial datasets have been compiled for Black Hawk County Iowa including soils, land cover, elevation, roads, rivers, water bodies, wetlands, mosquito control treatment locations, floodplain, remote sensing (Normalized Difference Vegetation Index), and census population data. Spatial processing was carried out to organize spatial attributes in relation to mosquito sampling locations from an extensive mosquito sampling project carried out by the

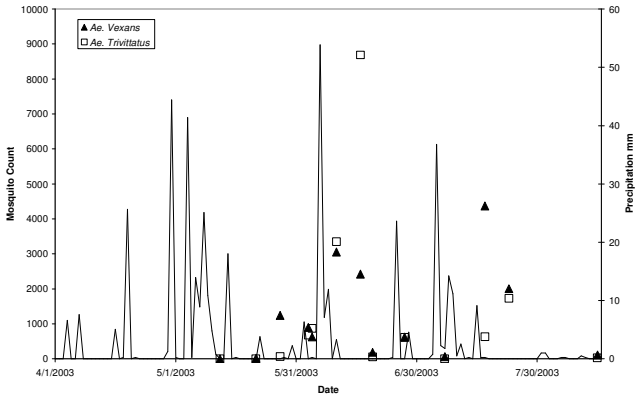
University of Northern Iowa (UNI) Biology Department in 2003. In addition climatic data on a daily basis was compiled for 2003 from a local weather station. The spatial and climatic data were statistically compared to individual mosquito species collection counts to discern landscape and climatic influences. Presence in floodplain, soil attributes indicating wetter soils, deciduous forest land cover, and proximity to wetlands were all shown to be positively correlated with the two most prominent mosquito species. Temperature and precipitation have also been shown to exert control over the mosquito counts. This work has been described in a paper that was submitted to the Journal of Medical Entomology and that is under revision presently.

We are presently developing an ArcGIS based set of tools which will provide a flexible framework for users to indicate landscape (spatial) and climatic (temporal) datasets in order to develop mosquito abundance risk surfaces for a given time period. The tools or model will utilize user's expert knowledge for weighting and ranking of landscape and climatic datasets. The model will use these rankings and weightings in map algebra and neighborhood (focal) statistics procedures to develop risk surfaces. This modeling framework will be tested against mosquito collection data from 2003 in Buchanan County and 2006 in Black Hawk County. This set of ArcGIS tools will be made publicly available.

Finally we are compiling data on mosquito collections and WNV incidence throughout the state of Iowa. We are working with Iowa State University (ISU) Medical Entomology Laboratory to standardize their historical mosquito collection data into a central database and to provide custom software for entering and querying data from this database. We are also working with Iowa Department of Public Health to acquire the best available data on WNV incidence in the state of Iowa. In the future we will analyze the mosquito and WNV incidence data in relation to landscape and climatic data to try and discern useful spatial and temporal dynamics. We will attempt to build what is learned into a set of ArcGIS modeling tools for predicting WNV incidence at a state level.

Expected Products

1. Useful analysis and description of landscape and climatic influence of individual mosquito species at a local level in Black Hawk County (publication in peer-reviewed journal).



Precipitation data in Black Hawk County 2003 compared to *Aedes Trivittatus* and *Vexans* mosquito counts.

2. A freely available set of ArcGIS based tools for modeling risk surfaces of mosquito abundances.

3. A useful study analyzing the use of the tools mentioned above in relation to mosquito collection data from two Eastern Iowa counties (expected publication).

4. A centralized database of mosquito collection records and a custom software tool with querying and reporting functionality for use by researchers at UNI and ISU.

5. Useful analysis and description of landscape and climatic influences on state-level mosquito abundance and WNV incidence (expected publication).

6. Development of a set of ArcGIS based modeling tools for WNV incidence at state level.

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