Report for 2003IA40B: Water Quality, Nutrient Loading and Mosquito Production in Northeastern Iowa

There are no reported publications resulting from this project.

Report Follows

Water Quality, Nutrient Loading and Mosquito Production in Northeastern Iowa

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Problem and Research Objectives

The influences of agricultural chemicals and human activities upon Iowa's water bodies may produce unexpected consequences. One possible outcome is the increase in mosquito production and associated risks of disease transmission. Higher levels of nutrients in water bodies may directly or indirectly augment mosquito populations if larvae feed upon nutrients or bacteria that result from runoff. Our objectives include assessment of water properties in a wide variety of natural and artificial pools and containers with an attempt to explain mosquito production. We will construct predictive models that will estimate the risks of disease transmission by mosquitoes, especially in relationship to human populations and activities.

Methodology

We conducted field surveys of putative mosquito developmental sites for correlation with biological (i.e., dead organic matter, total heterotrophic bacterial, plant and animal populations), chemical (i.e., pH, dissolved nutrients, electrical conductivity, and total alkalinity), and physical (i.e., depth, turbidity, and dissolved oxygen) properties of water bodies to identify characteristics that correlated with mosquito production. We conducted mosquito adult trapping in representative habitat types throughout Black Hawk and Buchanan Counties, Iowa. Ground-generated data are being incorporated into a Geographic Information Systems (GIS) model (ArcGIS v8.1 Mapping Software) together with land feature (i.e., soil types, land cover, land usage) and human demographic data. Using on-the-ground and remote sensing procedures, we are building a predictive model that will estimate mosquito production and the associated risks of disease transmission in Black Hawk County. We will verify our model using data from neighboring Buchanan County. We are paying particular attention to human activity and land use patterns in constructing our model.

Principal Findings and Significance

During the period of the grant, we sampled >350 putative larval developmental sites and trapped >16,000 adult mosquitoes. Although mosquito identification and data analysis are now nearing completion, to date we have demonstrated that mosquito numbers were significantly correlated with bacterial and dissolved phosphate concentrations in putative developmental sites. Using all field variables measured, we were able to explain 86% of mosquito production from sample sites in a multiple regression model. Our GIS model was able to identify urban and rural regions of risk, especially for West Nile virus transmission to older residents of Black Hawk County.

Data were complete enough to characterize mosquito production from Beaver Valley Wetlands, a reconstructed palustrine wetland in Black Hawk County that is managed by the Black Hawk County Conservation Board. Likewise, we were able to account for 70%

of mosquito production from this wetland during the study. We identified 10 mosquito species emerging from Beaver Valley Wetlands. These species ranged from probable vectors to species that rarely bite humans. The majority of mosquitoes and the greatest risk of disease transmission were associated with several temporary pools. In our manuscript we suggest that although relatively few mosquitoes were produced by the wetland, spot treatment using *Bacillus thuringiensis* var. *israelensis* might significantly reduce mosquito production while not affecting wetland services or non-target species. Furthermore, we suggest that remote sensing might be useful in identifying problematic microhabitat types and sources of nutrients that would affect the wetlands. This manuscript will be submitted for publication within the next few days.

Finally, during the funding period, we were able to compare dissolved nitrate and dissolved phosphate chemical titration strips used in field studies with standard laboratory protocols. We determined that the nitrate test strips were reliable for field assessment of nutrients in mosquito developmental sites whereas phosphate test strips were not reliable for limited sampling. A student (supported by ISWRRI funds) and I are developing this manuscript for publication.