Microclimate effects on *Aedes albopictus* mosquitoes

Taylor McClanahan[1], Cristina Huertas-Diaz[2], and Courtney Murdock[3]

[1]Univ. of Arkansas at Little Rock; [2]Department of Infectious Diseases, College of Veterinary Medicine, University of Georgia, [3]Odum School of Ecology, University of Georgia

INTRODUCTION

Aedes albopictus (Asian tiger mosquito), a mosquito native to East Asia, has became widespread in several North American countries, especially the United States.

Fig 1: Male *Aedes albopitcus*

Ae. albopictus is a known vector of Chikungunya and dengue virus, as well as many other arboviruses. Consequently, this mosquito vector is a public health risk.

Temperature plays an important environmental role in the distribution of vector-borne diseases.

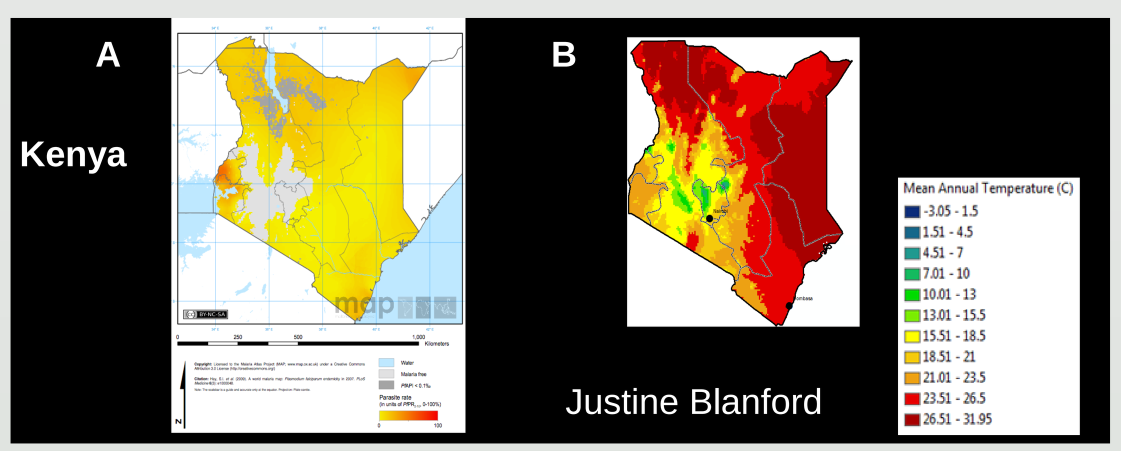


Fig 2: Map A represents the distribution of malaria incidence throughout Kenya. Map B illustrates the mean annual temperature corresponding with malaria incidence.

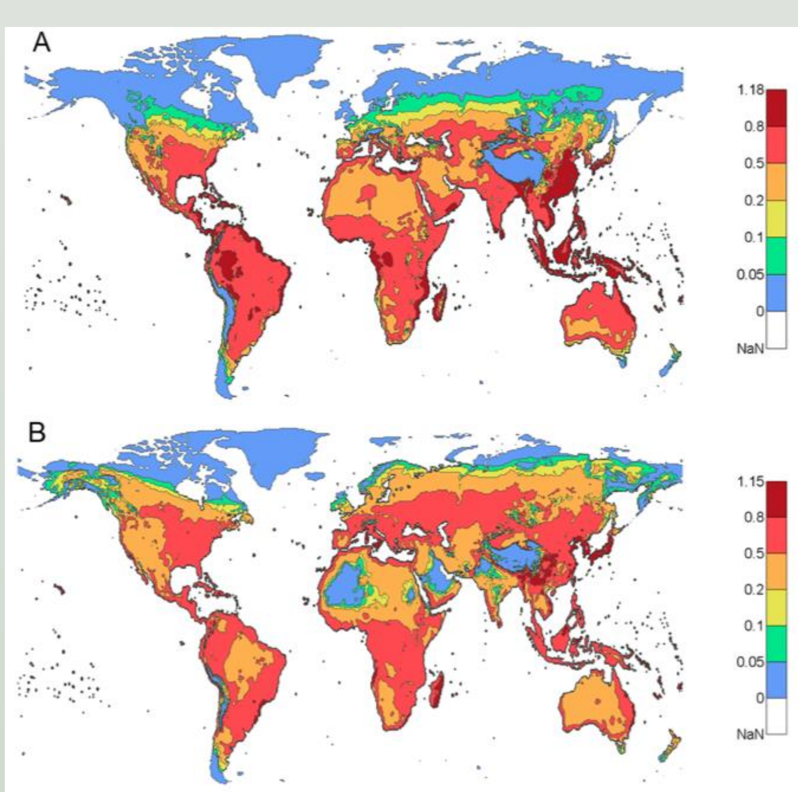


Fig 3: These maps represent the global distribution of dengue epidemic potential. Map A represents the present-day (1980-2009) and map B represents the future (2070-2099).

Researchers create models using global temperature data to predict disease potential.

This global temperature data may not directly reflect relevant mosquito microclimates.

This experiment evaluated if microclimate varied, and the implications for mosquito emergence.

HYPOTHESES

H_1: Microclimate will vary across urban, suburban, and rural environments.

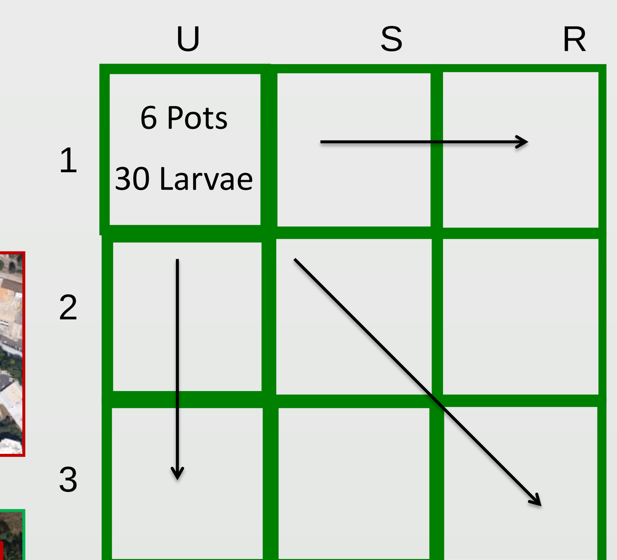
H_2: Weather station data will be different from relative microclimate.

H_3: Microclimate variation will affect mosquito transmission traits.

EXPERIMENTAL DESIGN

An impervious surface map was used to determine which areas were considered urban, suburban, and rural in Athens, Georgia. At each of these nine locations, six pots were placed in a specified 30m by 30m area.

Fig 4: Map of Athens-Clarke County showing impervious surface. Red boxes indicate the locations of nine sites.



A logger was placed inside and outside of the pot to represent typical microclimate conditions of the larval and adult environment.

Pots filled with 200 ml leaf infusion and 30 *Ae. albopictus* larvae were placed across each site in full shade. All pots were checked daily for emerging adults. Any adults present were counted and removed.

1 2 3 4 5

Fig 5:
1. Data loggers
2. Pot Set-up
3. Larvae in pot
4. Adult mosquitoes
5. Transfer tubes

RESULTS

H_1: Effects of land use on mosquito microclimate

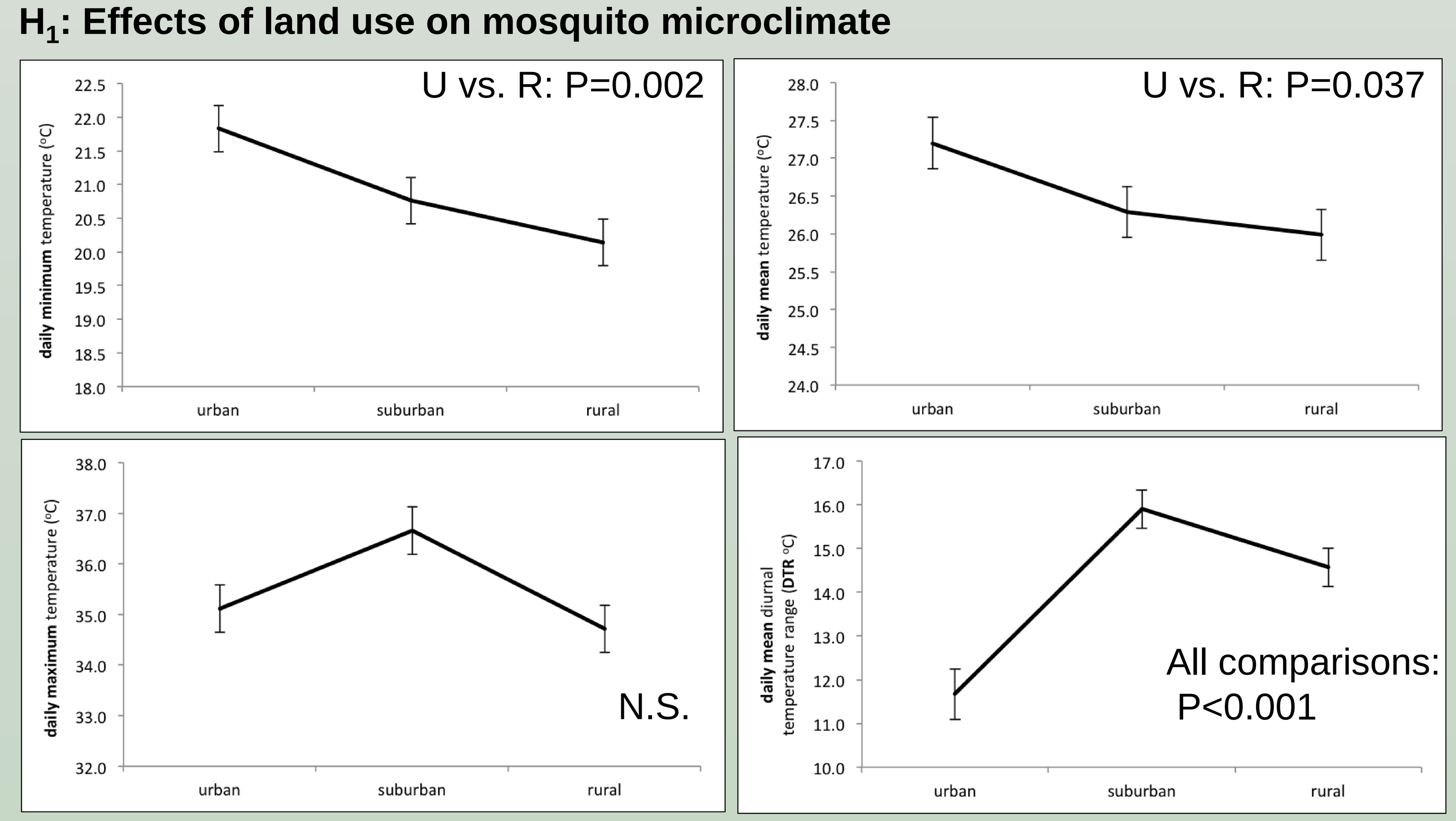


Fig 6: A generalized mixed effects model was ran to assess how daily minimum, mean, and maximum temperatures, as well as DTR, varies with urban, suburban, and rural land uses. Land use class was included as a fixed factor and site as a random factor in this analysis.

RESULTS AND DISCUSSION

Urban land uses have warmer mean and min. temperatures and smaller DTR, potentially due to the amount of impervious surface.

Suburban land uses display the highest DTR, potentially due to the amount of tree canopy.

Rural land uses have the lowest max., mean, and min. temperatures, potentially due to the amount of vegetation.

H_2: Weather station data vs. relative temperature data

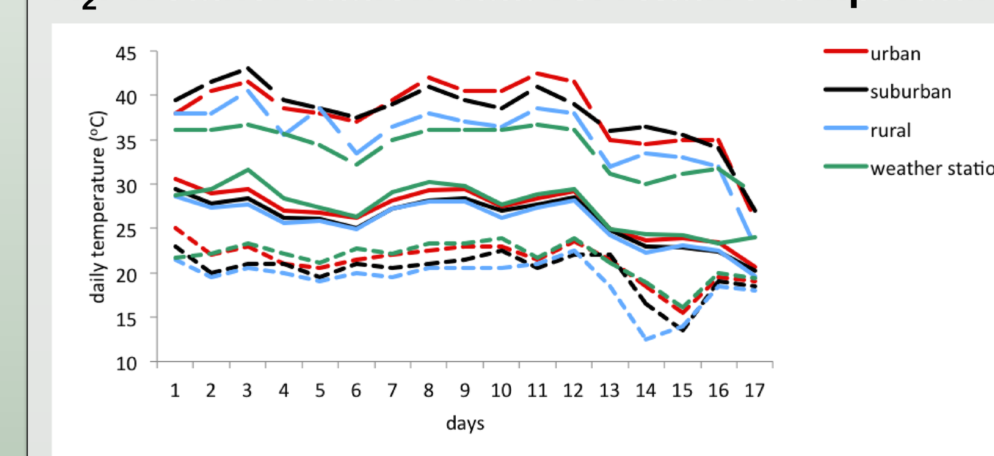


Fig 7: A graph comparing weather station temperature data to the data collected from the loggers.

- Daily mean, min. and max. temperatures reflected by solid, dotted, and dashed lines, respectively
- Weather station mean and min. temperatures are highest
- Weather station max. temperatures are lowest

H_3: Temperature effects on mosquito emergence

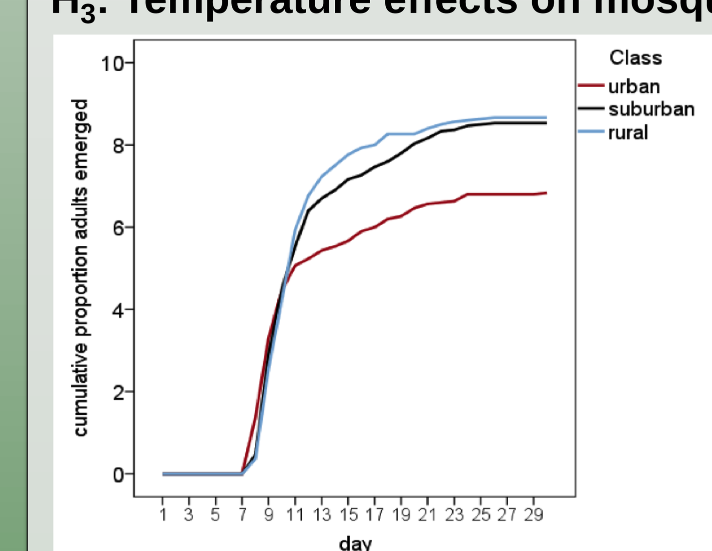


Fig 8: This graph illustrates the proportion of mosquito emergence.

- Mosquitoes from urban land uses were the first to stop emerging.
- Mosquitoes from suburban and rural land uses behaved similarly.
- The rate of emergence was similar across all land uses.

FUTURE WORK

- Wing size → Body size
- Compare seasons
- Calculate population growth rate
- Measure vectorial capacity
- Sex ratio
- Larval vs. adult environments
- Use field derived larvae

ACKNOWLEDGEMENTS

THE UGA COLLEGE OF VETERINARY MEDICINE Department of Infectious Diseases

National Science Foundation
Odum School of Ecology
Department of Infectious Diseases

Dr. John Drake
Dr. Courtney Murdock
Cristina Huertas-Diaz