

Spatial Analysis of Environmental Predictors for Tick-borne Disease in the Middle Atlantic Region, USA

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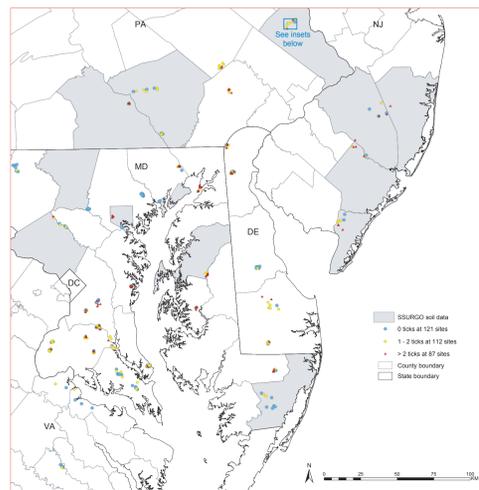
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INTRODUCTION

- 663 adult *I. scapularis* ticks from 320 transects over a 66,400 square kilometer area spanning five states in the Middle Atlantic region.
- Tick abundance patterns were found to be highly clustered, with relatively high numbers along the coastal plain of the Chesapeake Bay, decreasing to the west and south.
- Poisson regression analysis revealed statistically significant associations between tick abundance and the following environmental covariates: land cover, distance to water, distance to forest, elevation, and soil type.



STATSGO (1:250,000) all sites available
SSURGO (1:24,000) more comprehensive attributes but only for limited number of sites

METHODS

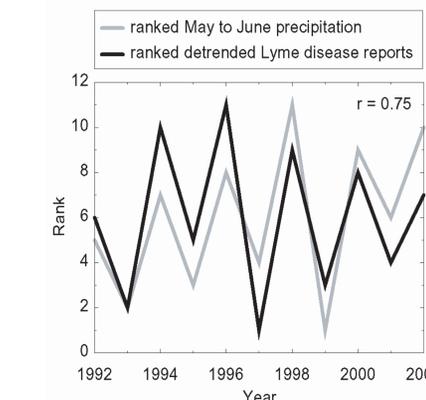
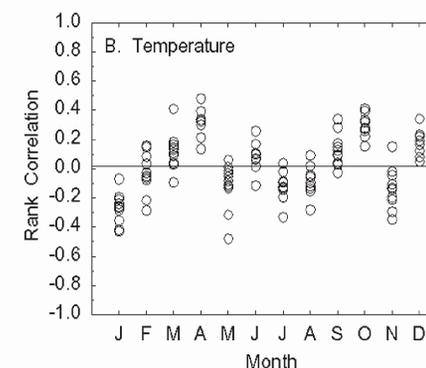
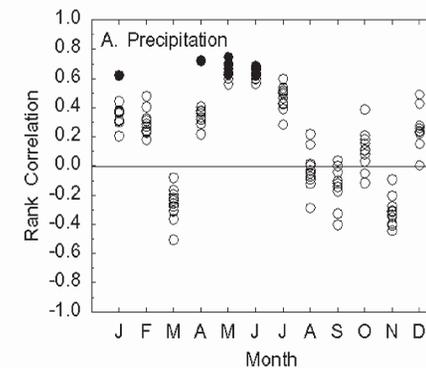
- Adult ticks collected in late autumn/early winter
- DNA fingerprinting to determine infection prevalence
- environmental covariates tested for predictive value
- human case reports compared to climate data



Flagging technique used to collect adult ticks.



Infection prevalence of *Borrelia burgdorferi* (Lyme disease agent) in *Ixodes scapularis* ticks found to be 17.6% (117 / 663)



Precipitation but not temperature is correlated with Lyme disease.

CONCLUSION

Must incorporate climate regime information to accurately predict tick habitat suitability for given soil type. Precipitation has more significant effect than temperature (in Middle Atlantic region).

FUTURE DIRECTIONS

- Obtain additional digital SSURGO data (USDA-NRCS) and run Poisson regression model.
- Design laboratory and field experiments to elucidate biological explanations for the observed impact of soil on tick distribution patterns, such as via egg development.

FOR MORE INFORMATION

- http://energy.er.usgs.gov/projects/Medical_Geology/ixode_article.pdf (Geographic Information Systems and Spatial Analysis of Adult *Ixodes scapularis* (Acari: Ixodidae) in the Middle Atlantic Region of the U.S.A.).
- McCabe, G. J. and Bunnell, J. E., 2004, Precipitation and the Occurrence of Lyme Disease in the Northeastern United States, *Vector-Borne and Zoonotic Diseases*, vol. 4, no. 2.
- Das A, S.R. Lele, G. E. Glass, T. Shields, J. Patz (2002) Modeling a Discrete Spatial Response using Generalized Linear Mixed Models: Application to Lyme Disease Vectors. *International Journal of Geographical Information Science*, 16 (2): 151-166.

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