Does urbanization play a big role in the rapid increase of Lyme disease cases?

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Ticks and Lyme disease
What is Lyme disease?

• A tick-borne disease caused by the spirochete bacterium, *Borrelia burgdorferi*.

• Transmitted through the bite of infected black-legged ticks.

• Symptoms include fever, headache, fatigue, and skin rash (erythema migrans). Cause joints, the heart, and nervous system problems.

• The most common vector-borne disease in U.S.A.
Tick vector life cycle and transmission

An inherent cycle, pathogens, vectors and reservoir hosts must coincidence.
Data Sources

- **Human reported LD cases** (1997-2014) from the Centers for Disease Control and Prevention (CDC) http://www.cdc.gov/


- **Demographic and Socioeconomic data** from the U.S. Census Bureau https://www.census.gov
Reported Cases of human Lyme Disease in U.S. 2000-2014

- Total cases reported from 2000-2014: 407,799
- The most severe public health problem in the United States, more than 30,000 new cases reported annually
- The increasing vector-borne disease, an increase of more than two times during the five-year period from 1992-1996 were 59,363 and that from 2007-2011 were 133,249.
Lyme disease human risk maps

- Uneven distribution, 96% of Lyme disease cases were reported in the Northeast and Upper Midwest in 2014.
The northeastern United States was the worst-hit areas, with 352,125 reported cases from 1997 - 2014, accounting for 85.81% cases of the United States.
Spatial patterns of Lyme disease

Aggregated distribution and sprawled expansion along the I-95 corridor.
Regional difference of human Lyme disease

- The dramatic contrast in the cases of Lyme disease between the rapid urbanizing counties and the mature urban area.

Baltimore and Howard counties of around Baltimore city all record more than 10 times increase in the human LD cases during the same period, while in Baltimore city a mature metro city (92.72% developed land), only had little increase.
Social-economic factors analysis

Clustered high-risk disease occurs in the areas with the dense population, rapid urbanization, higher income and distance closer to metro cities.
Summary

• The emergence and spread of tick-borne disease is a increasing serious threat.

• Humans are not separate from the natural ecosystem. Residential variations and sprawling suburbs have consequences for the spread of Lyme disease.

• Understanding cycle of ecology and transmission mechanism of Lyme disease to better prevent disease.

• Providing the theoretical base to planning commission to consider reasonably regional and community development.
OGC can play a role in developing interoperability standards to address the geospatial application in the public health

- Land use/cover classification schema that are suitable for public health application
- The current data of LD cases are reported at county levels
  - Lack of spatial details for analyzing the environmental impacts on the LD cases
  - How to provide more spatial/temporal details while preserve the patient privacy is an issue that OGC may provide solutions.