Spatial clustering of *Aedes aegypti* in coastal Ecuador

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Dengue

- Dengue is a viral infection caused by any of 4 viruses transmitted mostly by the *Aedes aegypti* mosquito (also called *yellow fever mosquito*).
- Transmittal of the disease to humans occurs through the bite of an infected adult female *Aedes aegypti* mosquito.
- *Aedes aegypti* live in tropical and subtropical areas of the world, and breed in areas of stagnant water (e.g. flower vases, uncovered barrels, buckets, discarded tires, etc.).
- Dengue fever is mostly prevalent in some Asian and Latin American countries where it is the leading cause of illness and death among children. Its prevalence in Latin and Caribbean countries has increased rapidly in the most recent years.
Dengue

- Symptoms of dengue fever include: fever, headaches, muscle, bone and joint pain, and widespread rash.
- Usually, the symptoms last for 2-7 days, with an incubation period of 4-10 days.
- No specific treatment for dengue and no commercial vaccine is available: preventative disease control depends mostly on mosquito management.
- Long-term disease management requires an understanding of the dynamics and spatial patterns of this mosquito.

Scientific question of interest

- We want to understand how important is the participation of community members in minimizing mosquito breeding.
- In particular:
  - Is the presence of *Aedes aegypti* mosquitoes in a household influenced by environments in neighboring households?
Data

• Data was collected at 199 randomly sampled houses located in the city of Borbón.
• Borbón spans a geographic area of 1.3 km² with ~ 5,000 residents living in 1,175 houses.
• Household surveys occurred during the week of May 20-27, 2010.

For each sampled house located at site \( s_i = (\text{lat}_i, \text{lon}_i) \), \( i = 1, \ldots, 199 \), we have information on:

• \( Y(s_i) \): a **binary** variable indicating whether at least one adult female *Aedes aegypti* mosquito was found at location \( s_i \) during the week of May 20-27, 2010 (1: yes; 0: no);

Given that we know house locations, we could create variables such as:

• \( X_1(s_i) \): the number of sampled houses **within** a 10 meter distance from \( s_i \) that were found to have at least one adult female *Aedes aegypti* mosquito;

• \( X_2(s_i) \): the number of sampled houses **within** a 10-20 meter distance from \( s_i \) that were found to have at least one adult female *Aedes aegypti* mosquito;

• ...

• \( X_{10}(s_i) \): analogous definition to \( X_1(s_i) \), but **within** a 90-100 meter distance from \( s_i \).
Data

- From $X_1(s_i), \ldots, X_{10}(s_i)$ we can generate, for $k = 1, \ldots, 10$ new covariates $Z_k(s_i) = \sum_{i=1}^{k} X_i(s_i)$ which report the number of houses in a $(10 \times k)$-meter radius from $s_i$ that were found to have at least one adult female *Aedes aegypti*.

- $s_i$: 5-point grey star
- $Y(s_i) = 1$ (filled symbols indicate presence of adult female *Aedes aegypti* mosquito at the location in consideration)
- $X_1(s_i) = Z_1(s_i) = 1$
- $X_2(s_i) = 2; Z_2(s_i) = 3$

Goals of the project

- We would like to understand:
  1. whether the presence of adult female *Aedes aegypti* mosquitoes in neighboring houses is significantly associated with an increase in the odds of having adult female *Aedes aegypti* mosquitoes in the house, accounting for spatial correlation in the data;
  2. whether there is a maximum distance upon which presence of mosquitoes in neighboring homes is not associated with the odds of having adult female *Aedes aegypti* mosquitoes in the house; and
  3. whether the spatial clustering of adult female *Aedes aegypti* mosquitoes is completely explained by characteristics of the neighboring homes.