

# The Mansueto Institute Lunch Colloquium Series

## Human Density at High Spatial Resolution is Key to Dengue Transmission within Urban Landscapes

**Victoria Romeo Aznar**

Institute Postdoctoral Fellow & Evolution and Ecology  
Postdoctoral Scholar



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**Zoom**  
**12:00 - 1:00pm CST**

Throughout history, infectious diseases have threatened populations' health and countries' economies. Nowadays, climate change, globalization, and rapid population growth are accelerating the spread of infectious diseases and pushing their geographic boundaries, as well as facilitating the global emergence of new pathogens. Although traditional 'well-mixed' models have contributed significantly to our understanding of conditions promoting the occurrence of epidemics, they are unable to properly capture the dynamics of infectious diseases in both space and time. In particular, it has become critical to better understand the transmission process at higher spatial resolutions than those of country or city levels, to enhance prediction of epidemics and the efficiency of control efforts, especially under limited resources.

In this talk, I discuss the key role played by human density in dengue transmission at the fine spatial scales of heterogeneous urban landscapes. Dengue increasingly affects a large fraction of the global population as it expands its areas of influence. Urban settings are key to maintaining dengue virus transmission and are increasingly complex given their heterogeneity in environmental, demographic, and socioeconomic conditions. In particular, human density within cities exhibits pronounced variation, and is a fundamental but neglected axis along which transmission of the disease must be better understood. Because humans are the main producers of breeding sites for the mosquito vector *Aedes aegypti*, I first show that their spatial distribution together with socioeconomic factors affects the emerging temporal patterns of incidence at coarse levels, and acts as a major driver of dengue risk at fine scales, in the city of Delhi. Because human density is related to human movement, I then show that it strongly affects the stochastic spread of dengue within the city of Rio de Janeiro at the fine scales of census track. Importantly, aggregation of spatial units according to human density produces clear, distinct temporal patterns of incidence, independent from the scale of aggregation. In contrast, standard aggregation based on contiguous space, such as neighborhoods and administrative areas, fails to exhibit any consistent pattern. An explanation for this intriguing pattern suggests a novel metapopulation model for the population dynamics of the disease.