“Mathematics for integrating ecological, epidemiological and environmental data to inform vector-borne disease propagation patterns”
Jianhong Wu, Laboratory for Industrial and Applied Mathematics, York University

Vector-borne diseases such as Lyme disease, Dengue fever and Zika virus have imposed significant challenges for public health decision support systems. Modern technologies and increasing global interdisciplinary collaborations have promised rich sources of data about vector and host ecology, pathogen epidemiology and environmental conditions, so it is imperative to have fundamental (mathematical and computational) frameworks which integrate data from all different sources in order to provide summative prediction of spatiotemporal patterns of disease spread and evaluation of intervention strategies. Here we use Lyme disease as a case study to show how clinical, laboratory, field observation and surveillance data along with remote sensor and GIS information can be integrated through a structured (hyperbolic or delay differential equation) epidemiological model to produce infection risk maps using the classical Floquet theory. We will also show how to incorporate climate change induced (vector) biological invasion into a typical reaction-diffusion epidemic model, and present some recent results about the spatiotemporal patterns of these reaction diffusion equations in an wave-like environment. (Host: Mac Hyman, Dept. of Mathematics, Tulane University)

Bio: Professor Jianhong Wu is recognized for his expertise and contribution in nonlinear dynamics and delay differential equations; neural networks and pattern recognition; mathematical ecology and epidemiology; big data analytics. He the founding Director of the Laboratory for Industrial and Applied Mathematics at York University, an editor-in-chief of the journal Infectious Disease Modelling, the Director of the Advanced Disaster, Emergency and Rapid Response Simulations (ADERSIM). He received the Canadian Applied and Industrial Mathematical Society's Research Prize, for his "very significant contributions in the area of infinite dimensional differential equations with applications to neural networks and population dynamics".
http://liam.lab.yorku.ca/liam-research-team-leader/
https://scholar.google.com/citations?user=Ox-xAulAAAAJ&hl=en