

Title and Abstract for “Models and Methodological Problems of Botanical Epidemiology”: Workshop at Rutgers Mar 16-18 2009.

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The interaction of the spatio-temporal heterogeneity of inoculum release and host susceptibility.

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Plant disease epidemics involve the cyclic process of infection, symptom development, propagule production, propagule dispersal and host re-infection. A critical factor in this process is the rate at which infective spores are transported from a source of spores to susceptible plant tissue. Pathogen biology and ambient weather conditions determine the rates of spore production and release at the source. However, the number of spores which are successful in producing a new infection is controlled by three additional factors:

- 1) Not all propagules released at the source fall on plant tissue, and the fraction that land on host tissue changes as the plants grow.
- 2) Not all host tissue is susceptible to infection. The susceptibility of plant tissue to infection is often a function of age and reproductive stage and its physical location changes with time as the plant grows.
- 3) Not all propagules which land on susceptible tissue will infect. Spore survival, germination and successful infection are all critically dependent on UV light levels and ambient weather conditions (temperature, relative humidity, and the availability of free water).

The entire process is episodic in time and aggregated in space. Source and target tissue are separated in space, and the relative length scales of the spore dispersal function and the source-target separation become important.

The above ideas are formalized in a mathematical model using a contact distribution dependent on the vector displacement between source and target to calculate transport probabilities. Some of the ramifications of the resulting model will be illustrated using grape powdery mildew, apple scab and the soybean rust/kudzu complex as examples.