Geographic Surveillance and Hotspot Detection for Homeland Security: Crop Pathogens and Bioterrorism

Short Description	Disruption of American agriculture and our food system could be catastrophic to the nation's stability. This project has the specific aim of developing novel remote sensing methods and statistical tools for the early detection of crop bioterrorism.
Full Description	American agriculture is a widely dispersed enterprise crossing the entire continent. Its impact on our country ranges from supplying the food for all our tables, to employing 16% of our workforce in Ag-related enterprises, to producing more than 25% of our export value, and generating 16% of the US GDP. Disruption of agriculture and the food system could be catastrophic to the nationÃƒÂ¢Ã‚Â€Ã‚Â™s stability. A wise enemy, familiar with the epidemiology of plant pests, could easily and quickly cause huge disruptions with virtually undetectable quantities of microbial pathogens. Congressional testimony has pointed to the high probability that crop bioterrorism could and would occur. This project has the specific aim of developing novel remote sensing methods for the detection of crop bioterrorism. A cross disciplinary team has been assembled from Penn State University to address this problem. The team is formed of members with extensive experience in plant pathology, entomology, biology, computer science, electrical engineering, environmental and ecological statistics. The objective is to utilize hyperspectral sensing technology as a coarse detection system to optimize time and resources of ground-based teams that monitor the US agriculture and forest lands with real-time PCR, and sentinel plant technologies. The research thrust is a four-pronged approach consisting of: (i) Development of signatures for key pathogens using ground-based, portable hyperspectral cameras; (ii) Development of a Photo-Florescence mapping operator that will create a deformable spectral signature mapping based on the biophysical and biochemical interactions of the plant with the pathogen; (iii) Confirmation of signatures developed in (i) under field conditions utilizing an airborne hyperspectral imaging platform; and (iv) Development of scan statistic algorithms for real-time detection of hotspots (anomalous patterns) in the remotely sensed imagery.
Strategic Cycle Elements	Prevention Crisis Management
Project URL	http://www.stat.psu.edu/~gpp/PDFfiles/Prospectus%2016%20overview.pdf http://www.stat.psu.edu/~gpp/PDFfiles/Prospectus%2016.pdf
Sponsor	NSF Digital Government Program, EPA STAR Grant Program
Keywords	Agricultural bioterrorism, pathogen spectral signatures, remote sensing, scan statistical methods