

## ABSTRACT/RTI SYMPOSIUM ON HOMELAND SECURITY

### Biosurveillance Geoinformatics of Hotspot Detection and Prioritization for Biosecurity

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Geoinformatic surveillance for spatial and temporal hotspot detection and prioritization is a critical need for the 21<sup>st</sup> century. A hotspot can mean an unusual phenomenon, anomaly, aberration, outbreak, elevated cluster, or critical area. The declared need may be for monitoring, etiology, management, or early warning. The responsible factors may be natural, accidental or intentional, with relevance to both infrastructure and homeland security.

This presentation describes a multi-disciplinary research project based on novel methods and tools for hotspot detection and prioritization, driven by a wide variety of case studies of potential interest to several agencies. These case studies deal with critical societal issues, such as carbon budgets, water resources, ecosystem health, public health, drinking water distribution system, persistent poverty, environmental justice, crop pathogens, invasive species, biosecurity, biosurveillance, remote sensor networks, early warning and homeland security.

Our methodology involves an innovation of the popular circle-based spatial scan statistic methodology. In particular, it employs the notion of an upper level set and is accordingly called the *upper level set scan statistic system*, pointing to the next generation of a sophisticated analytical and computational system, effective for the detection of arbitrarily shaped hotspots along spatio-temporal dimensions. We also propose a novel prioritization scheme based on multiple indicator and stakeholder criteria without having to integrate indicators into an index, using Hasse diagrams and partially ordered sets. It is accordingly called *poset prioritization and ranking system*.

We propose a cross-disciplinary collaboration to design and build the prototype system for surveillance infrastructure of hotspot detection and prioritization. The methodological toolbox and the software toolkit developed will support and leverage core missions of several agencies as well as their interactive counterparts in the society. The research advances in the allied sciences and technologies necessary to make such a system work are the thrust of this five year project.

The project will have a dual disciplinary and cross-disciplinary thrust. Dialogues and discussions will be particularly welcome, leading potentially to well considered synergistic case studies. The collaborative case studies are expected to be conceptual, structural, methodological, computational, applicational, developmental, refinements, validation, and/or visualization in their individual thrust.