Homeland Security

Science and Technology

Criticality Spatial Analysis (CRISTAL) Program

A DHS Science and Technology Center of Excellence Solution

Supply Chain Vulnerability

Essential supplies such as food, water, and gasoline travel through complex supply chains to reach communities. One disruptive event can upset multiple critical supply chains, impacting communities, businesses and individuals. The food software analytics market is valued at approximately $1.7B annually as food companies continuously try to understand their supply chains and threats to them.

The Need

To help mitigate the interruption of lifeline supply chains, researchers at a Department of Homeland Security Science and Technology Directorate Center of Excellence, the **Food Protection and Defense Institute (FPDI)**, are developing new ways of identifying and understanding how and where supply chains are vulnerable to disruptions. As part of this work, research teams are also finding methods to document and assess the components of food supply chains – something that could also help meet goals of the Food Safety Modernization Act.

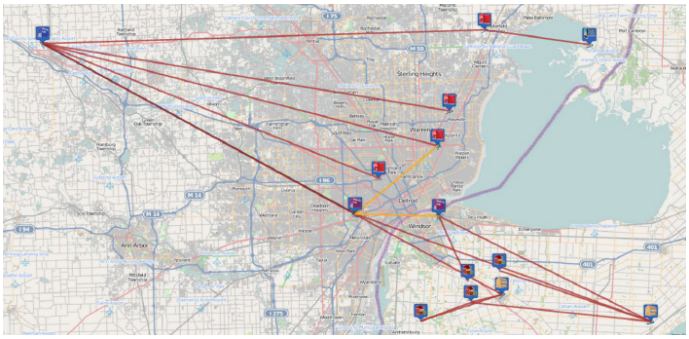
FPDI has developed an early prototype software tool for supply chain mapping, vulnerability assessments and analysis called **Criticality Spatial Analysis (CRISTAL)**. Through CRISTAL, FPDI aims to develop a new capability to: (1) define and document food critical infrastructure, and (2) assess risk in the global food supply chain.

Strengthening Systems and Reducing Costs

When further developed, CRISTAL may enable privately owned food companies to:

- Map supply chain components, including production, processing and distribution nodes and transportation links;
- Trace food products across companies and subsidiaries from farm to fork;
- Identify interdependent systems;
- Manage specific locations and facilities for potential hazards; and
- Mitigate risks to facilities and systems in advance.

These types of capabilities could help industry and government increase the overall security of supply chains, mitigate the length and extent of disruptions or better respond to foodborne illnesses.



CRISTAL System Map converts the diagram's geospatial information to a map with color coding for the types of nodes and transportation. The map integrates other geospatial data, such as hazard areas or flood plains, to display a risk profile for each location.

Current Status

To date, researchers at FPDI have developed:

- A method to collect food system data manually;
- A method to quantify risk spatially;
- A prototype to demonstrate and display food supply chains and preliminary risk scores; and
- An algorithm to assess critical nodes and risks.

Next Steps: Moving Toward Availability

Private food companies have engaged with FPDI to help identify challenges and inform data collection methods. In 2015, three privately owned food companies beta-tested the prototype. Their feedback informed spiral development and tool refinement in future research.

University of Minnestoa (UMN) submitted a patent application on the technology and will license copyrights and trade secrets to a transition partner.

UMN is supporting market analysis, transition process selection, and commercialization.

*To learn more about CRISTAL or FPDI, contact the DHS S&T Office of University Programs at **universityprograms@hq.dhs.gov.***