DHS Science and Technology Directorate

Foreign Animal Disease Modeling

Foreign animal disease response efforts require further analysis

Swift and often lethal, foreign animal diseases (FAD) can destroy a livestock population if not handled correctly. Animal health responders, analysts and decision-makers at federal, state and local levels are searching for better ways to plan for and respond to FAD outbreaks.

S&T is leading several FAD research projects

The FAD program encompasses several basic and applied research projects conducted in concert with interagency partners. These projects aim to create state-of-the-art, next-generation FAD modeling and analysis tools to support strategic and response planning; capture lessons learned from infectious disease modeling and advances in mathematical biology and train the next generation of experts in FAD modeling techniques.

The FAD Modeling program sponsors the following research efforts:

Research and Policy for Infectious Disease Dynamics (RAPIDD): the Department of Homeland Security Science and Technology Directorate (S&T) is collaborating with the National Institutes of Health's Fogarty International Center to enhance national expertise and capabilities in infectious disease (e.g., livestock and wildlife diseases, vector-borne and zoonotic diseases) modeling. The project is training the next generation of experts on how to use available data (rather than be limited by data gaps) and simpler, data-validated models (fewer parameters, modular, extensible and reusable) to respond to FADs. RAPIDD is working with national and international experts to develop case studies on priority topics and diseases and to recruit and train a cadre of postdoctoral fellows.

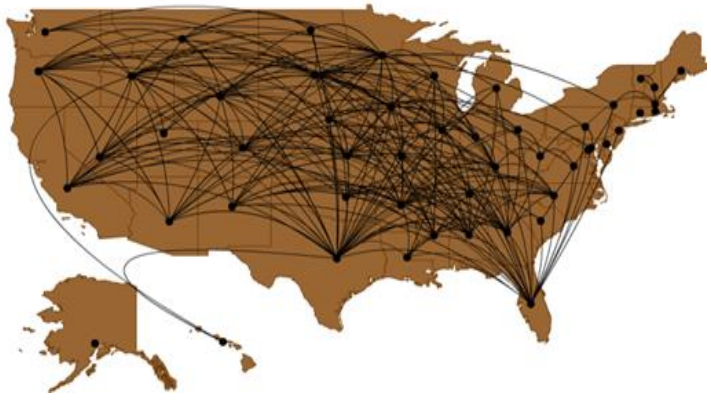
National Institute for Mathematical and Biological Synthesis: S&T, National Science Foundation and the Department of Agriculture (USDA) are combining mathematics and biology principles to address complex problems that operate at multiple spatial (local, regional, national), temporal (different seasons) and hierarchical (leaves vs. plants) scales, including mathematical and epidemiological modeling of infectious disease.

Applied research projects focused on critical knowledge and capability gaps: S&T has several applied research projects that are addressing major capability gaps (e.g., lack of national-scale FAD models, lack of efficient regional-scale simulation capability). Efforts have already resulted in the development of the following modeling tools and knowledge products, which S&T is transitioning to the customer (USDA):

- A regional-scale FAD modeling tool enhanced using cloud computing techniques and hardware is expected to greatly reduce the execution time of the FAD scenarios (Colorado State University [CSU])
- A prototype network model for the inter-state cattle movement is expected to be the basis for a national-scale FAD spread model (CSU, University of Warwick-UK; University of Linkoping, Sweden)
- A conceptual model for the Feral Swine population, developed using GPS based movement data collected in California, is expected to be the basis for wildlife FAD models (University of California, Davis).

Future efforts include:

- Analytical frameworks for infectious disease dynamics (USDA Agriculture Research Service, Cornell University);
- National-scale modeling tools for livestock FAD spread and control; and real-time analysis tools for such spread scenarios (Colorado State University).



RAPIDD image: Cattle contact network based on health certificate data (Source: RAPIDD fellow, now member of the faculty at Georgetown University)

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To learn more about Foreign Animal Disease Modeling, contact SandT-Chembio@hq.dhs.gov.

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