Pathways Assessment Mapping Tool Aids in Risk Analysis

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The Veterinary Services (VS) Centers for Epidemiology and Animal Health (CEAH) Center for Animal Disease Information and Analysis (CADIA) has developed a pathways assessment and mapping tool (PAMT), which will facilitate a pathways analysis for risk assessment.

A pathways analysis is a systematic assessment of the ways in which a foreign animal disease (FAD) agent might enter to cause an outbreak or establish a focus of disease. The pathways analysis is a critical and important component of a risk assessment. The objective of a risk assessment is to estimate the likelihood of an outbreak occurring from the pathways identified, such as imports of live animals or of legal/illegal commodities.

In order for an FAD outbreak to occur in the United States, several factors are required, which highlight the issues to be addressed in a pathways analysis. First, the disease agent must exist somewhere else in the world, with areas of higher prevalence and greater levels of export to the United States providing increased risk.

Second, the agent must cross the U.S. border, in either imported livestock or commodities, through inadvertent tourist introduction, environmental sources such as air or water, or intentional terrorist introduction.

Finally, the agent must reach the (livestock) host within the survival time of the organism and spread from the initial host to other animals to produce an outbreak.

The pathways tool will query and integrate data elements (i.e., internal VS and Plant Protection and Quarantine databases, and external public data sets) and create a spatial framework utilizing the ESRI ARCGIS server to geo-process the information to generate a target risk zone. The architectural design for PAMT is shown in Figure 1. Data elements relating to animals and commodities that represent a risk of disease threat are collected and geo-processed on this spatial framework.
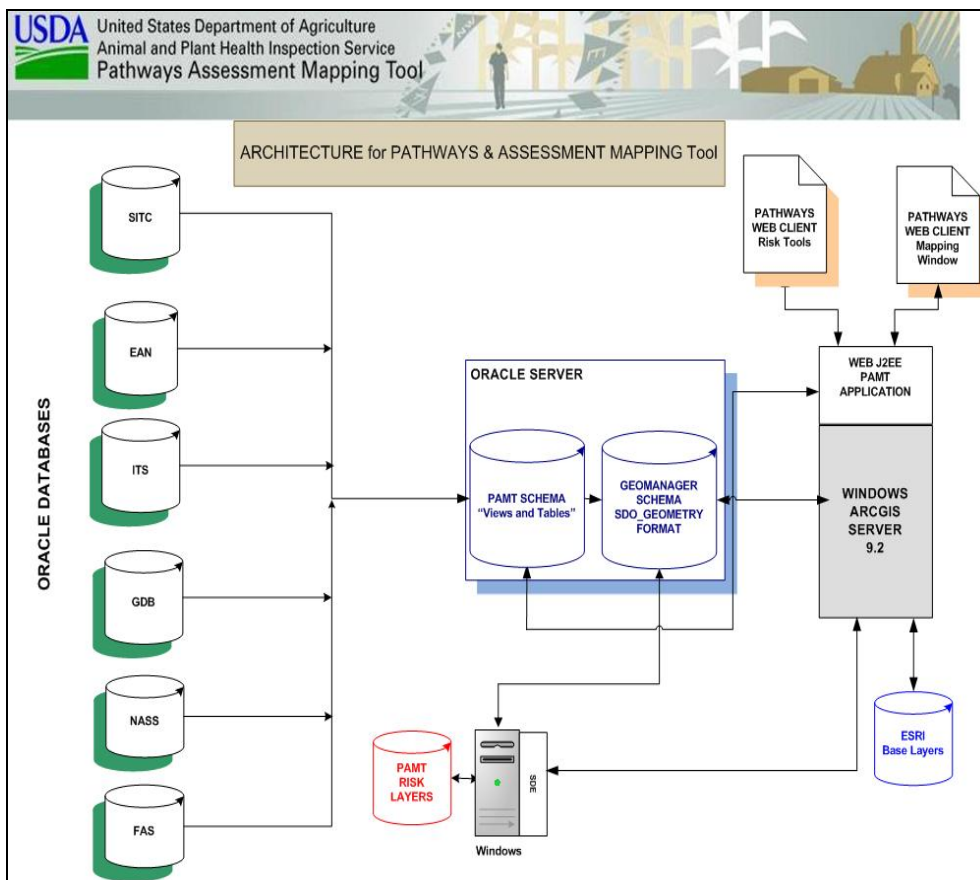
Figure 1 Architecture for the Pathways Tool based on ESRI ARCGIS Server.

The tool will have a user-friendly mapping interface to query, perform basic spatial and statistical calculations for pathways risk assessments, rank or derive analytical indices, and map and visualize target risk zones for a potential outbreak or FAD focus. For example, in a hypothetical animal disease outbreak, PAMT helps the analyst rapidly and seamlessly collect data to identify the pathways of release of the disease-causing agent into the United States, evaluate the risk for each path of entry, and identify the State/county with the highest potential for an outbreak.

The PAMT has the following modules for analysis (see Figure 2).

A. Pathways Module

- Identification of potential routes of entry into the United States:
    - Air, sea, automobile, train, foot traffic at entry points
- Legal movements:
    - Quantity of tourism
    - Quantity of risk products imported

- Illegal movements:
  - o Smuggled products

B. Demographics Module

- Animal density of potential host livestock, i.e., National Agricultural Statistics Service (NASS)
- Human population and Census Bureau data

C. Mitigation Module

- Data elements related to animal disease monitoring and surveillance activities in farm, market and slaughter testing.

D. Target Risk Module

- Assignment and calculation of risk indices for each module data set to identify and visualize the target risk zones.
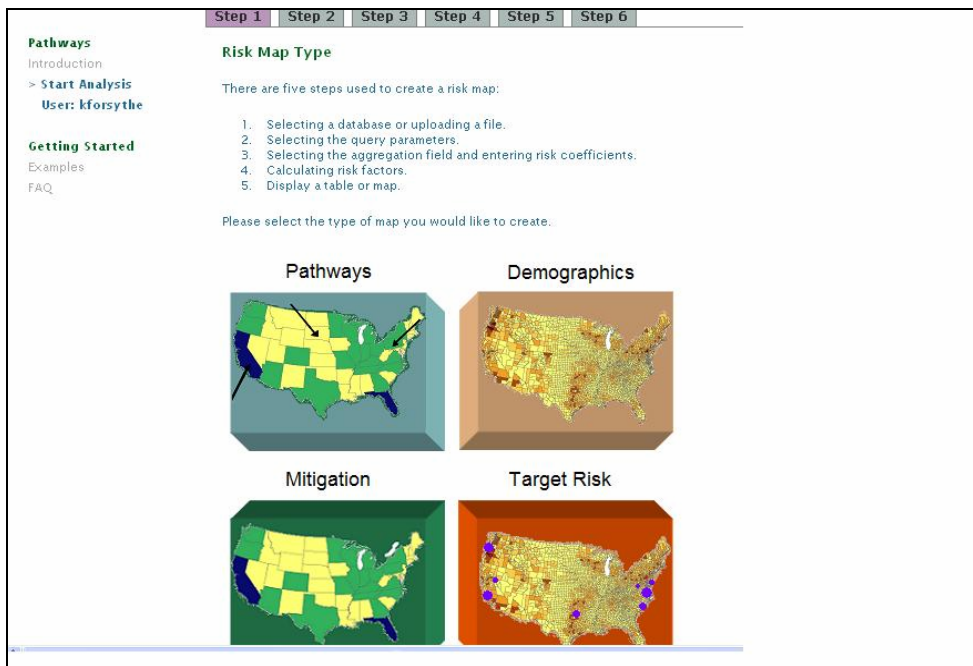

Figure 2 shows the four Modules of the Pathways and Assessment Mapping Tool.
The PAMT is aligned within the strategic goals identified by VS. Goal 1 of VS' FY 2006-2011 Strategic Plan states that VS will protect the United States from the occurrence of adverse animal health events. The pathways tool will facilitate the systematic assessment of the manner in which an FAD agent, such as highly pathogenic avian influenza (HPAI) virus, might enter to cause an outbreak or establish a focus of disease.

Goal 2 of the VS Strategic Plan states that VS will monitor and conduct surveillance of the health and productivity of our Nation's animal health populations and monitor the health-related attributes of animal products and veterinary biologics. PAMT implementation will enable VS to achieve this goal by providing a tool to aid in developing targeted surveillance and emergency response strategies.

Goal 3 of the VS Strategic Plan states that VS will enhance the health status of our Nation's animal populations by anticipating and responding to new or emerging threats and managing, controlling, or eradicating those already identified. The pathways tool will provide the capability to query and consolidate pathways data for risk analysis to help identify and visualize potential high-risk pathways for FAD outbreaks.

The PAMT will provide VS analysts with tools needed for a comprehensive, up-to-date, and quickly accessible source of information to meet the national requirements of USDA Animal Health Safeguarding initiatives. The PAMT will be completed mid-June 2007. Special requests for commodity or live animal pathways analysis must be submitted to the CADIA Risk Analysis Team supervisor.

Acknowledgements