



INSTITUTE FOR DEFENSE ANALYSES

**Introduction to Government Plant and  
Animal Disease Monitoring and Prevention  
Programs in the United States**

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# Executive Summary

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Infectious diseases are a major threat to agriculture biosecurity in the United States and can have significant economic impacts on agriculture. Plant and animal diseases can result in crop and herd production losses, restrictions on trade, market declination, and loss of agricultural employment opportunities.

In this document, the federal government organizations involved with plant and animal disease monitoring in the United States are identified and their specific roles and functions are discussed. Although the Department of Defense (DOD) has some capabilities to address plant or animal disease outbreaks, its efforts are usually in support of other agencies, such as the Animal and Plant Health Inspection Service (APHIS). Therefore, DOD assets are not described in this document.

Plant and animal disease outbreak response and investigations are also outlined and explained. The use of modeling to understand and predict the potential spread of plant and animal diseases throughout the country is described, and existing modeling tools are discussed. Finally, key resources and authorities relating to animal health, foreign animal diseases, and emergency management are provided.

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# 1. Introduction

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Infectious diseases are a major threat to agriculture biosecurity in the United States. Plant and animal diseases can have significant economic impacts on agriculture. These diseases result in crop and herd production losses, restrictions on trade, market declination, and loss of agricultural employment opportunities. During World War I and the first half of the 20<sup>th</sup> century, the federal government, along with states, conducted a massive campaign to eradicate the barberry bush from the United States, a plant known to host wheat stem rust, a major wheat pathogen.<sup>1</sup> The eradication was largely done by the general public, encouraged by public education on plant disease and propaganda that associated barberry removal with feeding soldiers and helping U.S. farmers. More recently, Huanglongbing, or citrus greening disease, has contributed to a 72% reduction in orange production in Florida and has increased the price of oranges in the United States threefold.<sup>2</sup> In 1983, an outbreak of highly pathogenic avian influenza (HPAI) in Pennsylvania required the depopulation of more than 17 million chickens and took 2 years to contain. The economic impact was estimated to be \$312 million in direct and indirect costs.<sup>3</sup> Between 2014 and 2015, in the worst animal disease event in U.S. history, a massive HPAI outbreak across 21 states required the depopulation of 50 million chickens, turkeys, and other domestic poultry to halt the spread of the disease.<sup>4</sup> The economic impact was estimated to be \$3.3 billion in direct and indirect costs.<sup>5</sup> Timely detection and response is critical to reducing the spread of disease and subsequent economic impacts. Although foot and mouth disease (FMD) has not been reported in the United States, a model of a hypothetical outbreak of FMD in California

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<sup>1</sup> P. D. Peterson, “‘The Barberry or Bread’: The Public Campaign to Eradicate the Common Barberry in the United States in the Early 20<sup>th</sup> Century,” *APS Features*, 2013, <https://www.apsnet.org/edcenter/apsnetfeatures/Pages/Barberry.aspx>.

<sup>2</sup> Bruno Dala-Paula et al., “Effect of Huanglongbing or Greening Disease on Orange Juice Quality, a Review,” *Frontiers in Plant Science* 9, article 1976 (January 2019): 2, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6350258/pdf/fpls-09-01976.pdf>.

<sup>3</sup> Mark G. Polyak, “The Threat of Agroterrorism: Economics of Bioterrorism,” *Georgetown Journal of International Affairs* 5, no. 2 (Summer/Fall 2004): 35, <https://www.jstor.org/stable/pdf/43134285.pdf>.

<sup>4</sup> United States Department of Agriculture (USDA), *Final Report for the 2014–2015 Outbreak of Highly Pathogenic Avian Influenza (HPAI) in the United States* (Riverdale Park, MD: U.S. Surveillance Preparedness and Response Services Department of Agriculture APHIS VS, August 2016), 2, [https://www.aphis.usda.gov/animal\\_health/emergency\\_management/downloads/hpai/2015-hpai-final-report.pdf](https://www.aphis.usda.gov/animal_health/emergency_management/downloads/hpai/2015-hpai-final-report.pdf).

<sup>5</sup> Joel L. Greene, *Update on the Highly-Pathogenic Avian Influenza Outbreak of 2014–2015*, R44144 (Washington, DC: Congressional Research Service, July 20, 2015), 7, <https://fas.org/sgp/crs/misc/R44114.pdf>.

demonstrated that delaying outbreak response efforts by just 15 days increased the estimated economic impact from \$3 billion to \$69 billion, with the depopulation of 2,000 additional cattle for each hour of delay after 21 days.<sup>6</sup> In an effort to mitigate potentially devastating outcomes, the United States has developed numerous plant and animal disease monitoring and prevention programs.

In this document, the federal government organizations involved with plant and animal disease monitoring in the United States are identified and their specific roles and functions are discussed. Although the Department of Defense (DOD) has some capabilities to address plant or animal disease outbreaks, its efforts are usually in support of other agencies, such as the Animal and Plant Health Inspection Service (APHIS). Therefore, DOD assets are not described in this document. Plant and animal disease outbreak response and investigations are also outlined and explained. The use of modeling to understand and predict the potential spread of plant and animal diseases throughout the country is described, and existing modeling tools are discussed. Lastly, key resources and authorities relating to animal health, foreign animal diseases, and emergency management are provided.

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<sup>6</sup> Tim E. Carpenter et al., “Epidemic and Economic Impacts of Delayed Detection of Foot-and-Mouth Disease: A Case Study of a Simulated Outbreak in California,” *Journal of Veterinary Diagnostic Investigation* 33 (2011): 29–30, <https://journals.sagepub.com/doi/pdf/10.1177/104063871102300104>.

## **2. Federal Government Organizations**

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### **A. United States Department of Agriculture (USDA)**

The USDA is the lead agency for agricultural matters in the federal government. As such, it contains most of the agencies responsible for plant and animal disease monitoring within the United States. The USDA’s mission statement is to “provide leadership on food, agriculture, natural resources, rural development, nutrition, and related issues based on public policy, the best available science, and effective management.”<sup>7</sup> The agencies listed here include most of the major players within the USDA for plant and/or animal disease monitoring.

#### **1. Animal and Plant Health Inspection Service (APHIS)**

<https://www.aphis.usda.gov/aphis/home/>

APHIS is responsible for protecting the health and value of American agriculture and natural resources. This responsibility includes monitoring and preventing the introduction of animal and plant diseases. APHIS has six operational program units: Biotechnology Regulatory Services (BRS), Plant Protection and Quarantine (PPQ), International Services (IS), Veterinary Services (VS), Animal Care, and Wildlife Services (WS).

##### **a. Plant Protection and Quarantine (PPQ)**

<https://www.aphis.usda.gov/aphis/ourfocus/planthealth>

PPQ is the main USDA APHIS program that protects U.S. crop agriculture against foreign pests and diseases. At airports, seaports, and border stations, PPQ officers inspect passenger baggage and other packages for plant and animal products that could harbor pests or disease organisms. They also inspect ship and air cargoes, rail and truck freight, and package mail from foreign countries for pests or disease organisms. Detector dogs in APHIS’s Beagle Brigade also help find prohibited agricultural materials at international airport arrivals. Much of this work is coordinated with Customs and Border Patrol (CBP). PPQ, in addition to its efforts to keep agricultural pests and diseases from entering the United States, has pest management and eradication programs to contain or eradicate diseases that have already entered the United States. PPQ is organized into three units: Science

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<sup>7</sup> “About the U.S. Department of Agriculture,” U.S. Department of Agriculture (USDA), last accessed August 10, 2020, <https://www.usda.gov/our-agency/about-usda>.

and Technology, Field Operations, and Policy Management. PPQ also includes some smaller efforts that are not associated with these three units, such as the Agricultural Select Agent Services (AgSAS). The major components of PPQ are outlined in the National Plant Health Emergency Management Framework, listed in Chapter 5.

### **1) Science and Technology**

<https://www.aphis.usda.gov/aphis/ourfocus/planthealth/ppq-program-overview/cphst>

The Science and Technology area contains the National Clean Plant Network (NCPN) program and the Center for Plant Health Science and Technology (CPHST). NCPN makes “clean plant” material for five specialty crop groups—(fruit trees, grapes, hops, berries, and citrus—available to the industry and supports 27 cooperators in its efforts. Clean plant material is plant material that has tested negative for common agricultural pests and pathogens.

CPHST includes seven laboratories that provide scientific support to PPQ regulatory decisions and operations. This support includes developing new diagnostic methods and pest identification tools, providing training, conducting tests, and developing methods of pest or weed management. One of the main CPHST labs is the Plant Epidemiology and Risk Analysis Laboratory (PERAL), which prioritizes new threats and helps design risk-based policies. In addition, CPHST maintains the North Atlantic Plant Protection Organization’s (NAPPO) Phytosanitary Alert System (PAS). This alert gathers, synthesizes, and reports information on pests of importance to the United States, Canada, and Mexico via its website.<sup>8</sup>

### **2) Field Operations**

<https://www.aphis.usda.gov/aphis/ourfocus/planthealth/ppq-program-overview/ppq-organization>

The Field Operations area leads and coordinates field operations associated with pest exclusion and plant health matters. This area also includes the State Plant Health Director’s (SPHD) office, which is located in almost every U.S. state and Puerto Rico.<sup>9</sup> Some SPHDs cover multiple states. SPHDs are federal employees who help coordinate operations and training between the federal government and state and local governments.

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<sup>8</sup> “Phytosanitary Alert System,” North American Plant Protection Organization, last accessed August 10, 2020, <https://www.pestalert.org/>.

<sup>9</sup> For a list of State Plant Health Directors, see “Plant Health (PPQ),” United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service, last accessed August 10, 2020, [https://www.aphis.usda.gov/plant\\_health/downloads/State-Plant-Health-Directors-Directory.pdf](https://www.aphis.usda.gov/plant_health/downloads/State-Plant-Health-Directors-Directory.pdf).

### **3) Policy Management**

<https://www.aphis.usda.gov/aphis/ourfocus/planthealth/ppq-program-overview/ppq-organization>

The Policy Management staff coordinate policy and regulatory frameworks nationally. They also provide budgetary, technical, and environmental documentation support to national pest programs. The staff also work with neighboring and offshore countries to minimize risk of accidental or natural entry of pests into the continental United States (CONUS).

The Policy Management area also includes the Plant Health Programs (PHP). PHP coordinates with trading partners and international plant protection organizations to develop and implement detection and control strategies. PHP also coordinates with CBP and Fish and Wildlife Services (FWS) to ensure all guidance and policies are aligned and coordinated.

Pest Lens<sup>10</sup> (<https://pestlens.info>) is a weekly e-mail sent by PPQ staff available to the public that summarizes new and emerging pest information. It also includes relevant background information where needed and provides a framework for making appropriate decisions. It is a merger of two previous programs: Exotic Pest Information Collection and Analysis (EPICA) and Offshore Pest Information System (OPIS).

### **4) Phytosanitary Issues Management (PIM)**

<https://www.aphis.usda.gov/aphis/ourfocus/planthealth/international/phytosanitary-management>

PIM is the technical point of contact for plant health communication with trading partners. PIM focuses on science-based solutions and initiates and presents studies to foster those solutions. This line of communication helps build consensus on plant health decisions among trading partners, both nationally and internationally.

### **5) National Identification Service (NIS)**

<https://www.aphis.usda.gov/aphis/ourfocus/planthealth/pest-detection/pest-identification>

NIS coordinates plant pest identification to support quarantine and other regulatory decisions. Scientists who aid in this identification include those at federal research and regulatory laboratories, plant inspection stations, land-grant universities, and natural history museums. They also support the use of new technologies for pest identification, such as digital imaging.

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<sup>10</sup> “Development of Pest Lens,” Pest Lens, last accessed August 10, 2020, <https://pestlens.info/>.

## **6) Agriculture Select Agent Services (AgSAS)**

<https://www.cdc.gov/cpr/dsat/about-fsap.htm>

USDA APHIS and the Centers for Disease Control and Prevention (CDC) jointly regulate those possessing, using, or transferring select agents or toxins. AgSAS provides regulatory oversight for plant pest select agents. This includes inspecting biocontainment and security system and ensuring that response plans are in place.

## **7) Pest Detection Program**

<https://www.aphis.usda.gov/aphis/ourfocus/planthealth/pest-detection>

The Pest Detection Program supports domestic agricultural pest detection through the Cooperative Agricultural Pest Survey (CAPS) program. APHIS coordinates with state departments of agriculture, universities, and industry partners to conduct surveys that are targeted at specific exotic plant diseases. Survey data are entered into the National Agricultural Pest Information System (NAPIS). Confirmation of pests new to the United States is done via the NIS.

## **2. International Services (IS)**

<https://www.aphis.usda.gov/aphis/banner/careers/foreign-service/foreign-service>

IS posts APHIS Foreign Service Officers (FSOs) in embassies across the globe. Those FSOs can collaborate with foreign countries to ensure that these countries can contain their animal or plant disease outbreaks and not let them escape to the United States or other countries, facilitate safe agricultural imports and exports, and provide advice and training to foreign countries in the identification and eradication of animal and plant diseases.

## **3. Veterinary Services (VS)**

<https://www.aphis.usda.gov/aphis/ourfocus/animalhealth>

VS is organized into four strategically focused units. The organizational structure is found in the USDA APHIS VS Reorganization Stakeholder Announcement in Chapter 5. VS addresses animal health incident management, animal disease programs, surveillance, emergency preparedness, animal and animal product import inspection and quarantine, World Organization for Animal Health (OIE) animal disease reporting, animal disease modeling, animal health data analyses and interpretation, national animal health laboratory network coordination, and animal health regulatory coordination.

**a. Surveillance, Preparedness, and Response Services (SPRS)**

[https://www.aphis.usda.gov/animal\\_health/downloads/vs\\_reorg\\_basics.pdf](https://www.aphis.usda.gov/animal_health/downloads/vs_reorg_basics.pdf), 2

SPRS is comprised of six districts (see Appendix A) in the United States that perform animal health incident management; commodity business planning; disease program, surveillance, and animal disease traceability policy setting and administration; emergency preparedness; epidemiologic investigations and tracing; veterinary accreditation; and veterinary medical supplies and equipment stockpiling. These six districts are organized geographically. Five programs are within the SPRS: the National Animal Health Surveillance System (NAHSS), the National Poultry Improvement Plan (NPIP), the One Health Coordination Center (OHCC), the National Veterinary Stockpile (NVS), and the National Veterinary Accreditation Program.

**1) National Animal Health Surveillance System (NAHSS)**

[https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/monitoring-and-surveillance/sa\\_nahss/ct\\_nahss](https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/monitoring-and-surveillance/sa_nahss/ct_nahss)

The NAHSS systematically collects, collates, and analyzes animal health data. It can then promptly disseminate that information to necessary stakeholders. This dissemination of animal health data can help to maintain and establish infrastructure for early detection of diseases, enhance surveillance efforts, and monitor disease trends. It also ensures that those who must act to mitigate disease are given the information required for their mitigation efforts.

**2) National Poultry Improvement Plan (NPIP)**

<http://www.poultryimprovement.org/>

The NPIP was initially created to eliminate Pullorum disease caused by *Salmonella pullorum*, which was rampant in poultry and could cause upwards of 80% mortality in young poultry. After Pullorum disease became more controlled, the program was extended and refined to include testing and monitoring for *Salmonella typhoid*, *Salmonella enteritidis*, *Mycoplasma gallisepticum*, *Mycoplasma synoviae*, *Mycoplasma meleagridis*, and Avian Influenza. The NPIP currently includes commercial poultry, turkeys, waterfowl, exhibition poultry, backyard poultry, and game birds. The NPIP has developed and implemented a number of standards, such as monthly environmental sampling, Salmonella reduction programs, flock sanitation and biosecurity plans, and monitoring by state agencies to evaluate poultry for these diseases.

### **3) One Health Coordination Center (OHCC)**

[https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/SA\\_One\\_Health](https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/SA_One_Health)

The OHCC conducts analysis of data, programs, and operational activities to prevent or eliminate threats to human health originating from the agriculture sector or from emerging or newly introduced animal diseases or from toxins affecting people, animals and the environment. The OHCC also applies joint strategies at the human-animal-ecosystem interface to improve human and animal health through increased collaboration among federal, state, local, and tribal governments and private industry to network with human health communities and animal health and agriculture communities for enhanced global health and prosperity.

### **4) National Veterinary Stockpile (NVS)**

[https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/emergency-management/nvs/CT\\_Nvs](https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/emergency-management/nvs/CT_Nvs)

The NVS maintains sufficient stockpiles of veterinary countermeasures against the most damaging animal diseases. This countermeasures stockpile can be deployed within 24 hours. The countermeasures includes animal vaccines, antivirals, or therapeutic products, supplies, equipment, and response support services needed to respond to damaging animal disease outbreaks. The NVS includes countermeasures against HPAI, FMD, Exotic Newcastle disease (END), and classical swine fever (CSF).

### **5) National Veterinary Accreditation Program**

[https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/sa\\_vet\\_accreditation](https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/sa_vet_accreditation)

The National Veterinary Accreditation Program ensures that accredited veterinarians are provided with the information that they need to ensure the health of the nations' live-stock and animal population and to protect the public health and well-being. Accredited veterinarians report to the Veterinarian-in-Charge and the State Animal Health Official (SAHO) all diagnosed or suspected cases of a communicable animal disease for which APHIS has a control or eradication program in 9 CFR chapter I (see Chapter 5) and all diagnosed or suspected cases of any animal disease not known to exist in the United States.

#### **a. National Import Export Services (NIES)**

[https://www.aphis.usda.gov/animal\\_health/downloads/vs\\_reorg\\_basics.pdf](https://www.aphis.usda.gov/animal_health/downloads/vs_reorg_basics.pdf), 3

NIES conducts inspection and quarantine on imported animals and animal products, animal facility inspections, and health certificate endorsement; sets import and export policy related to animals and animal products, issues permits, inspects animal facilities; represents the U.S. at the OIE; and conducts analysis and risk assessment. NIES also includes three USDA-operated animal import centers where VS veterinarians examine animals in

quarantine to make sure that these animals are not infected with any foreign pests or diseases before being allowed into the country.

**b. Science, Technology and Analysis (STAS)**

[https://www.aphis.usda.gov/animal\\_health/downloads/vs\\_reorg\\_basics.pdf](https://www.aphis.usda.gov/animal_health/downloads/vs_reorg_basics.pdf), 4

STAS provides analysis of animal health data and design, economics of animal health, epidemiology, and laboratory networks/diagnostics at the federal level. The Center for Veterinary Biologics, the National Veterinary Service Laboratory (NVSL) and National Animal Health Laboratory Network (NAHLN), and Center for Epidemiology and Animal Health (CEAH) fall under STAS.

**1) National Veterinary Service Laboratory (NVSL) and National Animal Health Laboratory Network (NAHLN)**

[https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/lab-info-services/sa\\_about\\_nvsl/ct\\_about\\_nvsl](https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/lab-info-services/sa_about_nvsl/ct_about_nvsl)

The two NVSLs are located in Ames, Iowa, and Plum Island, New York (moving soon to Manhattan, Kansas) and are part of the NAHLN. They provide a wide variety of information and services centered on diagnoses of domestic and foreign animal diseases and support of disease control and eradication programs. The NAHLN is part of a nationwide strategy to coordinate the work of all organizations providing veterinary surveillance and testing services to include confirmatory and routine testing of suspected foreign or transboundary animal disease samples.

**2) Center for Epidemiology and Animal Health (CEAH)**

[https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/sa\\_program\\_overview/sa\\_ceah/](https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/sa_program_overview/sa_ceah/)

CEAH is an OIE Collaborating Center for Animal Disease Surveillance, Risk Analysis, and Epidemiological Modeling. The center is comprised of five units: Information Management and Analytic Support (IMAS), Monitoring and Modeling (M&M), Program Support and Evaluation (PSE), Risk Identification and Risk Assessment (RIRA), and Surveillance Design and Analysis (SDA). The center partners with OIE and member countries to improve international disease surveillance capabilities and analytic methods supporting trade decisions. Two important animal health monitoring and reporting systems fall under CEAH: the National Animal Health Monitoring System (NAHMS) and the National Animal Health Reporting System (NAHRS). More information on NAHMS and NAHRS can be found in Chapter 4. More information on CEAH can be found in the USDA APHIS VS CEAH Factsheet (see Chapter 5).

**a. Program Support Services (PSS)**

[https://www.aphis.usda.gov/animal\\_health/downloads/vs\\_reorg\\_basics.pdf](https://www.aphis.usda.gov/animal_health/downloads/vs_reorg_basics.pdf), 4

Although not directly involved in animal disease monitoring, PSS provides services such as budget formulation, information technology systems, guidance documents/regulatory coordination, and technical training to the VS organization.

**4. Wildlife Services (WS)**

[https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/SA\\_Program\\_Overview](https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/SA_Program_Overview)

WS investigates and controls mammalian predators and rodent and bird pests and partners with public and private entities in the control of mammals and birds that are a nuisance or are reservoirs for zoonotic diseases. It also conducts numerous wildlife disease surveillance projects for feral swine diseases, avian influenza, plague, rabies, and other animal diseases.

**5. Agricultural Research Service (ARS)**

<https://www.ars.usda.gov/>

ARS is the USDA's premier scientific research agency. It includes research groups throughout the United States looking at a wide array of agricultural questions. Many of these groups research aspects of plant and animal disease. Although many of their efforts are more academic, such as examining the molecular pathways through which diseases operate, they are also integral in monitoring diseases around the country and determining the best ways to control and monitor those diseases. The Plant Disease, Crop Quarantine and Health, and Animal Health programs contain research that pertain to disease monitoring. Crop Quarantine and Health is predominantly associated with weed and insect pest research, but weeds and insects are often carriers of plant diseases. ARS programs related to plant diseases are found in 17 states, those related to crop quarantine are found in 21 states, and those related to animal health are found in 9 states.

**a. National Plant Disease Recovery System (NPDRS)**

<https://www.ars.usda.gov/crop-production-and-protection/plant-diseases/docs/npdrs/>

NPDRS is a cooperation between the USDA and the American Phytopathological Society (APS). Together, they create recovery plans for different plant diseases of concern. These plans can guide efforts by the USDA and other groups to prepare for and recover from outbreaks of those diseases. USDA and APS meet periodically to update the plans.

## **6. National Institute of Food and Agriculture (NIFA)**

<https://nifa.usda.gov/>

NIFA provides leadership and funding for programs that advance agriculture-related sciences. In addition to providing funding for various agriculture-related projects, NIFA oversees the Extension program and supports the National Plant Diagnostic Network (NPDN), both of which are important for monitoring plant diseases within the United States.

### **a. Extension**

<https://nifa.usda.gov/extension>

The USDA, via the NIFA, operates the Cooperative Extension System (CES) which provides scientific guidance to farmers and the public throughout the country. These extension services are run through the country's land-grant universities. Since Extension specialists work directly with the public and farmers, they often are some of those best-suited individuals to track plant disease spread and to ensure that farmers use the proper precautions so that disease does not spread further. Extension specialists or others can use sentinel plots across the country to monitor plant disease spread. In addition, Extension specialists often train farmers and others in how to spot crop diseases on their farms.<sup>11</sup>

### **b. National Plant Diagnostic Network (NPDN)**

<https://www.npdn.org/home>

NPDN is an association of plant diagnostic laboratories that are coordinated to quickly detect plant diseases of concern. It is partly funded through NIFA. These plant diagnostic laboratories are found at land-grant universities, state departments of agriculture, and industry. In addition to diagnosing plant diseases and ensuring that the proper entities are notified when a plant disease of concern is diagnosed, the NPDN First Detector Program trains CBP and APHIS personnel to be able to rapidly identify plant disease.

## **B. Health and Human Services (HHS)**

<https://www.hhs.gov/>

The HHS mission is “to enhance the health and well-being of all Americans, by providing for effective health and human services and by fostering sound, sustained advances in the sciences underlying medicine, public health, and social services.”<sup>12</sup> Several

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<sup>11</sup> E. J. Sikora et al., “A Coordinated Effort to Manage Soybean Rust in North America: A Success Story in Soybean Disease Monitoring,” *Plant Disease* 98, no. 7 (July 2014): 870.

<sup>12</sup> “Introduction: About HHS—Mission Statement,” U.S. Department of Health & Human Services (HHS), last accessed August 10, 2020, <https://www.hhs.gov/about/strategic-plan/introduction/index.html#mission>.

agencies within HHS deal with zoonotic diseases. The CDC addresses zoonotic disease, emerging diseases, and those with unknown etiologies. Specifically, CDC's National Center for Zoonotic, Vector-Borne, and Enteric Diseases (NCVED) provides leadership, expertise, and service concerning epidemiological science, bioterrorism preparedness, applied research, disease surveillance, and outbreak response for infectious diseases. The National Institutes of Health (NIH) provides support for zoonotic and bioterrorism preparedness research. Public Health Service (PHS) is one of seven uniformed services in which officers serve in National Invasive Species Council (NISC) agencies such as the National Park Service (NPS), the National Oceanic and Atmospheric Administration (NOAA), USDA, the Environmental Protection Agency (EPA), and DOD. The work of these agencies includes zoonotic disease surveillance and prevention.

### **1. Public Health Service (PHS)**

<https://www.usphs.gov/>

The U.S. PHS is the largest division of HHS. It contains 8 of HHS's 11 divisions. These divisions are the Agency for Healthcare Research and Quality (AHRQ), the CDC, the Agency for Toxic Substances and Disease Registry (ATSDR), the Food and Drug Administration (FDA), the Health Resources and Services Administration (HRSA), the Indian Health Service (IHS), the NIH, and the Substance Abuse and Mental Health Services Administration (SAMHSA). Many public health professionals of the PHS serve in the Public Health Service Commissioned Corps (PHSCC), which is one of eight uniformed services of the U.S. and the federal uniformed service for the PHS. The mission of the PHS is "to protect, promote, and advance the health and safety of our Nation,"<sup>13</sup> which includes protecting the public from vector borne and zoonotic diseases that can be passed between animals and humans.

#### **a. Centers for Disease Control and Prevention (CDC)**

<https://www.cdc.gov/>

Under the Public Health Service Act, the CDC is responsible for protecting the Nation's public health and increasing the Nation's health security by providing leadership, direction, and guidance in the prevention and control of diseases. It also responds to public health emergencies and conducts science to protect the public against health threats, which include zoonotic diseases.

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<sup>13</sup> "U.S. Public Health Service Commissioned Corps," U.S. Department of Health & Human Services (HHS), Office of the Surgeon General, last updated March 18, 2019, last accessed August 10, 2020, <https://www.hhs.gov/surgeongeneral/corps/index.html#:~:text=The%20mission%20of%20the%20U.S.,response%20to%20public%20health%20needs>.

## **1) Division of Global Migration and Quarantine (DGMQ)**

<https://www.cdc.gov/ncezid/dgmq/index.html>

Imported animals represent a significant risk for the introduction of zoonotic diseases into the United States.<sup>14</sup> The DGMQ works with other federal agencies to protect U.S. borders against diseases carried by animals and animal products. CDC's current regulations govern the importation of pet dogs and cats, African rodents, turtles, nonhuman primates, and civets and any product made from parts of these animals. Other animals or animal products may also be prohibited if they are known to be a risk to human health. The DGMQ maintains stations at U.S. ports of entry and land-border crossings where international travelers and imports arrive. Quarantine officers are responsible for screening cargo and inspecting animals and animal products for signs of disease.

### **a. Food and Drug Administration (FDA)**

<https://www.fda.gov/home>

The FDA is responsible for regulating animal drugs, animal feeds, animal medical devices, and the majority of animal health therapeutic products. With regard to animal diseases, the FDA regulates veterinary biologics and animal medical devices used in the prevention, diagnosis, management, and treatment of animal disease but does not conduct animal disease monitoring or regulate animal vaccines. The FDA's Center for Veterinary Medicine (CVM) ensures that animal feeds that may include plant and animal products from countries with known animal diseases foreign to the U.S. receive the proper permits or certifications through the USDA.

### **b. National Institutes of Health (NIH)**

<https://www.nih.gov/>

The NIH is charged with providing federal support and funding to biomedical research across the Nation, with the goal of preventing, detecting, diagnosing, and treating disease. The agency is organized into 27 Institutes and Centers, of which only one is directly involved with zoonotic diseases. The National Institute of Allergy and Infectious Diseases (NIAID) is the institute that supports and conducts basic research on pathogens and parasites that cause tropical diseases and on the interactions of these organisms between human hosts and animal/invertebrate vectors involved in disease transmission. NIAID also supports the Centers of Excellence in Influenza Research and Surveillance

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<sup>14</sup> Julie R. Sinclair et al., "Dogs Entering the United States from Rabies-Endemic Countries, 2011–2012," *Zoonoses and Public Health* 62, no. 5 (August 2015): 393–400, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4631526/pdf/nihms733499.pdf>; Emily W. Lankau et al., "Public Health Implications of Changing Rodent Importation Patterns – United States, 1999–2013," *Transboundary and Emerging Diseases* 64, no. 2 (April 2017): 528–537, <https://pubmed.ncbi.nlm.nih.gov/26245515/>.

(CEIRS) network. This program conducts domestic and international animal influenza surveillance and focuses on research intended to enhance understanding of influenza pathogenesis, transmission, evolution, and host response.

The NIH's Division of Veterinary Resources (DVR), under the Office of Research Services (ORS), supports centralized animal health surveillance programs by monitoring all NIH animal colonies for infectious disease and pathogenic entities. The program is charged with monitoring the health status of animals and animal specimens used in NIH research.

## **2. Federal Select Agent Program (FSAP)**

<https://www.selectagents.gov/>

The FSAP is a joint effort between the CDC's Division of Select Agents and Toxins (DSAT) and APHIS's AgSAS. FSAP oversees the possession, use, and transfer of biological select agents and toxins that have the potential to become a severe threat to public health, animal or plant health, or to animal or plant products. FSAP increases the Nation's ability to monitor the safety and security of select agents by developing, implementing, and enforcing Select Agent Regulations, maintaining a national database of select agents; inspecting organizations that possess, use, or transfer select agents; ensuring that security risk assessments are performed by the Federal Bureau of Investigation (FBI)/Criminal Justice Information Service (CJIS) Division on all individuals who work with select agents; providing guidance documents; and investigating any incidents of non-compliance.

## **C. Federal Bureau of Investigation (FBI)**

<https://www.fbi.gov/>

The FBI is charged with protecting and defending the U.S. against terrorist and foreign intelligence threats. The introduction of foreign or emerging animal diseases or exotic plant pests and diseases into the United States can occur as an intentional criminal or terrorist act. These actions can negatively impact agricultural export markets, agricultural populations, public health, and national security. The introduction of animal or plant disease through intentional or terrorist acts can be considered a weapon. Any weapon that contains a biological agent or toxin is defined by U.S. law as a weapon of mass destruction (WMD). The FBI is the lead federal agency in responding to threats from weapons of mass destruction. To specifically address these concerns, the FBI Weapons of Mass Destruction Directorate (WMDD) program provides leadership and expertise to domestic and foreign law enforcement, other federal and state agencies, industry and trade partners, and academic professionals. The WMDD is the lead directorate in preparedness, countermeasures, investigations and operations, and intelligence relating to WMD threats. See Chapter 3 for additional information on FBI investigations relating to animal and plant disease outbreaks.

## **D. Department of Homeland Security (DHS)**

### **1. Customs and Border Protection (CBP)**

<https://www.cbp.gov/>

CBP works with PPQ to inspect conveyances, cargo, and passenger baggage. CBP also carries out immigration inspection and clearance of passengers. CBP documents violations and spot settlements and targets based on analysis. A local pest-risk committee may review current interception and other data to identify potential risk patterns or to allocate inspection resources effectively. PPQ provides the scientific and technical support to CBP in the arena of plant pests. CBP took over these operations from PPQ when DHS was formed in the early 2000s.

### **2. Countering Weapons of Mass Destruction (CWMD)**

<https://www.dhs.gov/countering-weapons-mass-destruction-office>

The CWMD Office manages DHS's implementation of Homeland Security Presidential Directive (HSPD)-9 and thus coordinates the department's efforts regarding defense of the nation's food and agriculture. More information on HSPD-9 can be found in Chapter 5.

## **E. Department of the Interior (DOI)**

### **1. United States Geological Survey (USGS)**

<https://www.usgs.gov/>

The USGS is the lead federal agency for wildlife disease research and surveillance. Its wildlife health capabilities provide research, information, and technical assistance for management of wildlife during disease events. The USGS provides data and information to inform fish and wildlife disease policy, planning, and management.

### **2. United States Fish and Wildlife Service (USFWS)**

<https://www.fws.gov/>

The USFWS works to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the nation. USFWS partners with each state to combat the dynamic challenges of wildlife diseases that impact wildlife populations and potentially affect human and domestic animal health in the United States. They collaborate with state wildlife management agencies, academic organizations, non-governmental organizations (NGOs), the USDA APHIS WS, NOAA, the NPS, and the USGS National Wildlife Health Center (NWHC) to implement strategies for prevention of disease in susceptible populations and to respond to and manage wildlife diseases.

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### 3. Plant and Animal Disease Outbreak Response and Investigations

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#### A. Plant Disease Outbreak Investigations

In a plant disease outbreak, local or state governments and private sector organizations are the first responders to a plant health emergency. A state government could request additional assistance from the federal government. If federal assistance is required, APHIS-PPQ is the lead federal agency for responding to significant incidents affecting plants.<sup>15</sup> As the lead federal agency, PPQ, along with collaborators at the state, local, and federal level, assembles and transports the equipment and personnel required to contain the outbreak. PPQ is also in charge of long-term planning, science, and outreach to ensure that future outbreaks can also be contained quickly.<sup>16</sup> Although PPQ is in charge of the federal effort, the State Plant Health Director is still the lead program director overall, regardless of the emergency category.<sup>17</sup>

State and local agriculture agencies and law enforcement (where applicable) are in charge of quarantines and enforcement unless an emergency is declared and a federal quarantine is established.<sup>18</sup> A Declaration of Emergency allows interim or proposed rules to be established or additional funds to be given to PPQ to aid in the control of the disease. If a Declaration of Extraordinary Emergency is declared, PPQ has the authority to conduct survey and eradication measures, potentially including quarantines.<sup>19</sup> A Declaration of Extraordinary Emergency goes beyond a Declaration of Emergency in terms of the authority and resources that PPQ can use, but both types of emergency are declared by the Secretary of Agriculture. The Emergency Response Manual, published by PPQ (referenced in Chapter 5), outlines the organizational structure and the responsibilities of different groups

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<sup>15</sup> Department of Homeland Security, *National Food and Agriculture Incident Annex to the Response and Recovery Federal Interagency Operations Plans* (Washington, DC: Department of Homeland Security, August 2019), 47, [https://www.fema.gov/sites/default/files/2020-07/fema\\_incident\\_annex\\_food-agriculture.pdf](https://www.fema.gov/sites/default/files/2020-07/fema_incident_annex_food-agriculture.pdf).

<sup>16</sup> *Ibid.*, 50.

<sup>17</sup> United States Department of Agriculture, *Emergency Response Manual* (Riverdale Park, MD: Animal and Plant Health Inspection Service, Plant Protection and Quarantine, November 2010), 4-5, [https://www.aphis.usda.gov/import\\_export/plants/manuals/emergency/downloads/epm.pdf](https://www.aphis.usda.gov/import_export/plants/manuals/emergency/downloads/epm.pdf).

<sup>18</sup> *Ibid.*, 1-8.

<sup>19</sup> *Ibid.*, 1-10.

in the event of a plant health emergency. If agroterrorism is suspected, law enforcement may also be involved in the response.

The National Response Framework (NRF) outlines the organizational structure for the Federal Emergency Management Agency's (FEMA) response to various hazards, including plant health emergencies. Although PPQ is the main federal agency involved in plant health efforts, FEMA coordinates federal response to emergency situations generally. Within the NRF, Emergency Support Functions (ESFs) provide the mechanism for coordinated federal assistance to state, tribal, and local entities during the outbreak event. During response to plant or animal disease emergencies, ESF 11, "Agriculture and Natural Resource," is the main function that is followed. Depending on the extent of the incident, ESF 8, "Public Health and Medical Services" and ESF 13, "Public Safety and Security" may also be followed.<sup>20</sup> The National Incident Management System (NIMS) provides a command and control template for all entities to use when preparing for and responding to incidents, including plant and animal disease outbreaks. Within NIMS, the Incident Command System (ICS) is a chain of command model used to mobilize resources and personnel in an organized manner during emergency response activities. The ICS ensures that response activities are coordinated among all responding agencies and assists with maintaining integrated communications, allocates teams with appropriate span of control, and provides methods for staging supplies, equipment, and personnel until required. The ICS is a unified command structure that can be expanded or contracted as necessary to fit the scope of the emergency.

## **B. Animal Disease Outbreak Investigations**

Any contagious animal disease outbreak within the United States, especially foreign or emerging animal disease outbreaks, constitutes an animal disease emergency. Constitutionally, local or state governments and private sector organizations are responsible for public health and safety in their area and will be the first responders to an animal health emergency. In most cases, the state Agricultural Department will determine whether an emergency requires federal assistance. However, for a foreign or emerging animal disease outbreak, the federal government can, in coordination with the state(s), declare an emergency that will trigger additional response through the APHIS-VS National Center for Animal Health Emergency Management (NCAHEM).

The NCAHEM uses the Emergency Management Response System 2.0 (EMRS2) to coordinate APHIS-VS tasks associated with disease outbreak and animal emergencies, routine reporting of foreign animal disease investigations, state-specific disease outbreaks or control programs, or natural disasters involving animals. It will liaise with other emergency

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<sup>20</sup> "Emergency Support Functions," U.S. Department of Homeland Security: FEMA, last updated July 31, 2020, last accessed August 10, 2020, <https://www.fema.gov/media-library/assets/documents/25512>.

management groups and agencies through the APHIS-VS National Preparedness and Incident Coordination Center (NPIC) to ensure that VS emergency management policies, strategies, and responses are synchronous with national response activities. In any event during which agroterrorism is suspected, law enforcement is immediately contacted and involved in the investigation. If federal assistance is requested and approved, the DHS assumes overall authority for emergency response activities and will coordinate interventions through FEMA using the NRF. The NRF, ERFs, and ICS function the same as in plant health emergencies. See Appendix A for the Animal Health ICS Organizational Chart.

The Foreign Animal Disease Preparedness and Response Plan (FAD PReP) was developed by APHIS-VS to provide a comprehensive framework for preparedness and response to foreign or emerging animal diseases.<sup>21</sup> This framework is intended to integrate and synchronize the principles of the NRF and NIMS by providing goals, guidelines, strategies, and procedures to local, state, federal, and tribal outbreak responders. The FAD PReP documents consist of NAHMS's guidelines for general veterinary activities, disease-specific response plans, industry or facility manuals customized for industry stakeholders, standard operating procedures and checklists for planners and responders, and continuity of business plans that can be used as templates for response exercises and real-world animal disease outbreaks.

### **C. Animal Disease Traceability**

In the event of an animal disease outbreak, knowing where diseased and susceptible animals are currently located, where those animals have been, and when their movements occurred are critical for enabling rapid response by animal disease investigators. An animal disease traceability system may not prevent animal disease outbreaks, but it assists in national monitoring and surveillance programs, reduces the time required for investigators to locate animals and rapidly track their travel history, and ultimately minimizes the economic impact to livestock owners and the agriculture community. Animal traceability programs in the United States are consistently improving to use affordable technology to facilitate the electronic sharing of data among industry stakeholders, veterinary professionals, and federal and state animal health officials. Nationally unique numbers are permanently associated with individual animals or groups of animals from birth to slaughter. These unique numbers can take the form of official animal identification devices (e.g., ear tags, electronic microchips, tattoos, and brands). They are maintained for each animal or animal group through records kept by livestock or animal owners. Official animal identification numbers must adhere to one of the following numbering systems approved by

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<sup>21</sup> "FAD PReP Materials and References," United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service, last modified July 26, 2020, last accessed August 10, 2020, <https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/emergency-management/fad-prep/index>.

USDA APHIS: the National Uniform Eartagging System (NUES), an Animal Identification Number (AIN), a location-based number system, a flock-based number system (e.g., a Flock Identification Number (FIN)), or any other numbering system approved by USDA APHIS. Livestock that is moved between states must be officially identified and accompanied by an interstate certificate of veterinary inspection (ICVI) or other documentation (e.g., owner-shipper statements or brand certificates) for traceability purposes. USDA's Animal Disease Traceability General Standards were updated in 2019 and provide a wealth of information on animal identification requirements within the United States.<sup>22</sup> See Chapter 5 for additional information on interstate movement of livestock. Animal disease traceability requirements are discussed specifically in 9 CFR, Chapter 1, Subchapter C, Part 86 (see Chapter 5).

#### **D. Criminal Investigations of Agroterrorism**

Congress, the U.S. intelligence community, agricultural industry leaders, producers, veterinary stakeholders, and public health officials are concerned that agriculture in the United States serves as a potential target for domestic and international criminal or terrorist activities. Agroterrorism is a threat to national security and has the potential to severely impact the nation's economy, agricultural export markets, international trade relations, domestic food security, public health, and animal and plant population health. It may be difficult to determine whether the introduction of foreign or emerging animal or plant disease is the result of intentional bioterrorism actions, accidental activities, or natural means. To effectively determine the origin of the disease introduction, animal and plant health officials and law enforcement agents must collaborate simultaneously in numerous locations to investigate the incident. This collaboration is best achieved through a Joint Criminal-Epidemiological Investigation in which information sharing and effective communication are critical for detecting, recognizing, preventing, and disrupting criminal/terrorist use of biological agents. Participants include local and state law enforcement, FBI field office personnel, state and federal field veterinary medical officers, animal health technicians, epidemiologists, emergency coordinators, state and federal agricultural law enforcement investigators, agriculture subject matter experts, academic professionals, disease experts, and laboratory personnel. Primary federal agencies involved in these investigations are the FBI and USDA. The FBI's WMDD Chemical-Biological Countermeasures Unit offers an Animal/Plant Health Joint Criminal-Epidemiological Investigations course designed to provide concepts and operational tools to potential investigation participants/collaborators.

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<sup>22</sup> United States Department of Agriculture, *Animal Disease Traceability: General Standards*, Version 2.8 (Riverdale Park, MD: USDA APHIS Veterinary Services, Animal Traceability Staff, June 2019), [https://www.aphis.usda.gov/traceability/downloads/ADT\\_standards.pdf](https://www.aphis.usda.gov/traceability/downloads/ADT_standards.pdf).

Course materials are For Official Use Only (FOUO); however, the handbook for Domestic Criminal and Epidemiological Investigations is unclassified and publicly accessible.<sup>23</sup>

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<sup>23</sup> Federal Bureau of Investigation (FBI), *Joint Criminal-Epidemiologic Investigations Handbook*, 2018 Domestic Edition (Washington, DC: WMD Directorate, Biological Countermeasures Unit, 2018), <https://www.fbi.gov/file-repository/criminal-and-epidemiological-investigation-handbook.pdf/view>.

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## 4. Plant and Animal Disease M&M

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Once a plant or animal disease has entered the country, it needs to be monitored to contain the spread and eventually eradicate the disease where possible. The USDA and others use modeling to better understand the potential spread of plant and animal diseases throughout the United States.

### A. Plant Disease M&M

Plant diseases can be transported through a variety of means. The most common methods are by wind, water, and pest species (insects and so forth). Weed species can also act as alternate hosts of plant diseases since many crops are harvested during the fall and the disease requires an alternate host to overwinter in the area. For example, soybean rust, found in the southeastern United States, can use kudzu as an alternate host.<sup>24</sup> Therefore, in many plant disease models, not only the disease itself but also any alternate hosts or pest species must be considered.

From 2002 to 2013, USDA used the North Carolina State University-APHIS Plant Pest Forecasting System (NAPPFAS<sup>T</sup>) to forecast where crop pests or diseases would occur based on weather and other modeling.<sup>25</sup> Some of the most consequential plant diseases had models built into NAPPFAS<sup>T</sup>, but users of NAPPFAS<sup>T</sup> also had the ability to input the disease parameters for other diseases to obtain additional models. NAPPFAS<sup>T</sup>'s plant disease model was based on a temperature-/moisture-based generic infection model.<sup>26</sup>

After 2013, the USDA switched its crop disease monitoring efforts to the Integrated Pest Information Platform for Extension and Education (iPiPE).<sup>27</sup> iPiPE was created to

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<sup>24</sup> S. Pivonia and X. B. Yang, "Assessment of the Potential Year-Round Establishment of Soybean Rust Throughout the World," *Plant Disease* 88, no. 5 (May 2004): 523, <https://apsjournals.apsnet.org/doi/pdf/10.1094/PDIS.2004.88.5.523>.

<sup>25</sup> R. D. Magarey et al., "NAPPFAS<sup>T</sup>: An Internet System for the Weather-Based Mapping of Plant Pathogens," *Plant Disease* 91, no. 4 (April 2007): 336–345, <https://apsjournals.apsnet.org/doi/pdf/10.1094/PDIS-91-4-0336>.

<sup>26</sup> R. D. Magarey et al., "Risk Maps for Targeting Exotic Plant Pest Detection Programs in the United States," *EPPO Bulletin* 41 (2011): 51, [https://www.srs.fs.usda.gov/pubs/ja/2011/ja\\_2011\\_magarey\\_001.pdf](https://www.srs.fs.usda.gov/pubs/ja/2011/ja_2011_magarey_001.pdf).

<sup>27</sup> Scott A. Isard et al., "Integrated Pest Information Platform for extension and Education (iPiPE): Progress Through Sharing," *Journal of Integrated Pest Management* 6, no. 1 (March 2015): 1–8, <https://doi.org/10.1093/jipm/pmv013>.

promote the exchange of pest data among agriculture professionals, and the original funding was provided in the 2010 farm bill via NIFA. iPiPE collects observations of important pests and aggregates these observations so that they are useful for forecasting ongoing or new outbreaks. Without efforts like iPiPE, most disease monitoring is done in silos, based on the needs of seed companies or specific grants that may not be continued for more than a few years.<sup>28</sup> The disease-monitoring side of iPiPE, the Crop-Pest Programs, is run by extension professionals, who are helped by undergraduate interns in organizing and maintaining the database of disease observations. iPiPE, in addition to its disease monitoring side, includes local and aerobiological models to simulate local transmission and long-distance transmission of plant pests.<sup>29</sup> In the next few years, iPiPE will likely merge with EDDMapS, which was set up by the University of Georgia to track not only plant pests, but also invasive species.<sup>30</sup>

More academic disease models can also facilitate a broader understanding of how plant diseases can move but are generally not as useful for predicting the spread of a particular disease in a particular year.<sup>31</sup>

## **B. Animal Disease Monitoring**

Animal diseases can be transmitted via numerous pathways. The five main methods of transmission are direct contact between animals, inhalation of aerosolized pathogens, ingestion, indirect transfer of pathogens via fomites (e.g., equipment, footwear or vehicles), and vector transmission (e.g., fleas, ticks and mosquitoes). Direct contact is one of the most common methods of disease transmission between animals.

Monitoring, surveilling, and reporting animal diseases is crucial to instituting a timely response in establishing control measures. Two of the largest animal health monitoring and reporting systems, NAHMS and NAHRS, have been established by the USDA for this purpose. NAHMS was established in 1983 to collect and analyze data on animal health within the country. Program units conduct national studies on animal health and the health management practices of U.S. livestock and poultry and disseminate information on animal health trends to consumers, researchers, industry leaders, and academia professionals. Many of the NAHMS study findings are published in peer-reviewed research and scholarly journals that can be accessed by the public. Developed in 1996, NAHRS was designed to

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<sup>28</sup> *Ibid.*, 1.

<sup>29</sup> *Ibid.*, 2–4.

<sup>30</sup> J. LaForest, “Overview of iPiPE 2020 Including Discussion of Transition to EDDMaps,” briefing presented at iPiPE Participant Mixer for Year 6 (iPMx6), Raleigh, North Carolina, February 4–5, 2020, <https://sites.google.com/site/ipipeed/annual-meetings/ipmx6>.

<sup>31</sup> M. Donatelli et al., “Modelling the Impacts of Pests and Diseases on Agricultural Systems,” *Agricultural Systems* 155 (July 2017): 213–224, <https://doi.org/10.1016/j.agsy.2017.01.019>.

provide a national animal health surveillance system to collect information on the presence of OIE-reportable animal diseases and other diseases of interest in the United States. The system receives monthly reports from participating state animal health officials for confirmed cases of disease found on the proposed National List of Reportable Animal Diseases (NLRAD) that occur in livestock, poultry, and aquaculture populations. NAHRS provides comprehensive surveillance information used by the USDA to address concerns by trade partners and to protect the country's portion of the global market for animals and animal products.

### **C. Animal Disease Modeling**

Disease-dynamic models that predict animal disease transmission and outbreak patterns can be extremely useful tools in the animal health and public health fields. Integrating their use into animal health management and decision-making processes can serve to enhance and improve surveillance systems, risk mitigations, outbreak preparedness, and outbreak response activities.<sup>32</sup>

Unfortunately, diseases that affect wild and domestic animals are not only difficult to prevent and control, but they are also difficult to predict due to the multitude of potential hosts. The development of pathogen transmission models for these diseases is hindered by difficulties in identifying wildlife hosts and their distributions and movement patterns, understanding pathogen transmission pathways between wildlife and domestic animals, recognizing the differences in effects of the disease and associated control measures between wild and domestic animal populations, and overcoming barriers to communication among involved animal health organizations.<sup>33</sup>

The USDA's animal health modeling team is part of the M&M unit that operates under the oversight of CEAH. The modeling team conducts evaluation, acquisition, and enhancement of applied animal disease models based on epidemiologic and economic principles. The team also communicates modeling results to key animal health stakeholders through training and outreach efforts. Further, it supports federal and state emergency management organizations during animal disease outbreak response and preparedness events. The team's applied animal disease models address diseases that are highly contagious and have the potential to threaten the nation's food supply.

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<sup>32</sup> Ryan S. Miller and Kim M. Pepin, "BOARD INVITED REVIEW: Prospects for Improving Management of Animal Disease Introductions Using Disease-Dynamic Models," *Journal of Animal Science* 97, no.6 (June 2019): 2291, <https://doi.org/10.1093/jas/skz125>.

<sup>33</sup> Kathryn P. Huyvaert et. al., "Challenges and Opportunities Developing Mathematical Models of Shared Pathogens of Domestic and Wild Animals," *Veterinary Sciences* 5, no. 4 (October 30, 2018): 1–20, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6313884/pdf/vetsci-05-00092.pdf>.

The modeling team uses several established software applications to simulate the spread of highly contagious animal diseases and to predict potential economic impacts. InterSpread Plus® (ISP) and the North American Animal Disease Spread Model/Animal Disease Spread Model (NAADSM/ADSM) are the most commonly used applications to simulate animal disease spread and control.<sup>34</sup> These applications are stochastic state-transition models that provide a susceptible/infected/removed (SIR) framework that end users can manipulate to simulate disease progression and spread. The end user can also implement outbreak control measures (e.g., vaccination and depopulation) within the model to modify predictions. Further, he or she can add resource limitations in personnel or supplies to the model to tailor estimates to his or her specific situation. NAADSM was developed in 2002 to estimate the epidemiological and economic impacts of a highly contagious animal disease outbreak (e.g., FMD) within the United States and Canada.<sup>35,36</sup>

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<sup>34</sup> “Epidemiologic and Economic Modelling,” United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service, last modified June 2, 2020, last accessed August 10, 2020, [https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/SA-Epidemiology-AnimalHealth-CEAH/SA\\_Monitoring\\_and\\_Modelling](https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/SA-Epidemiology-AnimalHealth-CEAH/SA_Monitoring_and_Modelling).

<sup>35</sup> Neil Harvey et. al., “The *North American Animal Disease Spread Model*: A Simulation Model to Assist Decision Making in Evaluating Animal Disease Incursions,” *Preventive Veterinary Medicine* 82, nos. 3–4 (December 2007): 177–178, <https://doi.org/10.1016/j.prevetmed.2007.05.019>.

<sup>36</sup> The application has been consistently enhanced, and the most recent version is publicly available on the internet. See “An Application for Epidemiologic Simulation Modeling of Livestock Diseases,” NAADSM, last accessed August 10, 2020, <http://www.naadsm.org>.

## 5. Key Resources

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### A. USDA

- **Foreign Animal Disease Preparedness and Response Plan (FAD PRoP):** “FAD Prep Materials and References”
  - <https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/emergency-management/fad-prep/index>
- **USDA – APHIS – VS – Centers for Epidemiology and Animal Health - National Surveillance Unit:** “Guidelines for Developing an Animal Health Surveillance Plan”
  - [https://www.aphis.usda.gov/vs/nahss/docs/Guidelines\\_for\\_Developing\\_Animal\\_Health\\_Surveillance\\_Plan\\_September\\_14\\_2006.pdf](https://www.aphis.usda.gov/vs/nahss/docs/Guidelines_for_Developing_Animal_Health_Surveillance_Plan_September_14_2006.pdf)
- **Department of Homeland Security:** *National Food and Agriculture Incident Annex to the Response and Recovery Federal Interagency Operations Plans*
  - [https://www.fema.gov/media-library-data/1573149147918-2b572a77d771d2856d70978629e7cffe/Food\\_and\\_Agriculture\\_Incident\\_Annex.pdf](https://www.fema.gov/media-library-data/1573149147918-2b572a77d771d2856d70978629e7cffe/Food_and_Agriculture_Incident_Annex.pdf)
- **United States Department of Agriculture, Animal and Plant Health Inspection Service:** “National List of Reportable Animal Diseases (NLRAD).”

This resource contains links to the annual NLRAD, which lists the animal diseases with mandatory reporting to state and federal officials. It also provides information on how quickly the disease needs to be reported and who is responsible for making the report.

  - [https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/monitoring-and-surveillance/nlrاد/ct\\_national\\_list\\_reportable\\_animal\\_diseases](https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/monitoring-and-surveillance/nlrاد/ct_national_list_reportable_animal_diseases)
- **United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine:** *National Plant Health Emergency Management Framework*
  - [https://www.aphis.usda.gov/plant\\_health/plant\\_pest\\_info/biosecurity/download/PHE-framework.pdf](https://www.aphis.usda.gov/plant_health/plant_pest_info/biosecurity/download/PHE-framework.pdf)

- **United States Department of Agriculture, Agricultural Research Service (ARS): Disease Recovery Plans (Plants)**
  - <https://www.ars.usda.gov/ARUserFiles/np303/NPDRS/Documents/NPDRS%20Disease%20Recovery%20Plans.pdf>
- **Veterinary Services, Centers for Epidemiology and Animal Health (CEAH): *Surveillance and Data Standards for USDA/APHIS/Veterinary Services***
  - [https://www.aphis.usda.gov/vs/nahss/docs/surveillance\\_standards\\_v1\\_full\\_doc.pdf](https://www.aphis.usda.gov/vs/nahss/docs/surveillance_standards_v1_full_doc.pdf)
- **United States Department of Agriculture, Animal and Plant Health Inspection Service, Center for Epidemiology and Animal Health: “Factsheet”**
  - [https://www.aphis.usda.gov/animal\\_health/emergingissues/downloads/CEAH%20Factsheet\\_10032016.pdf](https://www.aphis.usda.gov/animal_health/emergingissues/downloads/CEAH%20Factsheet_10032016.pdf)
- **United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine: *Emergency Response Manual***
  - [https://www.aphis.usda.gov/import\\_export/plants/manuals/emergency/downloads/epm.pdf](https://www.aphis.usda.gov/import_export/plants/manuals/emergency/downloads/epm.pdf)
- **United States Department of Agriculture, Animal and Plant Health Inspection Service: Veterinary Services Reorganization: Stakeholder Announcement**
  - [https://www.aphis.usda.gov/animal\\_health/downloads/vs\\_reorg\\_basics.pdf](https://www.aphis.usda.gov/animal_health/downloads/vs_reorg_basics.pdf)
- **United States Department of Agriculture: *USDA Strategic Plan FY 2018 – 2022***

This resource outlines how the USDA responds to agricultural pest and disease threats. Strategies include surveillance and early detection of agricultural pests and diseases, emergency preparedness and response, and control and eradication.

  - <https://www.usda.gov/sites/default/files/documents/usda-strategic-plan-2018-2022.pdf>
- **United States Department of Agriculture, “Veterinary Services National Incident Management Teams (2017): Frequently Asked Questions”**
  - [https://www.aphis.usda.gov/animal\\_health/emergency\\_management/downloads/imt-faqs.pdf](https://www.aphis.usda.gov/animal_health/emergency_management/downloads/imt-faqs.pdf)

## **B. Authorities Relating to Animal and Plant Health, Foreign Animal Diseases, and Emergency Management**

Federal laws, regulations, and presidential directives provide guidance and requirements for animal health professionals charged with protecting the health and welfare of animals within the country. These authorities are most important to consider when designing or implementing an approach to animal disease monitoring and applying biosecurity measures for the protection of plant and animal agriculture.

### **1. Statutory Authorities**

#### **a. Agricultural Bioterrorism Protection Act of 2002**

<https://www.govinfo.gov/content/pkg/FR-2002-08-12/pdf/02-20354.pdf>

This law was passed in 2002 and adds agents that could pose a severe threat to animal or plant health to the list of select agents and toxins. In addition, it amends the current rules related to select agents to ensure that the rules include concerns from select agents that could harm animal or plant health.

#### **b. Animal Health Protection Act (AHPA)**

<https://www.govinfo.gov/content/pkg/USCODE-2018-title7/html/USCODE-2018-title7-chap109-sec8301.htm>

This law was passed in 2002 and authorizes the Secretary of Agriculture to impose livestock importation restrictions, limit livestock movement within the country, and order the depopulation or removal of animals to reduce, eliminate, or prevent the spread of animal diseases.

#### **c. Animal Welfare Act (AWA)**

[https://www.aphis.usda.gov/aphis/ourfocus/animalwelfare/SA\\_AWA](https://www.aphis.usda.gov/aphis/ourfocus/animalwelfare/SA_AWA)

This law was passed in 1966 and has been subsequently amended seven times, with the last amendment occurring in 2008. Although the AWA is well-known and regulates the care and treatment of most warm-blooded animals in the United States, it does not apply to animals that are used for food, fiber, or other agricultural purposes. It does require research facilities to use appropriate methods to control, prevent, and treat infectious diseases. The AWA also requires the isolation of research animals suspected of having a contagious disease.

## **2. Homeland Security Presidential Directives (HSPDs) and Presidential Policy Directives (PPDs)**

Presidential Directives are unique forms of Executive Orders that address policy for national security. The different acronyms indicate issuance by different administrations.

### **a. HSPD-5: Management of Domestic Incidents**

<https://www.dhs.gov/sites/default/files/publications/Homeland%20Security%20Presidential%20Directive%205.pdf>

HSPD-5 was issued in 2003 to establish policy to prevent, prepare for, respond to, and recover from terrorist attacks, major disasters, and other emergencies. It established a comprehensive national response strategy for crisis management of domestic incidents. The directive required the establishment of a National Response Plan (NRP) and streamlined the response of all levels of government in the effort to increase the nation's capacity to efficiently and effectively manage domestic incidents such as high-consequence plant and animal disease outbreaks.

### **b. HSPD-8 and PPD-8: National Preparedness**

<https://www.govinfo.gov/content/pkg/PPP-2003-book2/pdf/PPP-2003-book2-doc-pg1745.pdf>

<https://www.dhs.gov/xlibrary/assets/presidential-policy-directive-8-national-preparedness.pdf>

HSPD-8 was issued in 2003 during the George H.W. Bush administration, and PPD-8 was issued in 2011 during the Barack Obama administration. Both directives outline strategies, goals, and implementation plans to improve domestic emergency and public health preparedness efforts by federal, state, and local organizations. PPD-8 directed these activities to occur under the leadership of the Secretary of DHS. Both directives address "all-hazards preparedness" for domestic terrorist attacks, major disasters, or other emergencies. A high-consequence animal disease outbreak could be considered a major disaster or a national emergency, and, depending on whether intentional biological agents were used by foreign agents, the outbreak could also be considered a terrorist attack.

### **c. HSPD-9: Defense of United States Agriculture and Food**

<https://www.govinfo.gov/content/pkg/PPP-2004-book1/pdf/PPP-2004-book1-doc-pg173.pdf>

HSPD-9 was released in 2004 and is considered one of the most important Presidential Directives concerning the protection of agriculture. Its purpose is to establish a national policy to defend U.S. agriculture and food systems against terrorist attacks, major disasters, and other emergencies. Further, it directed the development of comprehensive surveillance and monitoring systems for animal disease, plant disease, wildlife disease, food, public

health, and water quality to provide early detection and awareness of disease, pest, or poisonous agents. It also directs an extensive collaboration between the Secretaries of Agriculture, Health and Human Services, and Homeland Security, the Attorney General, the Administrator of the Environmental Protection Agency, and the Director of Central Intelligence to develop and implement mitigation strategies to protect critical agricultural production and processing resources from the introduction of disease. The directive was also responsible for establishing two essential plant and animal disease response systems across federal, state, and local governments in association with the private sector. The first of these systems is the NVS, which contains appropriate amounts of animal vaccine, antiviral, and medicinal products to respond to outbreaks of the most devastating and dangerous animal diseases. The second system is the NPDRS, which is designed to respond to high-consequence plant disease through the use of resistant seed varieties and pesticide control measures intended to prevent or slow the spread of plant diseases that could have significant impact on the economy.

**d. HSPD-10: Biodefense for the 21<sup>st</sup> Century**

<https://fas.org/irp/offdocs/nspd/hspd-10.html>

HSPD-10 was released in 2004 to outline a strategy for preventing and controlling future biological threats, to include natural or deliberate disease outbreaks. Specifically, it addresses the protection of agriculture, food, and water through essential pillars—Threat Awareness, Prevention and Protection, Surveillance and Detection, and Response and Recovery—designed to address natural, unintentional, and intentional introduction of biological threats.

**3. Congressional Acts and the United States Code (U.S.C.)**

**a. Plant Protection Act of 2000 (P.L. 106-224)**

[https://www.aphis.usda.gov/plant\\_health/plant\\_pest\\_info/weeds/downloads/PPAText.pdf](https://www.aphis.usda.gov/plant_health/plant_pest_info/weeds/downloads/PPAText.pdf)

This act was passed in 2000 and authorizes the Secretary of Agriculture to impose quarantines, limit imports and exports, and limit movement of plant material across the United States to prevent major plant disease outbreaks. It also restricts the import or export of plant pests and noxious weeds. The USDA can take additional action in the event of a plant health emergency after discussions with the governor of the affected state indicate that the state is unable to contain an outbreak on its own.

**b. Protecting America’s Food and Agriculture Act of 2019 (P.L. 116-122)**

<https://www.congress.gov/116/plaws/publ122/PLAW-116publ122.pdf>

This act was passed in 2019 to increase the number of CBP agricultural technicians and canine units at borders and ports of entry in an effort to protect the nation’s farms and food supply by preventing the entry of African Swine Fever (ASF) and other foreign agricultural diseases.

**c. Robert T. Stafford Disaster Relief and Emergency Assistance Act  
(P.L. 93-288, as amended, 42 U.S.C. 5121 et seq., and Related Authorities)**

[https://www.fema.gov/media-library-data/1582133514823-be4368438bd042e3b60f5cec6b377d17/Stafford\\_June\\_2019\\_508.pdf](https://www.fema.gov/media-library-data/1582133514823-be4368438bd042e3b60f5cec6b377d17/Stafford_June_2019_508.pdf)

This act was passed in 1988 and describes the programs that the federal government uses to respond to disasters and emergencies. Large plant or animal disease outbreaks could fall under this category. Once the governor of an affected state or the chief executive of an affected Indian tribe calls on the president for additional assistance, the executive branch can mobilize additional federal resources to help the state, local, and/or tribal efforts.

**d. Swine Health Protection Act (SHPA) (P.L. 96-468)**

<https://www.govinfo.gov/content/pkg/USCODE-2018-title7/html/USCODE-2018-title7-chap69-sec3801.htm>

This act was passed in 1980 with the intent of protecting public health by ensuring that the food scraps and waste that are fed to commercial swine do not contain pathogens that pose a disease risk to swine health. Raw or undercooked food waste that contains meat may serve to transmit infectious diseases (e.g., FMD, ASF, CSF, and swine vesicular disease (SVD)). The act mandated that all food waste must be treated to kill disease-causing pathogens before being fed to swine intended for consumption by humans.

**e. Securing Our Agriculture and Food Act (P.L. 115-43)**

<https://www.congress.gov/115/plaws/publ43/PLAW-115publ43.pdf>

This law was passed in 2017 to amend the Homeland of Security Act of 2002. It directs the Assistant Secretary for Health Affairs for DHS to develop a program to coordinate DHS efforts related to defending the food, agriculture, and veterinary systems of the United States against terrorism and other significant events that pose a high risk to national security.

**f. 28 Hour Law (49 U.S.C. 80502)**

<https://www.nal.usda.gov/awic/twenty-eight-hour-law>

This federal law addresses the transportation of animals, including those raised for food or food production, across state lines. The law states that animals cannot be transported by rail carrier, express carrier, or common carrier, except by air or water, for more than 28 consecutive hours without being unloaded for 5 hours to receive rest, water, and food. This requirement helps protect animal health and prevent the onset of disease due to stress.

**4. Code of Federal Regulations (CFR)**

The code of federal regulations Title 9 is the most comprehensive U.S. regulation concerning animals and animal products. Several subchapters and sections are specific to situations involving the prevention, monitoring, and investigation of animal diseases.

**a. 9 CFR Chapter 1, Subchapter B: Cooperative Control and Eradication of Livestock or Poultry Diseases**

<https://www.law.cornell.edu/cfr/text/9/chapter-I/subchapter-B>

This subchapter outlines requirements for the identification, testing, depopulation, and reporting of animals due to tuberculosis, brucellosis, pseudorabies, foot-and-mouth disease, pleuropneumonia, and other communicable diseases of livestock. It also contains directives for payments to owners of destroyed animals. Lastly, the regulation outlines measure for the control of scrapie, chronic wasting disease, and H5/H7 low pathogenic avian influenza.

**b. 9 CFR Chapter 1, Subchapter C: Interstate Transportation of Animals (Including Poultry) and Animal Products**

<https://www.law.cornell.edu/cfr/text/9/chapter-I/subchapter-C>

This subchapter discusses the rules of transporting animals within the country, restrictions on movement of animals with certain communicable diseases, quarantine and isolation requirements for sick animals, and documentation requirements to facilitate animal disease traceability in the event of a disease outbreak.

**c. 9 CFR Chapter 1, Subchapter D: Exportation and Importation of Animals (Including Poultry) and Animal Products**

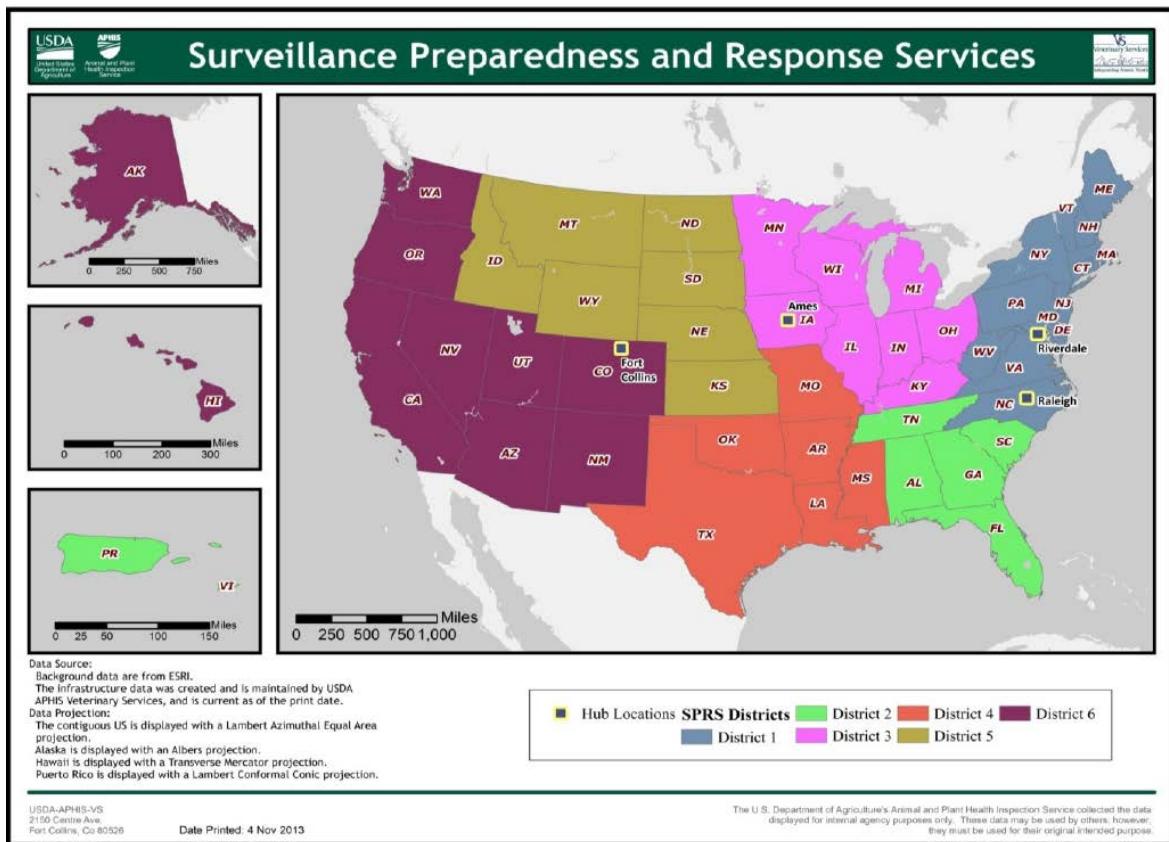
<https://www.law.cornell.edu/cfr/text/9/chapter-I/subchapter-D>

This subchapter outlines regulations for the importation and exportation of animals and animal products. Specifically, part 94 addresses prohibited and restricted importations

from regions where rinderpest, FMD, Newcastle disease, HPAI, ASF CSF, SVD, and bovine spongiform encephalopathy (BSE) are known to exist.

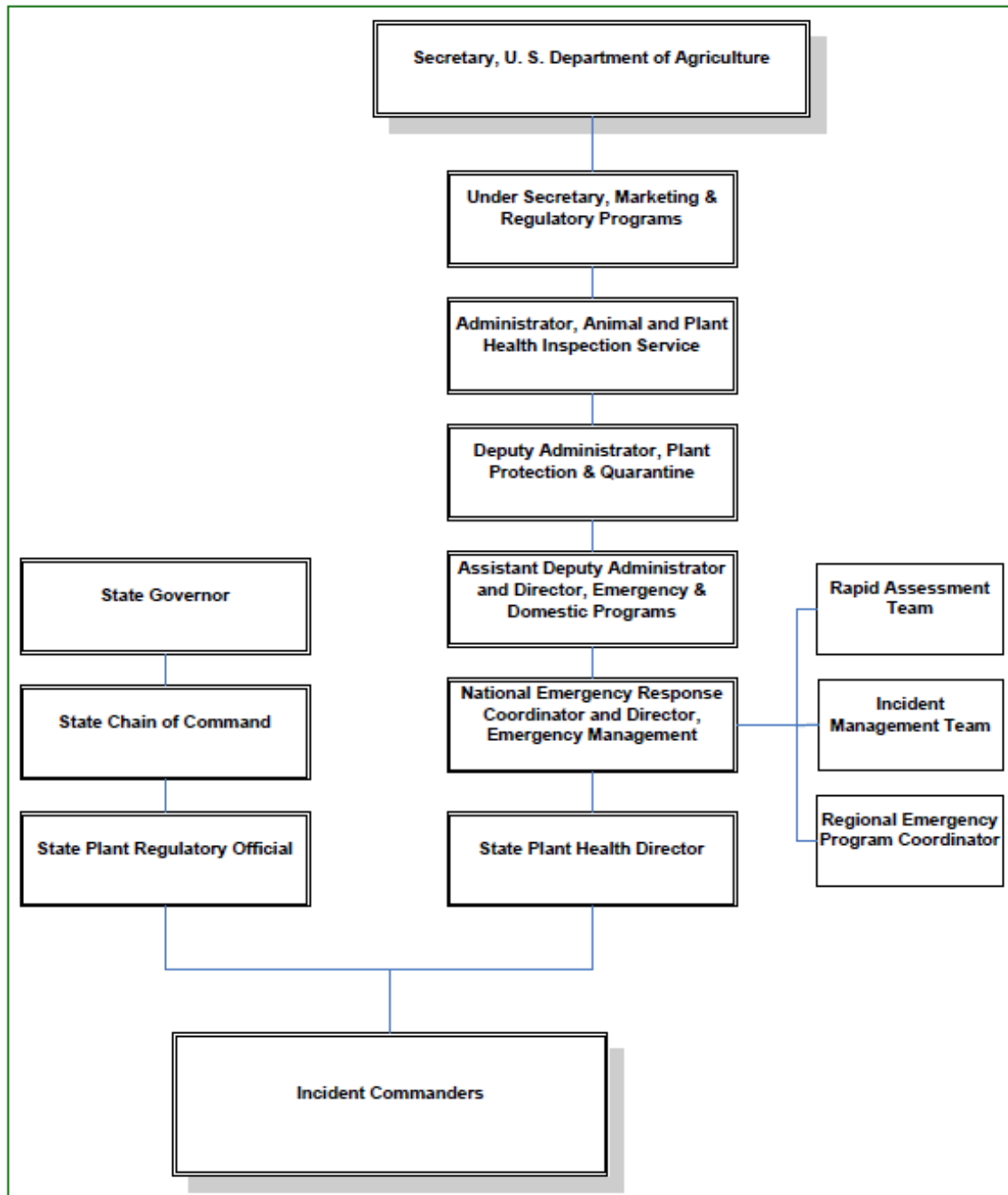
# Appendix A. Selected Figures

## Six Districts of Surveillance, Preparedness, and Response Services (SPRS)



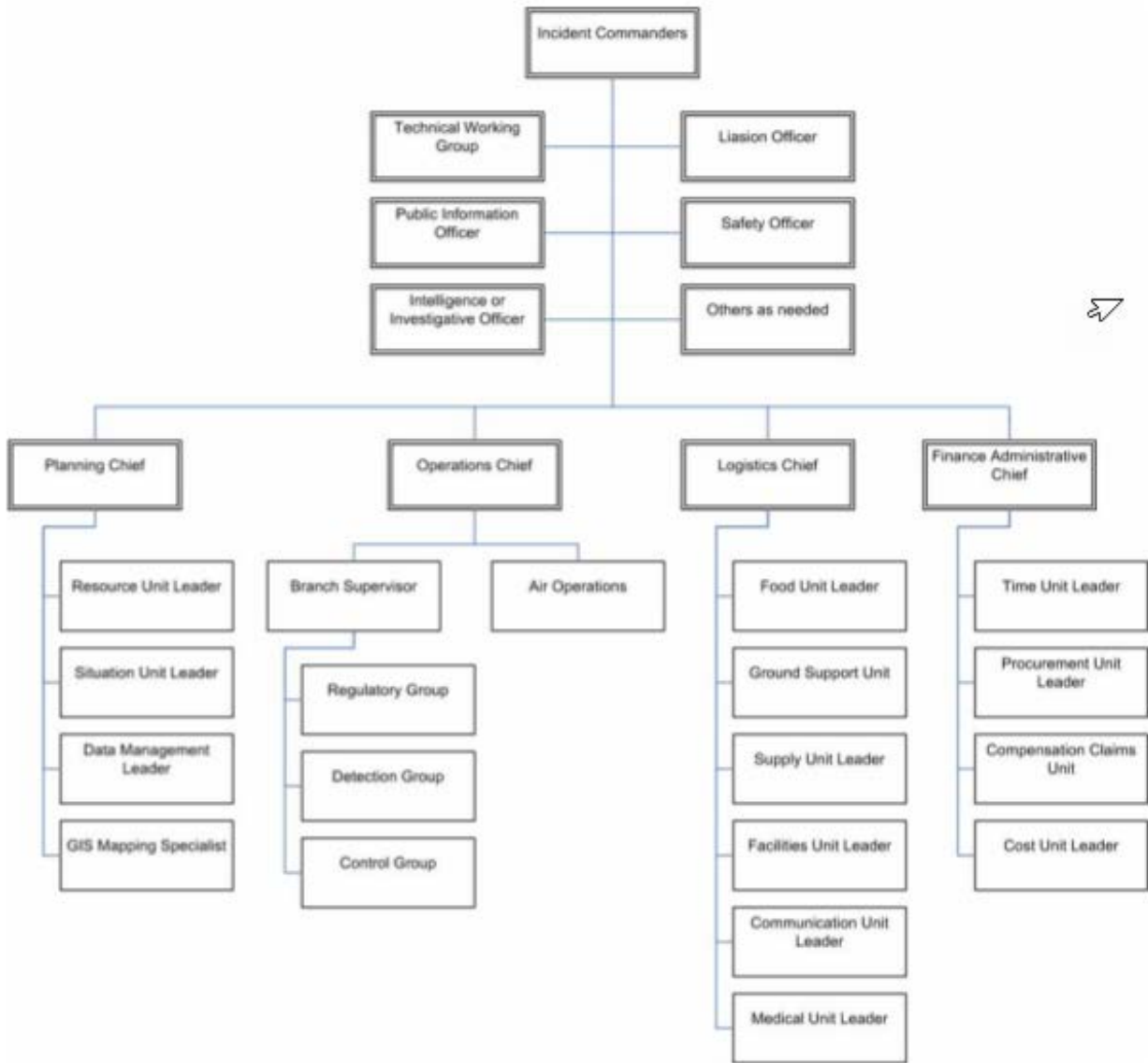
Source: United States Department of Agriculture, "Veterinary Services Reorganization," Stakeholder Announcement (Riverdale Park, MD: USDA APHIS Veterinary Services, November 2013), 2, [https://www.aphis.usda.gov/animal\\_health/downloads/vs\\_reorg\\_basics.pdf](https://www.aphis.usda.gov/animal_health/downloads/vs_reorg_basics.pdf).

## Organization of National & Regional Staff Supporting a Plant Health Emergency



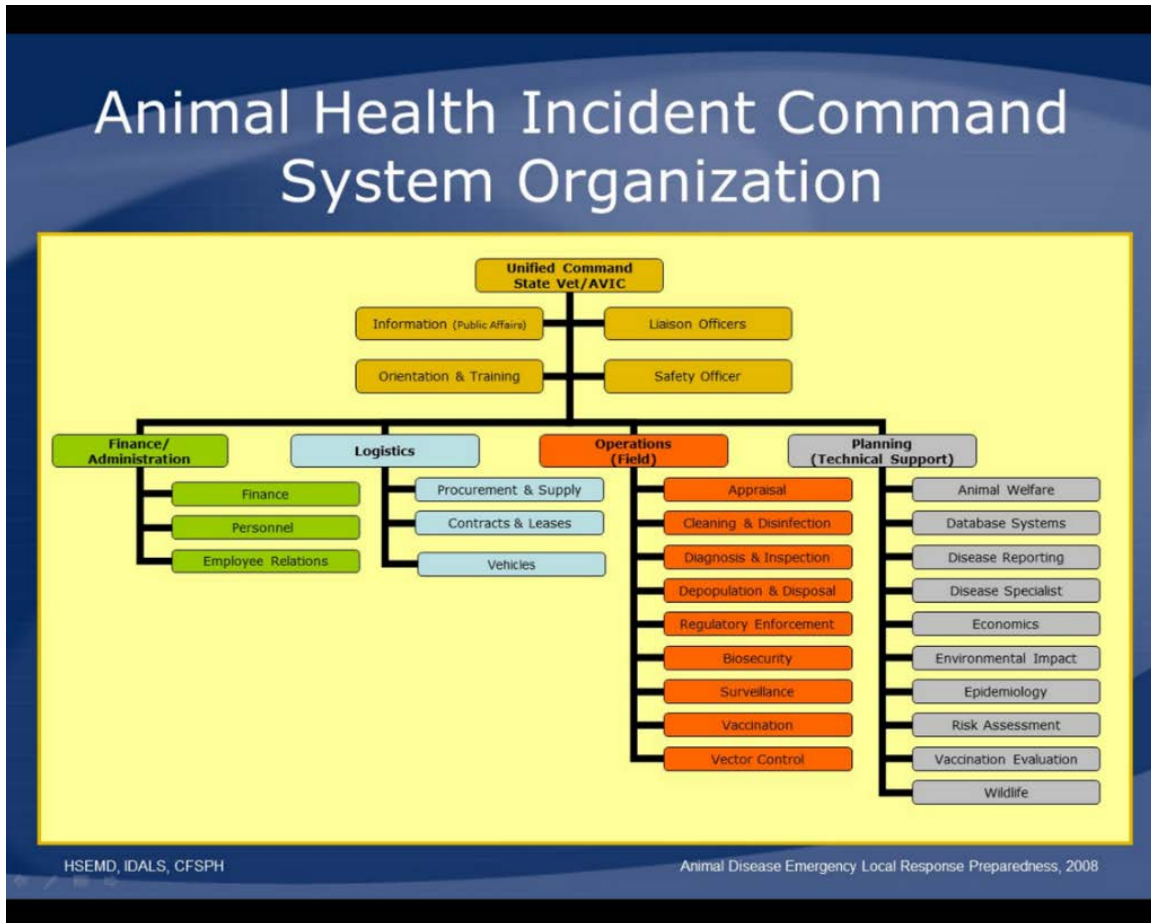
Source: United States Department of Agriculture, *Emergency Response Manual* (Riverdale Park, MD: Animal and Plant Health Inspection Service, Plant Protection and Quarantine, November 2010), 3-3, [https://www.aphis.usda.gov/import\\_export/plants/manuals/emergency/downloads/epm.pdf](https://www.aphis.usda.gov/import_export/plants/manuals/emergency/downloads/epm.pdf).

## Plant Health Emergency Command and General Staff Organization



Source: United States Department of Agriculture, *Emergency Response Manual*, 4-3.

## Animal Health Incident Command System (ICS) Organization



Source: Glenda Dvorak, Danelle Bickett-Weddle, and Gayle Brown (contributing authors), "NIMS and ICS: Animal Disease Emergencies," Animal Disease Emergency Local Response Preparedness (Des Moines, Windsor Heights, and Ames, IA: Iowa Department of Agriculture and Land Stewardship (IDALS), Iowa Department of Homeland Security and Emergency Management (HSEMD), and the Center for Food Security & Public Health (CFSPH), 2008), 16, [http://www.cfspH.iastate.edu/Animal\\_Response/English/ppt/S3\\_PPT\\_NIMS\\_ICs.ppt](http://www.cfspH.iastate.edu/Animal_Response/English/ppt/S3_PPT_NIMS_ICs.ppt).

## Appendix B.

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## Appendix C. Abbreviations

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ADSM	Animal Disease Spread Model
AgSAS	Agricultural Select Agent Services
AHPA	Animal Health Protection Act
AHRQ	Agency for Healthcare Research and Quality
AIN	Animal Identification Number
APHIS	Animal and Plant Health Inspection Service
APS	American Phytopathological Society
ARS	Agricultural Research Service
ASF	African Swine Fever
ATSDR	Agency for Toxic Substances and Disease Registry
AWA	Animal Welfare Act
BRS	Biotechnology Regulatory Services
BSE	bovine spongiform encephalopathy
CAPS	Cooperative Agricultural Pest Survey
CBP	Customs and Border Patrol
CDC	Centers for Disease Control and Prevention
CEAH	Center for Epidemiology and Animal Health
CEIRS	Centers of Excellence in Influenza Research and Surveillance
CES	Cooperative Extension System
CFR	Code of Federal Regulations
CFSPH	Center for Food Security & Public Health (Iowa State University)
CJIS	Criminal Justice Information Service
CONUS	Continental United States
CPHST	Center for Plant Health Science and Technology
CSF	classical swine fever
CVM	Center for Veterinary Medicine
CWMD	Countering Weapons of Mass Destruction
DGMQ	Division of Global Migration and Quarantine
DHS	Department of Homeland Security
DOD	Department of Defense
DOI	Department of the Interior
DSAT	Division of Select Agents and Toxins
DVR	Division of Veterinary Resources
EMRS2	Emergency Management Response System 2.0
END	Exotic Newcastle disease
EPA	Environmental Protection Agency

EPICA	Exotic Pest Information Collection and Analysis
ESF	Emergency Support Function
FAD PReP	Foreign Animal Disease Preparedness and Response Plan
FBI	Federal Bureau of Investigation
FDA	Food and Drug Administration
FEMA	Federal Emergency Management Agency
FIN	Flock Identification Number
FMD	foot and mouth disease
FOUO	For Official Use Only
FSAP	Federal Select Agent Program
FSO	Foreign Service Officer
FWS	Fish and Wildlife Services
HHS	Health and Human Services
HIS	Indian Health Service
HPAI	highly pathogenic avian influenza
HRSA	Health Resources and Services Administration
HSEMD	Iowa Department of Homeland Security and Emergency Management
HSPD	Homeland Security Presidential Directive
ICS	Incident Command System
ICVI	interstate certificate of veterinary inspection
IDALS	Iowa Department of Agriculture and Land Stewardship
IMAS	Information Management and Analytic Support
iPiPE	Integrated Pest Information Platform for Extension and Education
IPM	iPiPE Participant Mixer
IS	International Services
ISP	InterSpread Plus®
M&M	Monitoring and Modeling
NAADSM	North American Animal Disease Spread Model
NAHLN	National Animal Health Laboratory Network
NAHMS	National Animal Health Monitoring System
NAHRS	National Animal Health Reporting System
NAHSS	National Animal Health Surveillance System
NAPIS	National Agricultural Pest Information System
NAPFAST	North Carolina State University APHIS Plant Pest Forecasting System
NAPPO	North Atlantic Plant Protection Organization
NCAHEM	National Center for Animal Health Emergency Management
NCPN	National Clean Plant Network
NCVED	National Center for Zoonotic, Vector-Borne, and Enteric Diseases
NGO	non-governmental organization
NIAID	National Institute of Allergy and Infectious Diseases

NIES	National Import Export Services
NIFA	National Institute of Food and Agriculture
NIH	National Institutes of Health
NIMS	National Incident Management System
NIS	National Identification Service
NISC	National Invasive Species Council
NLRAD	National List of Reportable Animal Diseases
NOAA	National Oceanic and Atmospheric Administration
NPDN	National Plant Diagnostic Network
NPDRS	National Plant Disease Recovery System
NPIC	National Preparedness and Incident Coordination Center
NPIP	National Poultry Improvement Plan
NPS	National Park Service
NRF	National Response Framework
NRP	National Response Plan
NUES	National Uniform Eartagging System
NVS	National Veterinary Stockpile
NVSL	National Veterinary Service Laboratory
NWHC	National Wildlife Health Center
OHCC	One Health Coordination Center
OIE	World Organization for Animal Health (formerly the Office International des Epizooties)
OPIS	Offshore Pest Information System
ORS	Office of Research Services
P.L.	Public Law
PAS	Phytosanitary Alert System
PERAL	Plant Epidemiology and Risk Analysis Laboratory
PHP	Plant Health Programs
PHS	Public Health Service
PHSCC	Public Health Service Commissioned Corps
PIM	Phytosanitary Issues Management
PPD	Presidential Policy Directive
PPQ	Plant Protection and Quarantine
PSE	Program Support and Evaluation
PSS	Program Support Services
RIRA	Risk Identification and Risk Assessment
SAHO	State Animal Health Official
SAMHSA	Substance Abuse and Mental Health Services Administration
SDA	Surveillance Design and Analysis
SHPA	Swine Health Protection Act
SIR	susceptible/infected/removed
SPHD	State Plant Health Director
SPRS	Surveillance, Preparedness, and Response Services
STAS	Science, Technology and Analysis

SVD	swine vesicular disease
U.S.	United States
U.S.C.	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VS	Veterinary Services
WMD	Weapon of Mass Destruction
WMDD	Weapons of Mass Destruction Directorate
WS	Wildlife Service