NAHEMS GUIDELINES:
WILDLIFE MANAGEMENT AND VECTOR CONTROL FOR A FOREIGN ANIMAL DISEASE RESPONSE IN DOMESTIC LIVESTOCK

FAD PReP
Foreign Animal Disease
Preparedness & Response Plan

USDA

NAHEMS
National Animal Health
Emergency Management System

the Center for Food Security & Public Health
Iowa State University

United States Department of Agriculture • Animal and Plant Health Inspection Service • Veterinary Services

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The Foreign Animal Disease Preparedness and Response Plan (FAD PReP)/National Animal Health Emergency Management System (NAHEMS) Guidelines provide a framework for use in dealing with an animal health emergency in the United States.

This FAD PReP/NAHEMS Guidelines was produced by the Center for Food Security and Public Health, Iowa State University of Science and Technology, College of Veterinary Medicine, in collaboration with the U.S. Department of Agriculture Animal and Plant Health Inspection Service through a cooperative agreement.

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PREFACE

The Foreign Animal Disease Preparedness and Response Plan (FAD PReP)/National Animal Health Emergency Management System (NAHEMS) Guidelines provide the foundation for a coordinated national, regional, State, and local response in an emergency, complementing non-Federal preparedness activities. These guidelines may be integrated into preparedness plans of other Federal agencies, State and local agencies, Tribal Nations, and additional groups involved in animal health emergency management.

The Wildlife Guidelines are a component of APHIS' FAD PReP/NAHEMS Guideline Series, and are designed for use by APHIS Veterinary Services (VS), and other official response personnel in the event of an animal health emergency in domestic livestock, such as the natural occurrence or intention introduction of a highly contagious foreign animal disease in the United States.

The FAD PReP/NAHEMS Guidelines are designed for use as a preparedness resource rather than a comprehensive response document. These Guidelines: Wildlife Management and Vector Control for an FAD Response in Domestic Livestock are for information only; personnel with the appropriate skills and experience will be required to conduct operational activities.

APHIS DOCUMENTS

This *FAD PReP NAHEMS Guidelines: Wildlife Management and Vector Control for a Foreign Animal Disease Response in Domestic Livestock* references other APHIS documents including the following. These documents are available at http://www.aphis.usda.gov/fadprep.

- FAD PReP/NAHEMS Guidelines:
  - Biosecurity
  - Cleaning and Disinfection
  - Disposal
  - Health & Safety
  - Mass Depopulation and Euthanasia
  - Surveillance, Epidemiology, and Tracing
  - Quarantine and Movement Control

- VS Guidance Document 12001: Procedures for the Investigation of Potential Foreign Animal Disease/Emerging Disease Incidents (FAD/EDI)

- VS Memorandum 573.1: Animal Health Response Policy In Relation To Wildlife

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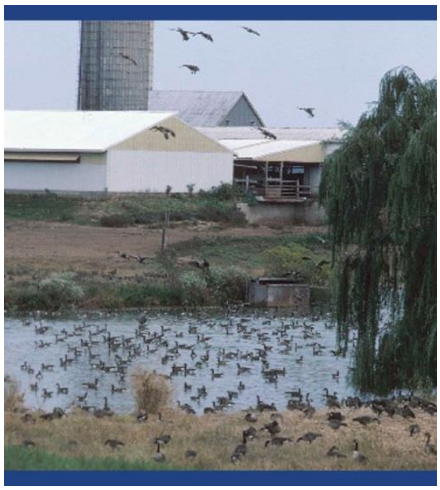
National Animal Health Emergency Management System

FAD PReP/NAHEMS Guidelines: Wildlife Management and Vector Control

For A Foreign Animal Disease Response In Domestic Livestock

1. INTRODUCTION



In order to effectively control, contain, and eradicate a foreign animal disease (FAD) in domestic livestock, the response effort must consider the role that wildlife may play in disease transmission. Wild animals may become exposed to the FAD, serve as a reservoir, or spread the disease to naïve domestic livestock, which may complicate emergency response to the FAD. In the event that wildlife play a role in an FAD outbreak, the Animal and Plant Health Inspection Service (APHIS), will cooperate with Federal, State, and Tribal agencies that have primary jurisdiction over wildlife. For some diseases, the involvement of wildlife in an FAD outbreak may serve as an additional challenge in demonstrating freedom from the disease for purposes of international trade.

These *FAD PReP/NAHEMS Guidelines: Wildlife Management and Vector Control for a Foreign Animal Disease Response in Domestic Livestock (2014)* provide information on the intersection of wildlife and domestic livestock or poultry, specifically during an FAD incident response. This document offers information on APHIS authorities, and the potential significance of wildlife in an FAD outbreak, in terms of epidemiology and international trade. Additionally, it provides general information on the roles and responsibilities of responders within Incident Command during an FAD outbreak in domestic livestock or poultry.

1.1 Purpose, Scope, and Audience

APHIS is authorized by statutory and regulatory authorities (see Section 3) to respond to FADs and other communicable diseases of livestock and poultry; Veterinary Services (VS) would lead the response effort for an FAD incident occurring in domestic livestock. An FAD response will be conducted through a Unified Incident Command, which will include Federal, State, tribal, local, and other responders. This document focuses on the critical activity of wildlife management and vector control in the context of an FAD incident in domestic livestock.

The information in this document is guidance only, and does not provide prescriptive procedures. When planning operations involving wildlife species, it is critical that Incident Command consult with persons having appropriate knowledge and expertise; such individuals should be integrated into the Incident Command structure as required by the specific disease incident. APHIS will work closely with State and Federal agencies and entities with jurisdiction over wildlife in any FAD incident. (Please see Appendix D for a listing of State agencies with jurisdiction over wildlife).

The information provided within this document is only intended to provide responders, at all levels, with a common general understanding of how wildlife management and vector control would be conducted in an

outbreak, offering an overview into wildlife management activities. The information provided in this document is *not* intended to replace personnel with appropriate wildlife related knowledge and expertise; all wildlife management and vector control activities undertaken in an incident should be conducted by skilled and experienced personnel.

1.2 APHIS-Wide Wildlife Management Activities

These *Guidelines* provide a very general overview of the role of wildlife management and vector control in responding to an FAD outbreak in domestic livestock or poultry. Notably, other units in APHIS engage in wildlife disease issues beyond an FAD outbreak in domestic livestock or poultry, for example, those wildlife disease concerns that exist as domestic animal health, captive or zoo animal, public health, or One Health challenges.

Multiple APHIS units, including Wildlife Services, VS, Animal Care, and International Services, all play a role in current wildlife disease activities. Provided as a reference only, the non-exhaustive list below offers a sample of important wildlife-related activities conducted by APHIS units on an ongoing basis that relate to detecting and preventing FAD incidents.

- Surveillance for avian influenza viruses in wild avian populations.
- Surveillance for classical swine fever (CSF) and influenza in feral swine.
- Research on avian influenza transmission, including in wild avian species.
- Collaboration on capacity building, outreach, and training in areas where highly pathogenic avian influenza (HPAI) is endemic.
- Collaboration on training, surveillance, and eradication in countries where CSF is endemic in both wild and domestic pig populations.
- Cooperation on preventing foot-and-mouth disease (FMD) intrusion in the United States through import regulations and training activities, considering the role wildlife may play; technical assistance to other countries with ongoing outbreaks.
- Provide laboratory expertise on FADs, including those that impact wildlife populations, through the National Veterinary Services Laboratories.
- Provide diagnostic and conduct research on preventing disease spread in wildlife, by the National Wildlife Research Center, operated by APHIS Wildlife Services.
- Regulation of the standards of care and treatment for captive wildlife that are exhibited, bred, used in biomedical research, or transported commercially, by Animal Care, under the Animal Welfare Act.
- Plan for a response to FADs, including HPAI and FMD, in zoo populations through the development of written response plans and procedures by Animal Care.

Additional information on wildlife responsibilities and plans of APHIS Wildlife Services, can be found at http://www.aphis.usda.gov/wps/portal/aphis/ourfocus/wildlifedamage.

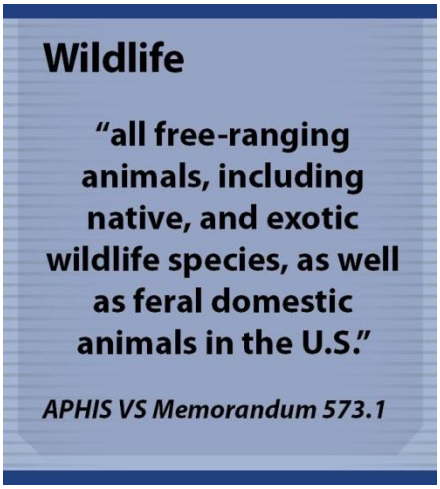
For more information on APHIS Animal Care, the Animal Welfare Act, and guidance for captive wildlife, go to: http://www.aphis.usda.gov/wps/portal/aphis/ourfocus/animalwelfare.

Information on APHIS International Services can be found at http://www.aphis.usda.gov/wps/portal/aphis/ourfocus/internationalservices.APHIS will collaborate with other Federal and State agencies which have primary jurisdictional authority over wildlife on issues of shared interest.

1.3 Foreign Animal Disease Preparedness and Response Plan (FAD PReP)

These *Guidelines* focus on FAD response, as part of FAD PReP. For more information on disease-specific response for foreign animal diseases, please see the *Foot-and-Mouth Disease (FMD), Newcastle Disease (vNDV), Classical Swine Fever (CSF), and Highly Pathogenic Avian Influenza (HPAI) Response Plans: The Red Books* (USDA APHIS). For more information on the need for FAD preparedness and response, and the documents which are part of FAD PReP, please see Appendix A.

2. DEFINITIONS



A wild animal, as defined by the World Organization for Animal Health (OIE) in the *2014 Terrestrial Animal Health Code*, is "an animal that has a phenotype unaffected by human selection and lives independent of direct human supervision or control." The use of the term "wildlife" for these guidelines is further defined as "all free-ranging animals, including native and exotic wildlife species, as well as feral domestic animals" in the United States (APHIS VS Memorandum 573.1). This definition does not include privately-owned captive wildlife, whether native or exotic, nor does it include zoological collections, which are defined as captive animals.[1]

This document focuses on situations involving wild mammals (e.g., ungulates, carnivores, and rodents) and birds (e.g., waterfowl); these species are most likely to have important implications for disease transmission in an FAD outbreak. In these situations susceptible wild animal species may become infected, serve as a reservoir, or further spread the pathogen to domestic livestock or poultry. Terms describing these modes of involvement are defined below; additional definitions are offered in the Glossary.

- **Feral:** domestic animals (e.g., cats, horses, pigs) that are not confined or under control.
- **Wildlife reservoir:** any population of free-ranging or free-living species in which an infectious agent/vector has become established, lives and multiplies and is therefore a potential source of infection/infestation to other domestic and free ranging species; VS recognizes that the initial source of infection of a wildlife reservoir may be an agricultural animal population (VS Memo 573.1).
- **Vector:** any living organism, including, but not limited to arthropods, rodents, and scavengers, that can carry disease causing agents from an infected animal to a susceptible animal, either biologically (e.g., an arthropod bite) or mechanically (e.g., carrying microorganisms on the body, such as feet or fur).
  - **Biological transmission:** transfer of a disease agent from a host to a susceptible animal after the pathogen has undergone some part of its life cycle within the host (e.g., mosquito, feral swine).
  - **Mechanical transmission:** transfer of a disease agent to a susceptible animal via external body parts of a host species; the pathogen does not undergo any development or multiplication while on the host species (e.g., flies).

[1] APHIS acknowledges the risk that an FAD in captive wildlife, including zoo animals, may pose to domestic livestock. However, this document focuses on free-ranging wildlife and feral animals in FAD responses. APHIS Animal Care will continue to work with state and local representatives, subject matter experts, and stakeholders to develop guidelines specific to captive wildlife. APHIS also supports surveillance for specific diseases in captive wildlife populations.

3. USDA APHIS AUTHORITIES FOR RESPONDING TO AN FAD OUTBREAK IN DOMESTIC LIVESTOCK

3.1 Introduction

The Code of Laws of the United States of America (U.S.C.) and the Code of Federal Regulations (CFR) are codified authorities representing different stages of the legislative process. The U.S.C. provides the general and permanent statutes of the United States, which are passed by Congress and signed by the President. Executive branch agencies then interpret the U.S.C., developing detailed regulations in the CFR. The CFR is developed through a public rulemaking process, where the public is allowed to comment. For more information, please see the *APHIS Foreign Animal Disease Framework: Roles and Coordination* (FAD PReP Manual 1-0).

In an FAD incident and coordinated response, the U.S.C. and CFR provide policy for the USDA, via statutes and regulations; interim regulations can be implemented—in the event of an outbreak—to prevent the spread of disease.

3.2 Foreign Animal Diseases, Emerging Diseases, and Wildlife

An FAD is a terrestrial animal disease or pest, or an aquatic animal disease or pest, not known to exist in the United States or its territories. An emerging animal disease may be any terrestrial animal, aquatic animal, or zoonotic disease not yet known or characterized, or any known or characterized terrestrial animal or aquatic animal disease, in the United States or its territories, that changes or mutates in pathogenicity, communicability, or zoonotic potential to become a threat to terrestrial animals, aquatic animals, or humans. An FAD or emerging animal disease may involve livestock, poultry, other animals, and/or wildlife.

In the event of an FAD or emerging animal disease outbreak in domestic livestock that involves wildlife, USDA APHIS will work in close collaboration, communication, and coordination with State, Tribal and Federal wildlife agencies that have primary jurisdictional authority and subject matter expertise for wildlife.

For information on the procedures for an FAD investigation and specimen submission, including for Foreign Animal Disease Diagnosticians, please see VS Guidance Document 12001 (previously APHIS VS Memorandum 580.4) and the *Foreign Animal Disease Investigation Manual* (FAD PReP Manual 4-0).

Additionally, the National Response Framework (NRF) also directs that the USDA is the coordinating agency for Emergency Support Function (ESF) #11—Agriculture and Natural Resources (ESF 11—Agriculture and Natural Resources Annex, 2013).

3.3 Animal Health Protection Act

APHIS receives its permanent and general regulatory authority from the Animal Health Protection Act (AHPA), 7 U.S.C. 8301 et seq.

The AHPA enables the Secretary of Agriculture to prevent, detect, control, and eradicate diseases and pests of animals, including foreign animal and emerging diseases, in order to protect animal health, the health and welfare of people, economic interests of livestock and related industries, the environment, and interstate and foreign commerce in animals and other articles. The term "animal" means any member of the animal kingdom (except a human), 7 U.S.C. 8301-8302. The Secretary is specifically authorized to carry out operations and measures to detect, control, or eradicate any pest or disease of livestock, which includes poultry, 7 U.S.C. 8308, and to promulgate regulations and issue orders to carry out the AHPA (7 U.S.C. 8315). The Secretary may also prohibit or restrict the importation, entry, or interstate movement of any animal, article, or means of conveyance to prevent the introduction into or dissemination within the United States of any pest or disease of livestock (7 U.S.C. 8303-8305).

Section 421 of the Homeland Security Act, 6 U.S.C. 231, transferred to the Secretary of Homeland Security certain agricultural import and entry inspection functions under the AHPA, including the authority to enforce the prohibitions or restrictions imposed by USDA.

The AHPA also provides the Secretary of Agriculture authority to cooperate with other Federal agencies, States, or political subdivisions of States, national or local governments of foreign countries, domestic or international organizations or associations, Indian Tribes, and other persons to prevent, detect, or control animal diseases (7 U.S.C. 8310).

3.4 Code of Federal Regulations

Title 9 of the CFR provides detailed USDA APHIS administrative regulations for the control and eradication of animal diseases, including FADs and emerging animal diseases. Below are several key sections of the CFR to safeguard public health, animal health, animal products, interstate commerce, and international trade.[2] Please refer to the *APHIS Foreign Animal Disease Framework: Roles and Coordination* (FAD PReP Manual 1-0) for more information:

- **9 CFR 71.2**
  - Secretary (of Agriculture) to Issue Rule Governing Quarantine and Interstate Movement of Diseased Animals, Including Poultry
- **9 CFR 71.3**
  - Interstate Movement of Diseased Animals and Poultry Generally Prohibited
- **9 CFR 53**
  - Foot-and-Mouth Disease, Pleuropneumonia, Rinderpest, and Certain Other Communicable Diseases of Livestock or Poultry
- **9 CFR 161**
  - Requirements and Standards for Accredited Veterinarians and Suspension or Revocation of Such Accreditation.

3.5 Policy Guidance for Veterinary Services

Following the statutory authorities and codified regulation, additional policy guidance has been developed regarding the role of APHIS VS in emergency response relating to wildlife within an FAD response in domestic animals. This section briefly discusses that guidance; it is specific to VS, because the policy guidance is a VS Memorandum.

3.5.1 VS Memorandum 573.1

VS Memorandum 573.1 (September 2008) "USDA, APHIS, VS Animal Health Policy in Relation to Wildlife" also provides guidance specifically for VS in the event of an FAD outbreak in domestic livestock that has a wildlife component, given the authority granted to APHIS under the AHPA. In any FAD outbreak in domestic livestock that involves wildlife, VS will work collaboratively with Federal, State, and Tribal wildlife entities to respond to the outbreak, recognizing that these agencies have primary authority and responsibility for managing free-ranging wildlife.

As specified in VS Memo 573.1, emergency management plans for FAD outbreak response should address the eradication of the FAD from affected wildlife. "In cases where VS policy supports eradication of an infectious agent/disease/vector, VS will seek measures, through (1) movement and testing requirements; (2) herd plans; and (3) emergency response plans to keep wildlife and livestock apart and to eradicate the disease from all potential reservoirs when eradication is deemed technically feasible" (VS Memo 573.1).

[2] Interstate is defined in 9 CFR 71.1 as follows: From one State into or through any other State.

Additionally, if eradication is not technically feasible, measures must be taken to keep wildlife separate from domestic livestock until there are improved mechanisms to eliminate the disease from wildlife populations.

As stated in the Memo, "VS recognizes that State fish and wildlife management agencies have primary authority and responsibility for managing free-ranging wildlife." However, "VS has statutory authority in the AHPA to implement disease control and/or eradication actions for wildlife under certain conditions." However, should wildlife be affected by the control and eradication measures proposed by the Secretary of Agriculture—including in an extraordinary emergency—"the Secretary will consult with the State agency having authority for protection and management of such wildlife."

Efforts to prevent, control, or eliminate transmission of infectious agents/diseases/vectors between animal agriculture populations and wildlife requires collaborative relationships between agencies. Such a relationship will be mutually beneficial for animal health, wildlife health, public health, and to overall FAD response objectives.

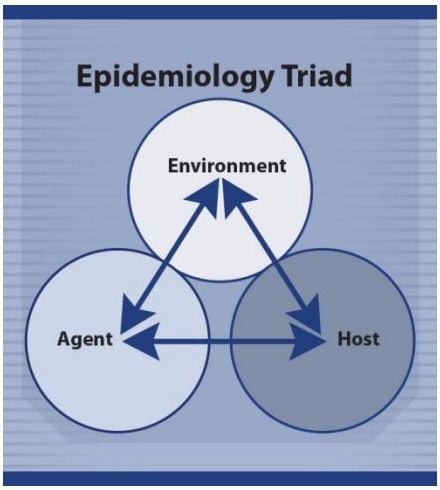
"VS managers and employees should use these resources to build communication channels with wildlife agencies and professions to develop measures that reduce risks of disease transmission. In addition, VS managers must contact their respective wildlife managers within States to develop and maintain effective working relationships."

4. RELEVANCE OF WILDLIFE IN AN FAD OUTBREAK IN DOMESTIC LIVESTOCK OR POULTRY

Wildlife species can be susceptible to many of the FADs that affect domestic livestock. For example, feral swine are susceptible to and can serve as a reservoir of classical swine fever and African swine fever viruses. Wild birds, particularly wild waterfowl, can serve as reservoirs for HPAI and virulent Newcastle disease (vNDV) (Siembieda 2011). This susceptibility can contribute to the epidemiology of the outbreak as well as have implications on the international trade of domestic livestock or poultry.

4.1 Epidemiological Considerations

The epidemiology of any infectious disease involves the complex interaction between factors of the host, disease agent and environment. These factors further impact the distribution of the disease within a population. This is also true for wildlife involvement in FAD outbreaks of livestock and poultry. The interaction of these factors determines characteristics of the disease outbreak. Therefore, epidemiological parameters and considerations will need to be evaluated for an FAD situation involving wildlife species.



These may include the following:

- **Agent factors:** host range, environmental resistance, tissue affinity, dose, mode of transmission
- **Host factors:** species, breed, age, nutritional status, immune status
- **Environment factors:** husbandry, housing, climate/season, presence of vectors.

The role of wild or feral animals in the epidemiology of the disease should be immediately assessed in an FAD response. In some diseases, wild animals may act as a reservoir for the disease and be a threat for the transmission of the FAD to domestic livestock. However, in other diseases, wildlife may simply be a reflection that the disease is already occurring in the

domestic livestock in the area. It is critically important to assess the role of wildlife in an FAD outbreak response in order to identify and evaluate the best options for mitigating the role of wildlife related disease spread and transmission of an FAD pathogen to domestic livestock.

Surveillance, epidemiology, and tracing techniques will be employed in an FAD outbreak to:

- Detect new and existing cases (animals or premises).
- Understand characteristics of the disease (e.g., clinical signs, incubation period, populations affected) and outbreak characteristics (e.g., sources, disease incidence patterns, geographic distribution, transmission dynamics, and reservoirs) and how they affect specific populations.
- Identify risk factors associated with disease occurrence (e.g., age, production practices, species, wildlife, vectors).
- Provide information for decision-making to design and implement control measures against the disease being targeted, such as designation of zones for disease control procedures.
- Evaluate the effectiveness of the control measures implemented and adjust them as the situation dictates.

Table 1 lists selected, key diseases that affect both wildlife and livestock, as well as the potential wildlife reservoirs and susceptible domestic livestock species. This list of diseases is based on that found in the *APHIS FAD Framework: Response Strategies* (FAD PReP Manual 2-0). The various modes of disease transmission for these agents are also listed. This table is not all inclusive, though it does include many high priority FADs.

For more information on epidemiology during an FAD situation, see the *FAD PReP/NAHEMS Guidelines: Surveillance, Epidemiology, and Tracing.*

Table 1: Species Susceptibility and Transmission of Select Livestock and Wildlife Diseases, Including High Priority FAD Agents

Disease	Relevant Wildlife in the U.S.						Domestic Animal Populations									Transmission Route					Zoonotic
	Bird	Bison/ Pronghorn	Cervids	Equids	Swine	Rodent/ Rabbit	Cat	Cattle	Dog	Domestic Cervids	Equids	Pig	Poultry	Goat	Sheep	Direct Contact	Indirect/ Fomites	Ingestion	Inhaled/ Aerosol	Vector-borne	
African horse sickness				■					■		■							■		■	No
African swine fever					■							■				■	■			■	No
Akabane								■						■	■					■	No
Avian influenza	■			■	■		■		■		■	■	■			■	■	■	■		Yes
Bovine babesiosis (cattle fever)		■	■					■		■										■	Yes
Classical swine fever					■							■				■	■	■			No
Contagious bovine pleuropneumonia		■						■											■		No
Contagious caprine pleuropneumonia														■					■		No
Dourine				■							■					■					No
Equine piroplasmosis				■							■						■			■	No
Foot-and-mouth disease		■	■		■	■		■		■		■		■	■	■	■	■	■		No
Glanders				■			■		■		■			■	■	■	■	■	■		Yes
Heartwater		■	■					■		■				■	■					■	No
Hendra				■							■						■	■	■		Yes
Japanese encephalitis	■			■	■						■	■								■	Yes
Lumpy skin disease		■						■								■				■	No
Nairobi Sheep disease														■	■					■	Yes
Newcastle disease (virulent)	■												■			■	■	■	■		Yes
Nipah					■		■		■		■	■		■	■	■	■	■	■		Yes
Peste de petits ruminants			■							■				■	■	■	■	■	■		No
Rabbit hemorrhagic disease						■										■	■				No
Rift Valley fever		■	■	■		■	■	■	■		■			■	■	■	■		■	■	Yes
Schmallenberg								■	■					■	■					■	No
Screwworm myiasis	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■					■	Yes
Sheep pox/goat pox														■	■	■	■		■	■	No
Surra		■	■	■	■	■	■	■	■	■	■	■		■	■			■		■	No
Swine vesicular disease					■							■				■	■	■			Yes
(Tropical) Theileriosis		■						■						■	■					■	No
Venezuelan equine encephalitis	■			■		■					■									■	Yes
Vesicular stomatitis		■	■	■	■	■		■		■	■	■		■	■	■	■			■	Yes

Source: OIE Manual for Diagnostic Tests and Vaccines for Terrestrial Animals; CFSPH Technical Fact Sheets; Foreign Animal Diseases (Gray Book) and the Merck Veterinary Manual; Subject matter expert review; scientific literature.

■ Susceptible

□ Unknown susceptibility or non-susceptible

4.2 Ecological Factors Influencing Role of Wildlife in an FAD Outbreak

There are a number of ecological factors that will affect the role that wildlife play in an FAD outbreak in domestic livestock. Many of these factors will affect the transmission, rate of spread and maintenance of disease within a population. These factors are listed in Table 2.

Table 2: Factors Influencing Wildlife Involvement in an FAD Outbreak

Factor	Description
Population distribution and density	These factors affect the amount of interaction between wildlife and domestic animals. Disease transmission is facilitated at higher densities; distribution of wildlife can help to determine where a disease is likely to occur (i.e., are there isolated populations?).
Habitat requirements and availability	Wildlife typically have specific habitat requirements, which will vary based on animal density of populations, including those of competing species. Habitat will influence the spread and maintenance of disease agents.
Social organization	Wildlife may live in herds or as solitary animals; this behavior may affect the ability to transmit and detect disease within a population. Breeding season can also impact disease transmission and epidemiology.
Reproductive status and seasonality	Breeding and other seasonal behaviors may lead to change in the size of the home range as well as the density and distribution of the wildlife population.
Age structure of population	Age structure can affect a wildlife population's immune status and susceptibility to a specific agent.
Home-range size	This can affect the geographical area in which a disease can potentially be spread by wildlife.
Movements and distances travelled	Large variations can exist in the movement and distances travelled by wildlife species depending upon the time of year, availability of mates or food, etc. This can impact the spatial transmission of the FAD.
Barriers to dispersal	Artificial and natural barriers can restrict dispersal, thereby mitigating disease spread. This factor can be leveraged during disease response operations.
Response to disturbances	In some cases, wildlife may leave areas where response operations are taking place; this could potentially disperse the disease agent or alternatively improve the buffer between wildlife and domestic animal populations.
Interactions between wildlife and domestic animals	Some wildlife species and domestic animals may have common day-to-day interactions, including at a watering point, shade area, or feeding grounds.

Adapted from AUSVET: Operational Procedures Manual Wild Animal Response Strategy (2011).

There is a significant amount of variation across the United States in terms of distribution, density, and habitats of wildlife species. Wild animals can be difficult to manage. Some species can avoid detection, relocate to inaccessible areas, and rapidly repopulate. Different FADs will have different consequences on wildlife populations.

4.3 International Trade Implications

In addition to the epidemiological implications of wildlife as a factor that may often need to be considered in the control and eradication of an FAD, there may also be international trade implications depending on whether or not wildlife are affected. For certain disease agents, the World Organization for Animal Health (OIE) *Terrestrial Animal Health Code (2014)* distinguishes between infection in wildlife and infection in domestic livestock for purposes of international trade. The OIE policy on diseases which may involve both wildlife and domestic livestock distinguishes whether or not the wild species plays an epidemiologically significant role in the transmission and maintenance of the disease agent in the domestic livestock population. Importing countries may or may not follow the OIE guidelines for trade in animals or their products in the event of an FAD event in an exporting country.

In the case of some FADs, the natural reservoir for infection may be in a wild animal or wild bird population. Although wildlife may be affected, or be the reservoir of the pathogen, it does not necessarily mean that domestic livestock for that country, region, or zone is also affected. Nevertheless, in the longer-term, the existence of the FAD in a wildlife population can make it more difficult to demonstrate disease-freedom. Negotiations to maintain or to resume trade in animals and animal products between trading partners will often occur on a case-by-case basis and will depend on the ability of an affected country to clearly show control and containment of the FAD. Table 3 lists three example disease agents and provides information on how the *Terrestrial Animal Health Code* distinguishes between infection in wildlife and domestic livestock. For other diseases not found in Table 1, readers should refer to the *Terrestrial Animal Health Code* for information on requirements for disease freedom: www.oie.int.

Table 3: International Trade Implications of FAD Detection for Selected Agents

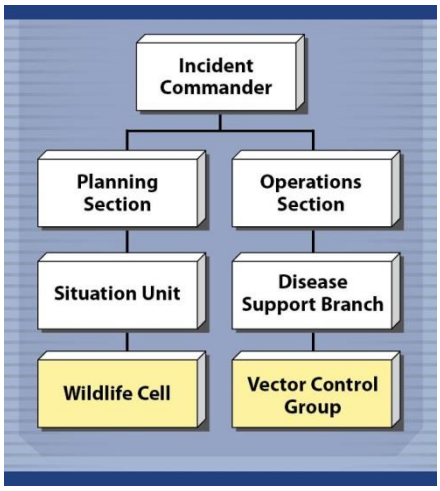
Differentiation Exists between Wildlife and Domestic Animals for Purposes of International Trade	
Disease	**Language from OIE Terrestrial Animal Health Code (2014)**
Highly Pathogenic Avian Influenza (HPAI)	Article 10.4.1: "Infection with influenza A viruses of high pathogenicity in birds other than poultry, including wild birds, should be notified according to Article 1.1.3. However, a Member Country should not impose bans on the trade in poultry commodities in response to such a notification, or other information on the presence of any influenza A virus in birds other than poultry, including wild birds.
Virulent Newcastle Disease Virus (vNDV)	Article 10.9.1 "A Member should not impose bans on the trade in poultry commodities in response to information on the presence of any APMV-1 in birds other than poultry, including wild birds."
Classical Swine Fever (CSF)	Article 15.2.1 "A Member Country should not impose bans on the trade in commodities of domestic and captive wild pigs in response to a notification of infection with CSFV in wild and feral pigs provided that Article 15.2.2 is implemented."

5. ROLES AND RESPONSIBILITIES IN AN FAD OUTBREAK

5.1 Incident Command System (ICS)/National Incident Management System

In an FAD outbreak in domestic livestock, an Incident Command would be established to manage the incident. APHIS will work in a Unified Command with other Federal and State agencies. For more information on ICS and APHIS Incident Management, please see the *APHIS Foreign Animal Disease Framework: Roles and Coordination* (FAD PReP Manual 1-0). Please note, ICS is flexible and scalable to all types of incidents.

A sample organizational chart for an animal disease emergency is found in Appendix B; this chart is only an example, additional positions, groups, or cells may be required depending on the incident. To the right is a condensed and example inset of this organizational chart, showing the Wildlife Cell (part of the Situation Unit in the Planning Section) and the Vector Control Group (part of the Disease Support Branch in the Operations Section). The Wildlife Cell will be comprised of individuals with relevant expertise and knowledge in managing disease in wildlife populations; in a Unified Command, this may include personnel from APHIS, as well as from other State or Federal agencies with primary jurisdiction or subject matter expertise. Please see Section 5.1.1 for more information.



This figure is only an example, in an actual event, the organizational structure may vary within this framework.

The Wildlife Cell and Vector Control Group would be important in leading wildlife management and vector control activities in the event of an FAD outbreak. Together, the Planning Section and Operation Section will coordinate wildlife management and vector control activities with other ICS Groups and Units (and their associated functions) in an outbreak. For example, activities such as biosecurity, surveillance, or cleaning and disinfection would be coordinated across Groups and Units, led by Incident Command.

Activities related to wildlife will be conducted in collaboration with Federal, State and Tribal wildlife agencies in a Unified Incident Command structure, including APHIS VS, APHIS Wildlife Services, other APHIS units, and the U.S. Department of Interior. Activities will be conducted in accordance with relevant Federal, State, and local laws. All operational wildlife management and vector control activities undertaken in an incident should be conducted by skilled and experienced personnel.

5.1.1 Personnel in the Wildlife Cell and Vector Control Group

Within the Wildlife Cell and Vector Control Group there will be different positions based on function and responsibility. The number of personnel in the Cell and Group will vary depending on the size and the scope of incident, but may also include one or more team leaders (supervising on-site activities or functions) with associated team members (conducting on-site activities or functions), who may also be technical specialists in specific areas in wildlife management, including personnel with experience handling wildlife. All operational/field personnel within the Unified Incident Command will be required to have the skills and experience to conduct wildlife-related activities.

5.1.2 Example Objectives of the Wildlife Cell and Vector Control Group in Incident Command

When wildlife are an important consideration in an FAD response in domestic livestock, the Wildlife Cell (Planning Section) and the Vector Control Group (Operations Section) will work to prevent the transmission

of the FAD between domestic animals and wildlife. Personnel may either supervise or perform wildlife management and vector control procedures for the response. Objectives of the Wildlife Cell and Vector Control Group include protecting both domestic animals and wildlife through prompt disease control, containment, and eradication. Tasks involved in achieving this goal may include—but are not limited to—the following:

- Assessing the presence of susceptible wildlife in the affected areas.
- Assessing the potential for spread of the disease agent to or by wildlife.
- Determining if infection has occurred in wildlife species.
- Determining wildlife surveillance measures and protocols needed.
- Determining if disease control within wildlife is necessary.
- Implementing management and control measures to prevent the spread of disease from wildlife to livestock.

In many cases, wildlife activities require personnel specifically trained in wildlife health; operational wildlife management activities should only be conducted by trained and experienced personnel.

5.2 Role of APHIS Wildlife Services

APHIS Wildlife Services will coordinate with VS and other Federal and State partners in the event that wildlife are involved in an FAD outbreak. Within Wildlife Services, the Surveillance and Emergency Response System (SERS) of the National Wildlife Disease Program (NWDP), serves as the primary emergency response contact point within APHIS. SERS has a cadre of wildlife biologists who are prepared to be mobilized within 24–48 hours of a request. SERS biologists have extensive Incident Command System training, current medical clearances for personal protective equipment and have participated in emergency response scenario drills. Selections for requested Incident Response Teams (IRT) depend on the specifics of the request (e.g., immobilization, depopulation) and the number of people needed. For more information go to http://www.aphis.usda.gov/wildlife_damage/nwdp/ER.shtml. Additionally, the National Wildlife Research Center may provide diagnostic capacity for wildlife testing.

5.3 Role of Livestock Owners and Producers

Livestock owners have an important role in protecting their herds and flocks from wildlife, both to prevent the introduction of diseases into domestic livestock as well as to prevent the spread of disease to wildlife, should their livestock or flocks by affected by an FAD. For example, fencing may create a buffer between livestock herds and wildlife populations. For diseases like HPAI and vNDV, wire netting and sealing entry points may also prevent direct contact between domestic and wild birds.

Multiple resources are available for owners and producers to learn more about the steps they can take to protect their herds and flocks, as well as learn about the common signs for different FADs to help with rapid detection.

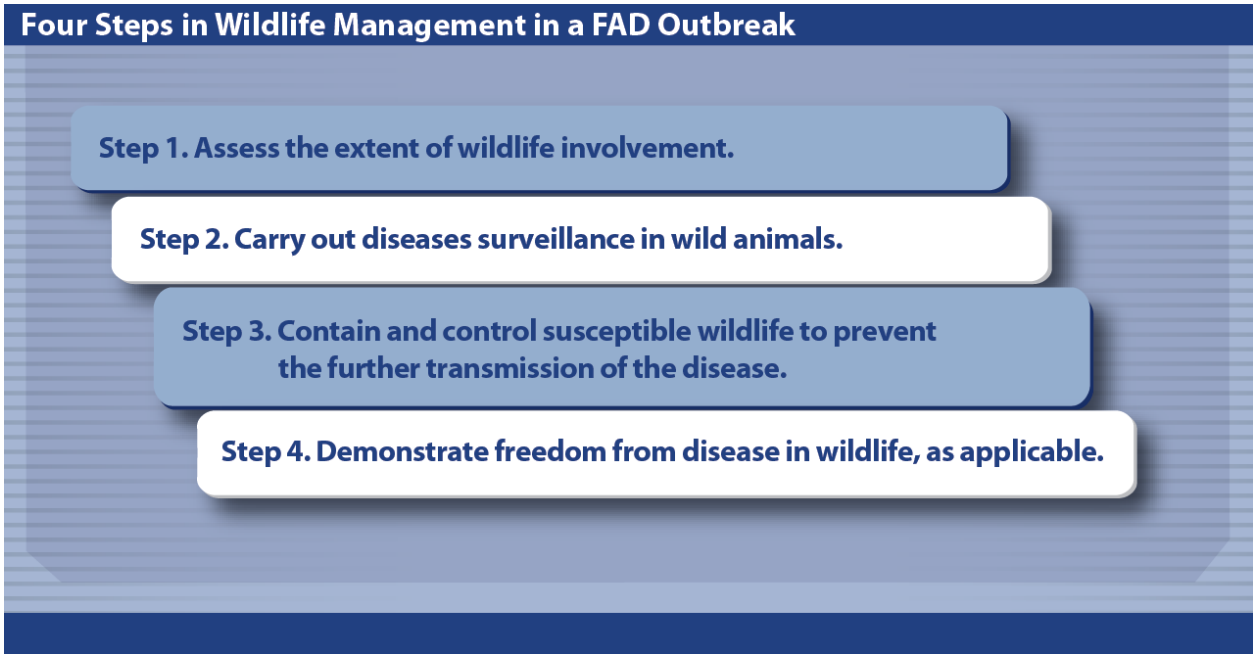
- Biosecurity for the Birds resources: http://healthybirds.aphis.usda.gov
- Center for Food Security and Public Health (CFSPH) resources: Disease factsheets and disease prevention practices handouts: http://www.cfsph.iastate.edu
- *FAD PReP/NAHEMS Guidelines: Biosecurity*: http://www.aphis.usda.gov/fadprep.
- USDA APHIS Wildlife Services: http://www.aphis.usda.gov/wildlife_damage/index.shtml

6. WILDLIFE MANAGEMENT IN AN FAD OUTBREAK IN DOMESTIC LIVESTOCK

This section provides general information on wildlife management for an FAD outbreak in domestic livestock. It is not intended to be prescriptive or to provide procedural direction to personnel performing wildlife management activities.

This section reviews how wildlife involvement will be assessed, how a wildlife management plan will be developed, and the various activities that may occur during wildlife management in an FAD outbreak. Many activities will be competing for resources in the event of an FAD outbreak, and many activities will need to be ongoing simultaneously in order for effective control, containment, and eradication of the disease. Wildlife management and control measures may have varying feasibility, and the likelihood of their success will depend on the species involved, animal density, geographic distribution, topography, and the practicality of needed measures. Again, in an FAD outbreak in domestic livestock, APHIS will coordinate with agencies that have primary jurisdiction over wildlife in a Unified Command, some of which have specific response guidance of how to manage various disease agents in wildlife.

The management of wildlife species during an FAD outbreak of livestock or poultry will involve four steps (adapted from AUSVET, 2011). The extent to which activities will be carried out under each of these four steps will depend on the specific outbreak situation; the order of the steps may be changed, and activities may occur simultaneously.

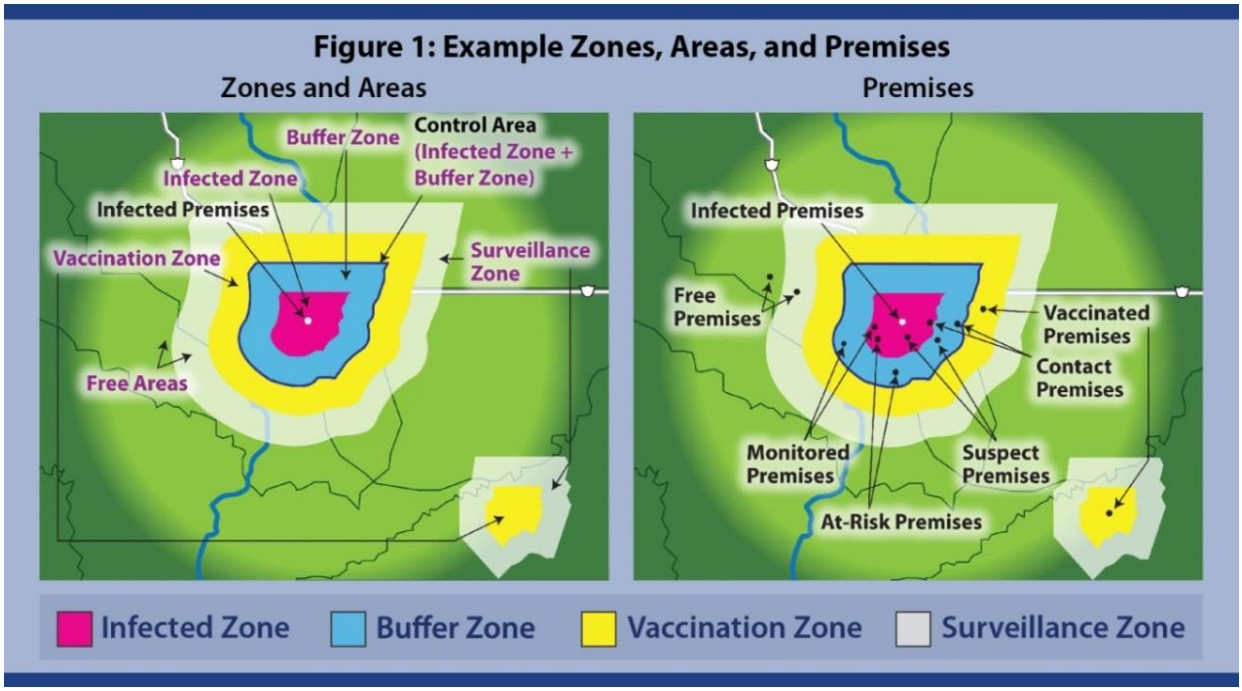


6.1. Assessment of Wildlife Involvement

6.1.1 Zone, Area, and Premises Designations

Initially, the epidemiological situation will need to be assessed by the Planning Section and Operations Section to determine the level of risk of infection and transmission of the targeted pathogen by wildlife, particularly in the regulatory Control Area surrounding an Infected Premises.

Figure 1 illustrates all the zones, areas, and premises designations to be used in an FAD outbreak. Additional information on defining the Control Area can be found in the *FAD PReP/NAHEMS Guidelines: Surveillance, Epidemiology, and Tracing.*



6.1.2 Wildlife Assessment Parameters

Epidemiologists will need to quickly assess which wildlife species exist in the Control Area and determine whether they are infected with the FAD or pose a risk for disease transmission to domestic animals. Frequently, response activities may need to be conducted without spending a significant amount of time assessing the situation.

Many factors will be considered by epidemiologists and Incident Command, including which wildlife species are present, the susceptibility of the wildlife species to the FAD, their potential to spread the disease agent, and the level or likelihood of exposure and interaction between wildlife and domestic livestock. Table 4 lists key assessment parameters that will be considered to better understand the role of wildlife in the FAD outbreak.

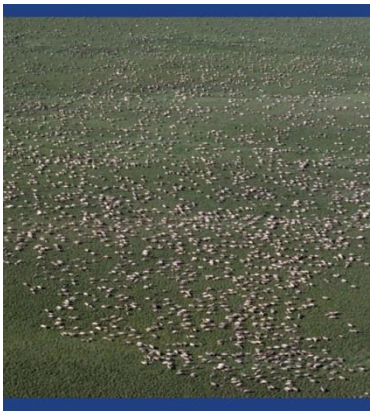
In a rapidly-moving incident, this assessment does not need to be formalized, and can be conducted rapidly, based on the best epidemiological information that is currently available. As the outbreak continues, additional assessment may occur. The extent of the wildlife assessment which occurs prior to commencing or conducting response activities will be at the Incident Command's discretion; response activities may change or evolve as new information becomes available.

Table 4: Wildlife Assessment Parameters	
Parameter	**Description**
Disease description	Scientific information relating to the disease agent, transmission (including airborne and vector), etiology, geographic distribution, clinical signs, persistence in the environment, etc. Relevant laboratory assays should also be identified.
Susceptible species	Wildlife species that are susceptible; identification of mechanical and biological vectors as well as reservoirs.
Wildlife species present	Distribution and population size of wildlife species present, as available. Home range, social organization, and movement patterns should be considered.
Habitat and land use	Information on the land use and habitat in and surrounding the Control Area. May include natural barriers for wildlife, as well as topographical features and shared space between livestock and wildlife.
Potential risk for exposure	Risk of interaction of wildlife and domestic livestock, given movement patterns, distribution, population, husbandry practices of involved domestic species, and other factors.

Based on this assessment, mitigation strategies can be developed. If wildlife populations are determined to be infected or otherwise pose a biological risk for transmission to domestic animals, appropriate wildlife management principles will be applied to reduce exposure of wildlife to livestock. If wildlife populations are determined not to be infected or a biological risk for transmission, wildlife management tools will be implemented to keep wildlife populations from acting as mechanical vectors.

> The susceptibility of many wildlife species in the United States to many FADs is not well understood; in an FAD outbreak, a Unified Incident Command, working with agencies that have primary jurisdiction over wildlife, will need to work together to assess the possible involvement of wildlife species.

6.1.2 Wildlife Population Data



Collecting data to assess the distribution, density, and involvement of wildlife in an FAD outbreak may be difficult. There may be multiple sources of information; different data sources have different advantages and disadvantages. Appropriate sources will have to be determined depending on the risk of wildlife transmitting the disease and resource considerations. The list below provides brief descriptions of different ways that wildlife data can be obtained in an FAD outbreak. Existing local knowledge from farmers, ranchers, hunters, wildlife biologists, and others familiar with the area and wildlife should be leveraged. Local knowledge will often be most useful in defining the distribution of the wildlife species.

- **Population surveys:** This data may already be available from local or State wildlife agencies. The information may help to determine the size and location of wildlife populations.
- **Visual inspection:** This method can be used to find evidence of sick or dead animals. It may involve different types of surveying techniques.

  - **Ground surveys:** This methodology may involve spotlight and day counts, trapping, and indirect detection (e.g., looking for dens or tracks). It can be time consuming, but may be useful in obtaining initial information about targeted susceptible species. This method should be followed up with another method.
  - **Aerial surveys:** This methodology is often conducted by helicopter or airplane, and works best for larger species. It can be expensive, and counting the animals themselves may not be practical.

- **Local reports/knowledge:** Often local knowledge and reports are an important resource for obtaining information on normal or abnormal characteristics of wild animals in the area, including wildlife morbidity and mortality. These reports may originate from land managers, wildlife biologists, hunters, and others.
- **Carcasses:** Wildlife carcasses can be a useful source of information, and necropsies may be possible if carcasses are located rapidly after death. Carcasses may come from hunters and trappers, sharp shooters, carcass searches, and road-kill surveillance; these methods should be applied as determined appropriate by the Incident Command for the situation.
- **Live animal capture:** Another means of obtaining wildlife populations data can be through the use of live animal capture. This method can also be used to determine disease status. In some instances, the capture of live animals may not be desirable or practical.
- **Sentinels:** Sentinel animals, placed deliberately in an environment to detect the presence of the disease, may be used in limited and specific circumstances, as determined by the Incident Command.

Table 5 offers a comparison of the advantages and disadvantages of these various methods of collecting information on wildlife populations.

Table 5: Comparison of Various Sources of Information for Population Data

Data Sources	Advantages	Disadvantages
Aerial Surveys	• Rapid, quickly completed • Useful for tough or inaccessible terrain • Cost effective for survey of large areas	• Counting can be difficult and impractical • Often provides underestimate due to visibility bias • Requires trained/experienced observers • Costly
Carcass Searches	• Useful for small geographic areas where wildlife collections cannot be conducted	• Labor intensive • Most go undetected due to few individuals; may occur in areas of low human density, or quickly become unavailable for sampling due to predation, scavenging, or rapid autolysis
Free Feeding	• Ability to select particular species according to bait	• Only for use as crude estimate, requires investigative follow-up • Bait-shy animals undetected
Ground Surveys	• Useful for disease sampling and population reduction • Less expensive	• Highly variable outcomes and accuracy • Wildlife tend to hide impairments • Time consuming • Requires follow up methods

Table 5: Comparison of Various Sources of Information for Population Data		
Data Sources	**Advantages**	**Disadvantages**
Hunter/Trapper Harvested Submissions	• Practical • Cost effective • Minimal disturbance • Reduced risk of dispersal of animals	• Subject to bias: hunting regulations, animal accessibility and selection • Success dependent upon habitat/ terrain
Live Animal Capture	• Most efficient for determining disease status of free ranging animals and shy animals	• Labor intensive • Does not represent random sample of population • Sick animals unlikely to be trapped • May require diagnostic testing for diseases without external manifestations • Increased risk of animal death due to capture and handling
Local Reports/ Knowledge	• Helpful for getting a sense for what is normal	• Only for use as crude estimate, requires investigative follow-up
Population Surveys	• Information may be available from reporting systems or control programs • Establishes size, location, and type of response needed • Helps determine resource requirements, transmission risk, and appropriate disease strategy	• Time and resources requirements, depending on size of population survey
Road-kill Surveillance	• Easily accessible	• Supplemental only • Requires skilled personnel • Subject to weather
Sentinels	• Easily accessible	• Could potentially introduce disease into the endemic wildlife
Sharp Shooters	• Easily mobilized • Can obtain difficult to find animals	• Costly • Requires skilled or trained personnel
Behavioral Signs (tracks, markings, etc.).	• Various methodologies available • Can be done in difficult terrain • Can monitor multiple species • Flexible sampling schedule	• Only for use as crude estimate, requires investigative follow-up • Bait-shy animals undetected • Potential for interference (trampling from vehicles, humans…)

6.2 Disease Surveillance in a Wildlife Population

Based on the assessment of the wildlife population, disease surveillance—potentially including both visual surveillance and/or diagnostic testing—may be necessary. Surveillance of wildlife will be based on the prevailing local circumstances of the outbreak. Any surveillance for the FAD in wildlife considered necessary by the Incident Command in an FAD response effort will be closely coordinated with relevant State, Federal, and Tribal authorities with primary jurisdiction that are involved in wildlife disease management. Experienced wildlife personnel will be part of the Unified Command responding to an incident. Surveillance will help to demonstrate the absence, presence, spread, and/or prevalence of the FAD in a given wildlife population.

6.2.1 Surveillance Plan

Incident Command will consider many factors in developing a surveillance plan in wildlife, including:

- the case definition for the FAD (which is defined prior to an incident, but may change over the course of the outbreak),
- the targeted population (wildlife species at risk), and
- the area in which surveillance must be conducted.

Because wildlife are likely to move into and out of the Control Area, this may pose additional challenges to developing an effective surveillance plan. In particular, it is important to survey the animal population to assess if the FAD has spread between wildlife and domestic livestock populations, and if so, the extent to which it has spread.

6.2.2 Diagnostic Sample Collection and Processing

Diagnostic sampling of wildlife may be necessary in order to detect or confirm the presence or absence of the FAD in a wildlife population during surveillance activities. Disease samples can be obtained by a number of different methods, including—but not limited to—live capture, observation, and carcass collection.

Prior to sampling, parameters, such as those listed below, must be determined:

- **Sample type:** e.g., serum or swab or possibly visual inspection (or any combination),
- **Sample unit:** whether the samples will be individual or pooled samples from multiple individuals,
- **Sample size:** number of individual samples to be gathered,
- **Sample time, duration, and frequency:** when samples will be collected, for how long they will be collected, and how frequently they will be collected during a given period,
- **Sampling methods:** e.g., random sampling of a population, targeted sampling of animals with clinical signs, systematic sampling (of every n^{th} animal), etc.

In wildlife surveillance, many of the sampling parameters may be dictated by the availability of resources and practical feasibility of sampling wildlife. Sampling parameters should be described in detail for an effective surveillance plan. For further information on surveillance principles and procedures, please see *FAD PReP/NAHEMS Guidelines: Surveillance, Epidemiology, and Tracing.*

Samples collected from wildlife in an FAD outbreak will be sent to a diagnostic laboratory as identified by Incident Command, State officials, and/or Federal officials. Care should be taken in evaluating diagnostic test results in the event that the laboratory assay has not been validated for specific wildlife species. As with the collection of any other samples for diagnostic testing, appropriate biosecurity measures should be observed by personnel. Appropriate packaging and labeling procedures, consistent with procedures for other diagnostic samples, should be followed.

For more information, see:

- USDA APHIS VS Guidance Document 12001: http://www.aphis.usda.gov/fadprep
- USDA APHIS Packaging and Labeling Submissions webpage

6.2.3 Handling and Restraint of Wildlife

Handling and restraint of wildlife, in some instances, may be necessary in an FAD outbreak. For example, diagnostic samples may need to be taken or the wildlife may need to be moved to another area. A discussion of these methods is presented here only for informational purposes.

Handling and restraint methods will differ depending on species of animal, skill level of responder and other safety considerations, including the safety of the animal being restrained. General anesthesia may be necessary to relieve distress and anxiety in the animals. For the safety of animals and personnel, handling and restraint of wildlife should *only* be performed by trained personnel who have extensive experience and certification to perform these activities.

Additional information on handling and restraint of wildlife can be found in:

- Fowler ME. Restraint and Handling of Wild and Domestic Animals, 3rd Edition. 2008. Wiley-Blackwell: Ames.
- Kreeger TJ, Arnemo JM. Handbook of Wildlife Chemical Immobilization, 3rd Edition. 2007. Sunquest: Shanghai, China.
- Palmer SB. Chapter 1.16: Wildlife handling. In: Veterinary Disaster Response. 2009. Wiley-Blackwell: Ames.
- Sikes RW, Gannon WL, and the Animal Care and Use Committee of the American Society of Mammologists. Guidelines of the American Society of Mammologists for the use of wild mammals in research. Journal of Mammalogy. 2011. 92(1): 235-253.

Regardless of restraint or handling methods used, animals should be kept as calm as possible. During restraint and handling procedures, an animal should never be left unattended nor should it be muzzled if there is any chance that the animal may escape. Handling procedures alone should minimize injuries and mortality and, consequently, should only be performed by trained and experienced personnel.

The following techniques may be used, as appropriate, to ensure stress is minimized:

- Avoid direct eye contact.
- Minimize loud noises.
- Minimize threatening gestures.
- Direct animals with visual barriers (similar to chutes for large livestock).
- Sedate the animal, as appropriate.
- Blindfold the animal.
- Avoid handling predator species prior to prey species.

Both physical and chemical restraint may be used to effectively accomplish the goals of the surveillance and control program. Regardless of the method, humane treatment and safety measures must be implemented. It must always be ensured that the appropriate equipment is available and functioning properly. Physical

restraint methods may include corrals, cages, nets shields, and squeeze chutes. In all cases, personnel operating the equipment must be trained in the use of *and* have experience with the technique being used and the species being handled.

Chemical restraint requires knowledge of the various drugs and dosages for each particular species, as well as proper training on drug administration. Many restraint drugs require licensing from the Drug Enforcement Agency and the maintenance of accurate records. A list of drugs and reversal agents for each species should be available. Drugs contraindicated in each species should also be known. All drugs must be properly stored and transported; a cold-chain may be required.

6.2.3.1 Capture Myopathy

Capture and restraint of wild animals can result in a fatal condition called capture myopathy. This occurs in some species following capture, restraint, or transport. Muscles remain in a contracted state, decreasing blood perfusion, and thereby the amount of oxygen reaching the muscle. Physiologically, a buildup of lactic acid occurs, leading to acidic conditions within the body. High body temperature is another characteristic of capture myopathy. Tranquilization can worsen capture myopathy due to the drop in blood pressure that results, leading to even less perfusion of the tissues. Additionally, products from the muscle breakdown can cause damage to the kidney as they are being excreted, which can lead to kidney failure.

The effects of capture myopathy can occur immediately (i.e., sudden death), develop within a few hours, or take as long as several weeks after the stressful event. Delayed deaths are usually due to renal failure. Various species of mammals and birds can develop capture myopathy. Prey species are generally more susceptible but young predator animals can also have increased risk. Species at risk of capture myopathy should be handled in a manner that minimizes stress (e.g., calm, quiet environment, cooler part of the day).

6.2.3.2 Euthanasia/Depopulation

At times, euthanasia and/or depopulation of one or more wild animals may be required. This may be necessary for humane reasons or for diagnostic sample collection, particularly to initially indicate whether the disease has spread to wildlife. Appropriate and humane methods must be selected. The following are resources regarding euthanasia/depopulation of wildlife species:

- American Society of Mammalogists. Guidelines of the American Society of Mammalogists for the Use of Wild Mammals in Research. Journal of Mammalogy. 2007; 88(3):809-823.
- The Ornithological Council. Guidelines to the Use of Wild Birds in Research, 2nd Edition. 1999. Gaunt AS, Oring LW, eds. http://oacu.od.nih.gov/WildBirdGuide.pdf
- *Highly Pathogenic Avian Influenza (HPAI) Response Plans: The Red Book* (USDA APHIS).
- American Association of Zoo Veterinarians. Guidelines for the Euthanasia of Nondomestic Animals http://www.aazv.org
- AVMA Guidelines for Euthanasia. 2013. https://www.avma.org/kb/policies/documents/euthanasia.pdf.

For guidance on the mass depopulation and disposal of livestock and poultry during an FAD outbreak, please see the *FAD PReP/NAHEMS Guidelines: Mass Depopulation and Euthanasia* and *FAD PReP/NAHEMS Guidelines: Disposal.* The Executive Summary for the AVMA Guidelines for the Euthanasia provides an important distinction between depopulation and euthanasia: https://www.avma.org/KB/Policies/Documents/Euthanasia_Guidelines_2013_ExecSummary.pdf.

6.2.4 Personnel Safety

During all wildlife handling and restraint procedures, personnel safety is paramount. Ways to optimize safety include being aware of the behavior and hazards the particular species may present. Prior to any handling and

restraint procedures, safety plans and protocols should be in place and communicated to all personnel present. This should include verbal and hand signals to be used. Have all resources including equipment and personnel prepared and available ahead of time. Develop a chain of command and assign each person to a specific duty. Determine ahead of time how the animal is to be released if necessary.

Personal protective equipment such as gloves or goggles may often be necessary. Expect things to not go as planned. All personnel should be familiar with any back up plans. There should be procedures in place for handling injured personnel.

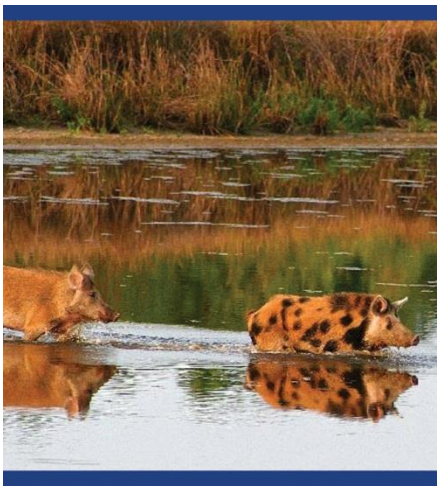
6.3 Wild Animal Containment and Control

The primary objective of wildlife containment and control is to stop the transmission of disease in order to control and eradicate the FAD. However, containment of wild animals can be a very difficult endeavor, given their elusive nature. To contain and control wildlife, measures employed can involve the manipulation of the wildlife population itself, habitat, or factors affecting the disease agent and/or human behavior. In many cases, the risk cannot be eliminated; but wildlife control and containment strategies can help to mitigate key risks.

This section provides general information about the tools that could be employed if containing and controlling wild animals is necessary to control the FAD agent. It is not intended to provide prescriptive guidance to implement wild animal containment and control activities, but to provide all responders with a broad overview of the potential techniques that could be applied and associated considerations.

In the event that multiple species are involved in the transmission of the FAD agent, it is ideal if the chosen techniques apply to all species. This enables operations to be more effective and resources to be used more efficiently. If this is not possible, it is important to ensure that techniques used for one species do not compromise the effectiveness of efforts used for another species. If resources are limited, it is important to prioritize which species of wildlife should be targeted first.

Again, all wildlife activities in an FAD incident in domestic livestock will be coordinated through the Wildlife Cell (or other group, as designated) in the Unified (State-Federal) Incident Command. Individuals with the appropriate skills, knowledge, experience, and abilities will conduct such activities.



6.3.1 Methods for Manipulating Wildlife Populations

Incident Command will receive an assessment of the need for manipulating wildlife populations in an FAD outbreak to minimize disease spread or illness. In the event that wildlife infected with the FAD are detected, preventive measures may need to be instituted to reduce the incidence of infection within the wildlife population, and lower the risk of transmission to domestic animals. Experienced personnel will conduct these activities, as appropriate, as part of the Unified response to the incident. This may include the removal, relocation, or dispersal of such wildlife, and possibly the vaccination or treatment of animals depending on the disease agent. Containment of wildlife to prevent the spread of disease can be a very difficult task.

Procedures for manipulating wildlife populations require careful planning and coordination. Methods for manipulating wildlife populations may change as the outbreak response evolves. Additionally, monitoring and surveillance will be necessary in order to determine the effectiveness of the program. Some of the challenges with disease control procedures in wildlife involve their ability to evade detection and disperse broadly. Short-term and long-term consequences and impact must be evaluated and requires consideration of the impact the control measures may have on animal species and ecosystems in the area, as well as the potential effects (including mortality) that the FAD may have on wildlife populations.

Table 6 offers a comparison of the advantages and disadvantages of various population manipulation methods.

Table 6: Comparison of Population Manipulation Methods

Population Manipulation Methods	Advantages	Disadvantages
Depopulation	• Prevents the spread of disease within the population or affected location • Reduces mechanical transmission of disease	• May result in extirpation or extinction of species • Expensive • Time consuming • Negative public opinion
Dispersal	• Effective when source of disease is associated with specific geographic location	• Potentially spread disease to unaffected areas • Requires expert knowledge/ assessment of disease agent ecology • Requires adequate/acceptable new habitat is available
Hazing Techniques	• Effective at keeping wildlife away from specific areas (e.g., carcass disposal sites) • Relatively cheap and easy	• Negative public opinion
Selective Culling	• Prevents the spread of disease within the population or affected location • Reduces mechanical transmission of disease	• Expensive • Time consuming: must reach all affected animals • Negative public opinion
Treatment	• Useful for small target populations or endangered species	• Impractical, do not usually have a significant impact • High cost of labor makes treatment very expensive
Vaccination	• Establishes herd immunity • Provides a buffer zone between infected and uninfected animals	• Approved vaccines/delivery methods may not be available • Very expensive

6.3.2 Methods for Manipulating Wildlife Habitats

In addition to manipulating wildlife populations, manipulating wildlife habitats is another option in wildlife management. Habitat manipulation in response to an FAD outbreak can involve the use of physical structures or habitat alterations to change the distribution, density, and composition of wildlife populations. Containment may use natural or artificial barriers, to restrict the movement of wildlife. Barriers, such as

fences, may also be important to prevent further disease spread and transmission. The methods for manipulating wildlife habitats are likely to evolve as the response effort continues.

6.3.2.1 Fencing

Fencing may be useful in separating infected animals from non-infected animals, or in preventing movement or dispersal of wildlife between infected and uninfected zones. This method, if used solely, should only be considered when the goal is to reduce disease exposure, rather than to eradicate the FAD. Factors affecting the efficiency of fencing include the target species, the size and topography of the geographical area, availability of personnel for monitoring and maintenance of the fence, length of time the barrier must be in place, and the daily and seasonal movement patterns of wildlife in the area. The impacts on access to food, water, cover, and other resources necessary for survival for all affected wildlife must be considered.

6.3.2.2 Habitat Alteration

Habitat alteration may be used under some circumstances to eliminate the attractiveness of certain areas for wildlife, to create buffer zones between infected and uninfected wildlife, or to attract wildlife to areas away from the FAD outbreak. The manipulation of habitat areas may also change environmental conditions so they are less favorable for the survival of the disease agent being controlled or, vectors able to transfer it. Table 7 compares various habitat manipulation methods. Habitat alteration can involve activities like controlled burning, manipulation of water and water movements, cultivation of soil, and changing vegetation. These activities serve to reduce or eliminate food, water, cover, or other resources in an area affected with an FAD. These activities may have long-term effects on the local environment and need to be evaluated for their effectiveness and environmental impact.

Table 7. Comparison of Habitat Manipulation Methods

Habitat Manipulation Methods	Advantages	Disadvantages
Fences	• Useful for separation of infected and uninfected populations	• Not very effective against very large species • Expensive, resource intensive and inflexible
Habitat Alteration	• Effective means of removal or relocation without having to physically move the animals yourselves	• Possible long-term negative effects on the environment • Expensive and resource intensive
Vector Control	• Effective means of stopping further disease transmission • Most methods are fairly easy to implement	• Unknown long-term effects on environment • Expensive and resource intensive

6.3.3 Education and Training

Implementing management strategies that change public practices can also influence the spread and transmission of the FAD when wildlife is involved (Fischer and Gerhold, 2003). For example, hunting practices may be modified, or feeding or baiting of wildlife which causes populations to congregate. Education and training, particularly for hunters, farmers, ranchers, and others closely involved with wildlife

species can also help to control and contain the disease, through rapid identification of sick animals or atypical behavior in wildlife.

6.4 Demonstrating Disease Freedom

It may be necessary to demonstrate disease-freedom in wildlife to reestablish international trade, depending on the disease agent (for information on international trade implications, including diseases that may not require proof of freedom in wildlife, see Section 4.3). A wildlife specific surveillance plan for disease-freedom may need to be developed based on the wildlife species, disease agent, diagnostic tests available, and epidemiology of the outbreak. Proving freedom from disease in wildlife populations may not be feasible or practical. For further information on disease surveillance for proof of disease-freedom, please see the *FAD PReP/NAHEMS Guidelines: Surveillance, Epidemiology, and Tracing.*

7. DEVELOPING A WILDLIFE MANAGEMENT PLAN

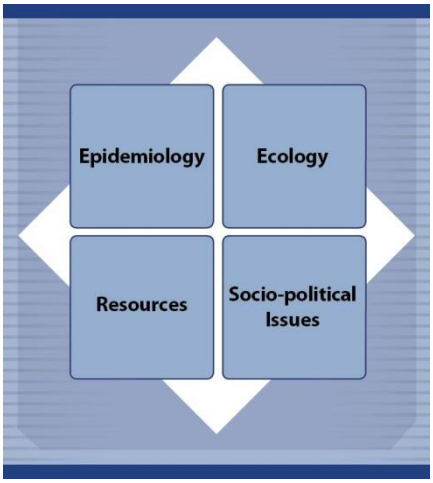
7.1 General Considerations for Developing a Wildlife Management Plan

If the assessment indicates that wildlife may play an important role in the FAD outbreak, Incident Command, in coordination with the Wildlife Cell and Vector Control Group, will need to develop a wildlife management plan. The decision to implement control measures in wildlife will be based not only on the risk assessment and surveillance, but also the feasibility of conducting successful control measures. In all cases, the wildlife management plan must be conducted within local laws and regulations. A flow chart for assessing the response actions to an FAD outbreak situation involving wildlife can be found in Appendix C.

7.1.1 Short-term and Long-term Objectives

In the short term, containing and controlling the outbreak is the foremost objective. However, in the longer-term, depending on the FAD, the objective may be to eradicate the FAD from the wildlife species. This may require extended wildlife management activities, including activities such as containment and reduction of wildlife populations so the disease can no longer persist; elimination of populations; or vaccination to reduce the spread of infection. In all cases, the implications of short-term and long-term unintended consequences needs to be considered, such as animal welfare, occupational health, use of chemicals, environmental damage and/or contamination, effects on non-targeted animals, presence of threatened or vulnerable species, and views of local citizens and animal owners.

The wildlife management plan should specify whether demonstrating freedom from the FAD in wildlife is required for OIE-free status, and, if so, how to demonstrate freedom from disease in wildlife to national and international standards. The most appropriate strategy will be based on the size of the outbreak, species involved, and of course the FAD agent.



7.1.2 Factors to Consider

Certainly the epidemiological factors, as have been frequently discussed in this document, are critically important in creating a wildlife management plan for an incident. Such factors include the transmission pathways of the disease, the epidemiological importance of wildlife, disposal issues, and availability of veterinary countermeasures. However, other factors are also critically important to consider in the development of a wildlife management plan:

- **Epidemiology:** the study of the distribution of disease in populations and of factors that determine its occurrence.

Investigations involve observing animal populations and making inferences from data and observations.

- **Ecology:** the location(s) of the disease outbreak, and habitat for wildlife. The season may also be important in terms of social and feeding behavior. Additionally, the presence of other susceptible species in the area, and the likely movement of susceptible animals should be considered. The current density of the wildlife population, as well as vulnerabilities should be weighed.
- **Resources:** the availability of resources to complete the outbreak response successfully should be considered. For example, is it feasible to reduce the density of the wildlife population? Over what size of an area? Carcass disposal can be particularly resource-intensive, so the plan should consider the need for disposing of wildlife carcasses. The benefits and costs of countermeasures should also be weighed, if such countermeasures are available. The need for properly trained and equipped personnel should also be considered.
- **Socio-political Issues:** issues such as the local, regional, and national economy may play a role in the wildlife management plan, as well as law, regulation, and policy guidance at various jurisdictional levels. Public opinion and public safety should be considered in a wildlife management plan, particularly if the plan suggests population reduction measures.

7.1.3 Personnel

The number of personnel needed for a response will vary depending on the size and scope of the incident and the type of activities being conducted. Wildlife management activities must be conducted by individuals trained and proficient in wildlife health, capture, collection, and restraint. All personnel should understand biosecurity requirements, as well as safety concerns, prior to field activities.

7.1.3.1 Health, Safety, and Personal Protective Equipment (PPE)

During an animal health emergency response, any number of physical, environmental even psychological hazards can occur. The specific hazards encountered during a response will depend on the type of activities required; the location (e.g., terrain) and time of year (e.g., weather conditions). Physical hazards that may occur while performing response activities may include animal related incidents (e.g., bites, scratches, and kicks), musculoskeletal injuries (e.g., strains, sprains, and repetitive motions), slips, trips or falls, and fatigue. Environmental hazards such as extremes in weather and temperatures, or insect vectors, as well as psychological hazards due to the long unusual hours, physical demands and emotional stress involved are additional concerns for animal disease emergency responders.

While protecting the health and safety of personnel assigned an emergency response is everyone's responsibility, management and monitoring of a safe working environment for all responders is done by a Safety Officer as part of the Incident Command Structure. The Safety Officer will identify current and potential hazards, establish and train responders on safe work procedures (e.g., appropriate PPE), and prepare a Health and Safety Plan specific for the incident. Any injuries, accidents, or unsafe working conditions should be reported to the Safety Officer. Personnel should carefully monitor themselves as well as other responders. Vaccinations for wildlife responders, consistent with current guidance, may be indicated depending on the risk and FAD involved, but may also include endemic wildlife diseases of concern like rabies.

7.1.3.2 Zoonoses

Some FADs are also zoonotic (transmissible between animals and humans); this may include wildlife species. Response situations involving zoonotic diseases may involve increased risk to response personnel. Responders should be informed of any zoonotic risks prior to beginning wildlife management activities, including animal handling or sample collection. Responders should avoid unnecessary exposure and use protective measures (i.e., PPE) to reduce the risk of zoonoses. Appropriate PPE should be worn when

interacting with susceptible or infected wildlife, especially when handling tissues, blood, or other items that could contain the FAD.

7.1.4 Equipment

Effective planning will specify the personnel and equipment needed, and the locations in which activities will be conducted. Equipment needed specifically for wildlife management will vary with the situation and depend on the scale of the incident, species involved, and activities that will be conducted. Equipment may include traps, cages, tranquilizer guns, firearms, as well as items such as laptops, GPS units, cell phones, and sample collection and/or packing materials. Personnel should be aware of relevant cleaning and disinfection procedures, biosecurity measures, and health and safety concerns, as well as the associated equipment required for each of these activities. Personnel will be provided with appropriate PPE, based on the agent of concern. Equipment for use in fieldwork should be disposable when possible, packaged in pre-planned supply kits, and easy to clean and disinfect. All unessential equipment should be removed from vehicles prior to entering an affected area. Local laws and regulations also must be followed if sedation agents or firearms are employed by personnel.

In addition to personnel and equipment, vehicles may also be needed. Boats or all-terrain vehicles may be required for wildlife management activities. Again, vehicles used for wildlife management must be cleaned and disinfected like other vehicles and equipment involved in the FAD outbreak response.

7.1.5 Information Management and Reporting

A wildlife management plan also needs to consider how information collected during the population surveys, surveillance, diagnostic testing, and any control measures is to be managed, stored, analyzed, and disseminated to appropriate personnel throughout the relevant agencies, the Wildlife Cell, the Vector Control Group, and the Incident Command. The preparation of routine reports, at intervals as specified by the Incident Commander, is an important part of developing and executing a wildlife management plan.

8. VECTOR CONTROL IN AN FAD OUTBREAK IN DOMESTIC LIVESTOCK

Vector control is an important consideration and component for an FAD response. Many FADs spread by arthropod vectors (e.g., biting midges, mosquitoes, ticks, and flies) can affect domestic livestock as well as wildlife species. Vectors can transmit disease over relatively large distances, significantly complicating disease control efforts.

Disease transmission by arthropod vectors can occur by mechanical or biological means. Mechanical transmission involves the transfer of a pathogen by an external body part (e.g., legs) of the vector; the pathogen remains unchanged (i.e., does not replicate or develop further). Most species of flies serve as mechanical vectors. Biological transmission involves the alteration of the pathogen within the vector. The vector uptakes the pathogen–usually through a blood meal from an infected animal–and the pathogen undergoes further development or replication within the arthropod vector before being transferred to a susceptible animal, usually through a bite. Midges, ticks, and mosquitoes are common biological disease vectors. Additionally, myiasis—the infestation of the skin or wounds by fly larvae—can also be of great economic concern and can affect wildlife and domestic livestock.

Table 8 lists key vector-borne diseases which may affect domestic and wildlife populations in the United

States. This list is based on Table 2-1 in the *APHIS FAD Framework: Response Strategies (FAD PReP Manual 2-0)* Some vector-borne FADs can also affect humans; these are also indicated in Table 8.

Additional information on vector-transmitted FADs can be found in the FAD PReP Etiology and Ecology documents (www.aphis.usda.gov/fadprep–select the Standard Operating Procedures link, then Overview of Etiology and Ecology) or the CFSPH Factsheets (http://www.cfsph.iastate.edu/DiseaseInfo/factsheets.php).

8.1 Authority for Vector Control

In the United States, vector control is primarily left to the discretion of county or municipal governments; public health departments typically take the lead on vector control issues affecting human health. In an FAD outbreak in domestic livestock involving arthropod vectors, APHIS will coordinate and collaborate with these agencies and entities to implement vector control strategies. Personnel with appropriate skills and experience in vector control are likely to be incorporated into the Unified Incident Command structure in an FAD response.

Pesticides used in the United States to control arthropod vectors are registered and licensed through the Environmental Protection Agency (EPA) under its authority from the Federal Insecticide, Fungicide, and Rodenticide Act (also known as FIFRA). States may also register or license pesticide products. In vector-borne FAD incidents, which also involve public health (especially mosquito-borne diseases), APHIS will collaborate with the Centers for Disease Control and Prevention who works closely with State and local health departments.

8.2 Methods of Vector Control

Vector control focuses on measures to prevent or eliminate vector populations and begins with an understanding of the arthropod's life cycle as well as the vector-pathogen-host relationship. Arthropod life stages (e.g., egg, larvae, pupae, adult) vary and the control approach for one species may not work for another. For example, the egg-laying habitat for flies is different than that of mosquitoes or midges. Additionally, different control measures may be needed to target a particular life stage of the vector for greater effectiveness. For example, a larvicide may be used for mosquito breeding areas while an adult knockdown insecticide may be needed within building structures. Understanding the vector life cycle can aid in better design of vector management and control programs. Controlling the egg and larval stages is generally more efficient than controlling adults. Vector control measures generally focus on four measures: habitat reduction, minimizing contact, chemical control, and biological control.

Personnel with the appropriate skills and experience in vector control issues would be integrated into the Incident Command structure for an FAD response effort in domestic livestock; APHIS would coordinate with all authorities with primary jurisdiction over vector control and vector populations through a Unified Incident Command.

8.2.1 Habitat Reduction

Most arthropods require specific conditions in order to breed or develop, such as standing or stagnant water (mosquitoes, biting midges), vegetation (ticks), or areas with wet manure or organic material (flies). Disrupting, eliminating or reducing these areas can reduce population growth. This may include minimizing stagnant water sources (e.g., old tires), agitating water sources (e.g., waterers), mowing vegetation, or disposing of manure or organic material properly.

8.2.2 Minimizing Contact

Limiting exposure to arthropod vectors can reduce vector-borne transmission and infection risks significantly. Additionally, arthropods also have peak activity times, usually dusk and dawn. Excluding access of livestock (or wildlife) to vector habitat areas (e.g., dense vegetation, mud) and when possible, housing livestock during peak vector activity times, can reduce exposure to vectors and lower the risk of vector-borne disease transmission.

8.2.3 Chemical Control

Insecticides and other chemical methods can be an important part of vector control, but are usually the least efficient way to control vectors and are therefore better used as a supplemental measure. Some products are used in vector habitat areas, while others may be approved for use with food-producing animals and applied directly to animals (e.g., sprays, pour-ons, ear tags). Additionally, insect growth regulators (known as IGR) can be feed additives used to disrupt the life cycle of some vectors by making manure inhospitable to larval development. Insecticides are only effective when used properly and according to label directions. Improper use may contribute to resistance or reduce the effectiveness of the control measures. Insecticides often require multiple applications. Some pesticides can be harmful or even deadly to humans; proper protective equipment (e.g., gloves, goggles) and procedures (e.g., washing exposed skin) must be used when applying them.

It is a violation of State and Federal Law to use a pesticide in a manner that differs from the product label. Use only according to label directions to avoid meat or milk residue hazards, environmental damage, and animal or human injury.

8.2.4 Biological Control

Another method of vector control implements the use of biological agents or natural predators for the vectors. This might include bacterial toxins (e.g., *Bacillus thuringiensis*), mosquitofish, or parasitic wasps or dung beetles that feed on arthropod larvae. The release of sterilized male screwworms has helped reduce breeding of these flies in efforts to control this vector (please see the *FAD PReP Disease Response Strategy: New World Screwworm Myiasis* for more information).

8.3 Arthropod Vectors of Foreign Animal Diseases

The Vector Control Group, as part of Operation Section, would assess the involvement of arthropod vectors and the actions needed to control and prevent the further spread of the FAD agent. The following sections provide general, practical information about vector control for common vectors.

8.3.1 Biting Midges

Biting midges, also called no-see-ums, are a Family (Ceratopogonidae) of small flies. The blood feeding species *Culicoides* are important vectors of several FADs. Adult midges lay eggs on wet, organic matter, including mud or moist soil around streams, ponds, and marshes. The moisture is required to keep the larvae and pupae alive; therefore, minimizing moist areas can significantly reduce the number of biting midges in an area. If possible, animals should be housed at least 2 miles from moist areas, including marshes and ponds. Fine insecticide mists can be used to kill adult biting midges but typically needs to be applied daily to be effective.

8.3.2 Mosquitoes

Mosquitoes are in the Family Culicidae. There are about 200 different species of mosquitoes in the United States, all of which live in specific habitats, exhibit unique behaviors, and bite different species of animals.

Mosquitoes in the genera *Aedes*, *Anopheles*, and *Culex* can transmit a number of FAD to livestock and wildlife species. Mosquito control requires knowledge of the behavioral and habitat differences among species in order to plan and carry out a control program. All mosquitoes require water to complete their life cycle. Some lay single eggs on damp soil that is later flooded by water; others lay an egg raft on the water's surface. Most eggs hatch within 48 hours. Both the larvae and pupae live in the water and feed on organic matter in the water. The best way to control mosquitoes is to remove potential egg laying sites–standing water. Drain any containers or structures (e.g., barrels, old tires) that may trap water. Reduce weeds and other vegetation that may shelter mosquitoes during the day. In areas with ponds, stocking mosquito eating fish can reduce mosquito numbers. Only approved larvicides should be used, but should not be applied to moving water sources (e.g., streams).

8.3.3 Ticks

Ticks are important as FAD vectors. Classified as arachnids (vs. insects), they are highly successful ectoparasites, efficient at transmitting several diseases, in part because they are persistent bloodsuckers. Ticks prefer vegetation and are able to live for many years, even under unfavorable environmental conditions. Ticks have a wide host range and may feed on several different species throughout their lifetime. They attach and feed for long periods of time, which allows the pathogen to enter the host, as well as extends the time and distance that the ticks are transported by the host. They have a high reproduction potential and lay several thousand eggs. Hard ticks (Family Ixodidae) are responsible for the transmission of the majority of tick-borne diseases in the United States. Important FAD Ixodid ticks include *Amblyomma*, *Dermacentor*, *Hyalomma*, *Ixodes*, and *Rhipicephalus*. Soft ticks (Family Argasidae), in particular the genus *Ornithodoros*, are vectors for the African swine fever virus. Livestock should be examined regularly for the presence of ticks. Tick control measures such as mowing vegetation and removing leaves and brush from around buildings can aid in reducing these vectors. Many chemical pour-on and spray products applied to animals are also available.

8.3.4 Flies

Flies belong to Order Diptera. Several biting fly genera, including *Tabanus* spp. (horse flies), *Chrysops* (deer flies), *Stomoxys* (stable flies), as well as species in the Family Simuliidae (black flies), are important mechanical vectors for FADs. Like the biting midge, adult flies prefer to lay eggs on wet organic matter. Wet bedding, spilled feed, lagoons, and manure around feeders must be disturbed to prevent fly eggs from hatching; insecticides are commonly used to control flies. Residual sprays are also available and can be applied to surfaces where flies rest, killing them through contact. Fly strips or tapes, and fly traps are environmental control options aimed at reducing adult fly populations.

8.4 Additional Information on Vector Control

A number of resources outlining vector control measures are available.

- The Armed Forces Pest Management Board has a number of technical guides on the control and management of various vectors: http://www.afpmb.org/content/technical-guides
- The Centers for Disease Control provides resources and information on vector control for public health emergency preparedness and response: http://www.cdc.gov/nceh/ehs/ETP/vector.htm
- The Environmental Protection Agency has several resources for Mosquito Control: http://www2.epa.gov/mosquitocontrol
- The World Health Organization (WHO) guide titled "Pesticides and their applications for vectors that are of public health importance" contains comprehensive information on various diseases vectors and control measures: http://whqlibdoc.who.int/hq/2006/WHO_CDS_NTD_WHOPES_GCDPP_2006.1_eng.pdf

- CFSPH has a number of factsheets on vector control measures: http://www.cfsph.iastate.edu/Infection_Control/Routes/vector-borne.php
- The National Integrated Pest Management Network and University of Florida, Public Health Pesticide Applicators Training Manual at http://entnemdept.ufl.edu/fasulo/vector/manual.htm
- Contact your local extension office for additional information.

Table 8: Vector-Borne Diseases Relevant to Domestic Animals and Wildlife in the United States

Disease	Vector Type*			Arthropod Vector (Primary Genus or Species)	Humans Affected
	Flies	Mosquitoes	Ticks		
African horse sickness	■			*Culicoides* (biting midges); *Stomoxys calcitrans* (stable fly)*, *Tabanus* (biting horsefly)*, other biting flies	No
African swine fever			■	*Ornithodoros*	No
Akabane	■	■		Flies: *Culicoides* Mosquitoes: *Aedes; Anopheles; Culex*	No
Bovine babesiosis			■	*Ixodes* (in Europe)*; Rhipicephalus (Boophilus)*	Rarely
Equine piroplasmosis			■	*Dermacentor; Hyalomma; Rhipicephalus (Boophilus); Anocentor nitens (*formerly *Dermacentor); Amblyomma cajennense*	No
Heartwater			■	*Amblyomma*	No
Japanese encephalitis		■		*Aedes; Culex*	Yes
Lumpy skin disease	■	■		Flies: *Tabanus*, Stomoxys*,* other biting flies Mosquitoes: *Aedes; Culex*	No
Nairobi sheep disease			■	*Ixodes*	Yes
Rift Valley fever		■		*Aedes; Anopheles; Culex; Mansonia*	Yes
Schmallenberg	■			*Culicoides*	No
Screwworm myiasis	■			*Cochliomyia hominivorax* (New World screwworm)*; Chrysomya bezziana* (Old World screwworm)	Yes
Sheep pox/goat pox	■			*Tabanus*, Stomoxys**, other biting flies	No
Surra	■			*Tabanus*, Stomoxys**, other biting flies	No
(Tropical) Theileriosis			■	*Rhipicephalus; Hyalomma; Amblyomma*	No
Venezuelan equine encephalitis	■	■	■	Mosquitoes: *Aedes; Anopheles; Culex; Mansonia; Psorophora; Ochlerotatus; Deinocerites* Flies: *Simuliidae* (black flies) Ticks: *Amblyomma; Hyalomma*	Yes
Vesicular stomatitis	■			*Lutzomyia* (sandflies); *Simuliidae* (black flies); *Culicoides*	Yes

*Please note the comments in Section 8.3 regarding mechanical versus biological transmission for these vectors. For example, biting flies typically transmit these FADs through mechanical transmission.

Also, this table does not imply that there is evidence of vector competence in the United States for these agents; it is solely to provide information about these FAD threats. In some cases, the competence of North American vectors to carry these diseases may not be established. While most of the arthropod genera listed in the table are found in North America, *Hyalomma* ticks and Old World and New World screwworms are not found in the United States, Mexico, or Canada.

Other means of transmission for the listed FADs, such as direct contact, or ingestion may also be possible.

9. OTHER RESPONSE ACTIVITIES

Many other critical activities will be ongoing at the same time as wildlife management and vector control activities as part of an FAD response. Many of these activities will intersect with wildlife management and vector control activities; there may be competing interests and priorities during the response effort. Resources need to be allocated appropriately, based on the goals and stated objectives of the outbreak response. Some of these key activities are highlighted here. For more information on these activities please see the corresponding *FAD PReP/NAHEMS Guidelines*.

9.1 Quarantine and Movement Control

Upon detection of an FAD in livestock, a Control Area will be established by Incident Command. This includes the Infected Zone and the Buffer Zone (see Figure 1). In the event that wildlife are involved in the FAD outbreak in domestic livestock, hunting and other activities, such as field trials, should be identified to determine the risk. Wildlife personnel and any wildlife or wildlife product physically transported by personnel must adhere to the quarantine and movement control guidance provided by Incident Command.

As stated in VS Memo 573.1, interstate movement requirements for livestock and/or poultry, including captive animals, should require States or zones with known wildlife reservoirs of the causative agent to conduct more extensive mitigation activities than States or zones of equivalent status that do not have a wildlife reservoir.

To learn more about quarantine and movement control, please see the *FAD PReP/NAHEMS Guidelines: Quarantine and Movement Control.*

9.2 Health, Safety, and PPE

As discussed previously, the health and safety of responders is critically important in an FAD outbreak. Responders must be protected from zoonotic diseases, physical hazards such as scratches and kicks, environmental hazards such as severe weather, as well as psychological hazards such as the anxiety caused by depopulation activities. For more information on the Health and Safety issues during an FAD response, see the *FAD PReP/NAHEMS Guidelines: Health and Safety*. The donning of personal protective equipment may also be necessary depending on the FAD at hand. To learn more about appropriate PPE for an FAD situation, see the *FAD PReP/NAHEMS Guidelines: Personal Protective Equipment.*

9.3 Biosecurity

Biosecurity measures, in an FAD response, work to prevent the introduction of the FAD to naïve animals. Biosecurity measures are also implemented as standard practice, to ensure diseases are not transmitted onto or off of premises. Personnel involved in wildlife management need to follow Incident Command's procedures. *FAD PReP/NAHEMS Guidelines: Biosecurity.*

9.4 Euthanasia/Depopulation

Euthanasia or depopulation of domestic livestock or poultry may occur in an FAD response. All animals subject to euthanasia or depopulation procedures must be provided with humane treatment at all times until animals are euthanized or depopulated. Regardless of the method selected, efforts to reduce pain and distress to the greatest extent possible should be taken. For accepted methods please refer to the references at the end of this document and the *FAD PReP/NAHEMS Guidelines: Mass Depopulation and Euthanasia.* Methods of carcass disposal are discussed in the *FAD PReP/NAHEMS Guidelines: Disposal*. Additionally, disease-specific response plans provide guidance on euthanasia and/or depopulation.

9.5 Cleaning and Disinfection

Cleaning and disinfection procedures are used to remove, inactivate, reduce, or destroy contagious agents from contaminated premises, equipment, and vehicles in order to prevent the spread of pathogens. Cleaning and disinfection procedures may vary according to the FAD agent. Cleaning and disinfection policies and procedures will apply to all personnel, vehicles, equipment, and supplies. Cleaning and disinfection procedures for vehicles, equipment, clothing, and personnel are described in the *FAD PReP/NAHEMS Guidelines: Cleaning and Disinfection*.

9.6 Communication

Public support for FAD response activities is essential for success. The general public, including various constituency groups such as consumptive and non-consumptive wildlife users, sport-hunting interests, farmers, and animal welfare activists, will be affected by an FAD outbreak. The Public Information Officer will be responsible for providing information to the general public and the media, and making any public statements. Wildlife activities may also receive media attention. Specific information to justify wildlife response activities will be developed by Incident Command, specifically the Public Information Officer in coordination with the Wildlife Cell and Vector Control Group.

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11. FOR MORE INFORMATION

American Association of Zoo Veterinarians
Guidelines for the Euthanasia of Nondomestic Animals.
http://www.aazv.org/displaycommon.cfm?an=1&subarticlenbr=441

American Society of Mammalogists
http://www.mammalsociety.org

American Veterinary Medical Association
Emergency Preparedness and Response Guide.
https://ebusiness.avma.org/ProductCatalog/product.aspx?ID=193

Association of Fish and Wildlife Agencies
http://www.fishwildlife.org/

Internet Center for Wildlife Damage Management
http://icwdm.org/ Animal Handling, Euthanasia and Disposal Information
http://icwdm.org/wildlife/euthanasia/default.aspx

Southeastern Cooperative Wildlife Disease Study
Field Manual of Wildlife Diseases in the Southeastern United States, 3rd Edition.
http://vet.uga.edu/scwds/manual

U.S. Animal Health Association
www.usaha.org

U.S. Department of Homeland Security, Federal Emergency Management Agency
National Response Framework – Emergency Support Function #11 – Agriculture and Natural Resources Annex
http://www.fema.gov/pdf/emergency/nrf/nrf-esf-11.pdf

U.S. Department of the Interior
National Wildlife Health Center
http://www.nwhc.usgs.gov

U.S. Geological Survey
http://www.usgs.gov/

U.S. Fish and Wildlife Service
http://www.fws.gov/

U.S. Department of Agriculture, Animal and Plant Health Inspection Service
National Preparedness and Incident Coordination Center
http://www.aphis.usda.gov/wps/portal/aphis/ourfocus/animalhealth?1dmy&urile=wcm%3apath%3a%2Faphis_content_library%2Fsa_our_focus%2Fsa_animal_health%2Fsa_emergency_management%2Fct_emergency_management_home

Veterinary Services
http://www.aphis.usda.gov/wps/portal/aphis/ourfocus/animalhealth?1dmy&urile=wcm%3apath%3a%2FAPHIS_Content_Library%2FSA_Our_Focus%2FSA_Animal_Health%2F

Wildlife Services
http://www.aphis.usda.gov/wps/portal/aphis/ourfocus/wildlifedamage

Zoological Animal Health Network (ZAHN)
http://www.zooanimalhealthnetwork.org/

12. ACKNOWLEDGMENTS

The *FAD PReP/NAHEMS Guidelines: Wildlife Management and Vector Control for an FAD Response in Domestic Livestock (2014)* reflects the efforts of a number of people including USDA APHIS staff members, the CFSPH at Iowa State University and a several subject matter experts and reviewers.

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13. PHOTO AND ILLUSTRATION CREDITS

Page 1 This photo shows Canada geese in a pond outside a livestock production facility, demonstrating the potential interaction between wildlife and livestock. Photo source: USDA Natural Resources and Conservation Service

Page 3 This graphic lists the definition of wildlife according to APHIS VS memorandum 573.1. Graphic illustration by: Glenda Dvorak, Iowa State University

Page 6 This graphic shows the epidemiology triad of host, agent and environment interaction to establish disease. Graphic illustration by: Bridget Wedemeier, Iowa State University

Page 10 This graphic shows the USDA and OIE logos. Graphic illustration by: Kate Harvey, Iowa State University

Page 11 This graphic shows the Wildlife Cell and Vector Control Group within the Incident Command System structure. Graphic illustration by: Kate Harvey, Iowa State University

Page 12 This photo shows two USDA APHIS Wildlife Services employees gathering data on a raccoon. Photo source: USDA APHIS

Page 13 This graphic shows the four steps in wildlife management in an FAD outbreak. Graphic illustration by: Kate Harvey, Iowa State University

Page 14 This graphic shows example standardized zones, areas and premises designations to be used in an FAD outbreak. Zone illustration provided by: USDA; Graphic illustration by: Dani Ausen, Iowa State University

Page 15 This aerial photo shows a caribou aggregation. Photo source: U. S. Fish and Wildlife Service

Page 16 This photo shows a raccoon in a live capture trap. Photo source: USDA APHIS

Page 18 **(Top)**This photo shows several diagnostic sampling supplies. Photo source: Dani Ausen, Iowa State University

Page 18 **(Bottom)** This photo shows sample packaging for diagnostic samples. Photo source: Danelle Bickett-Weddle, Iowa State University

Page 19 This photo shows several wildlife responders looking over a GPS collared big horn sheep, which has been blindfolded to minimize stress to the animal. Photo source: USDA Forest Service

Page 21 **(Top)** This photo shows a responder donning personnel protective equipment. Photo source: Dani Ausen, Iowa State University

Page 21 **(Bottom)** This photo shows two feral swine crossing a waterway. Photo source: USDA Forest Service

Page 23 This photo shows a tall fence placed around the perimeter to keep out unwanted wildlife species. Photo source: USDA Forest Service

Page 24 This graphic shows factors to consider when developing a wildlife management plan. Graphic illustration by: Kate Harvey, Iowa State University

Page 26 This photo shows a person holding a GPS unit and recording data. Photo source: Danelle Bickett-Weddle, Iowa State University

Page 32 **(Top)** This photo shows a biosecurity sign hanging at the perimeter of a response site. Photo source: Alex Ramirez, Iowa State University

Page 32 **(Bottom)** This photo shows several containers of disinfectant solution. Photo source: Carla Huston, Mississippi State University

Glossary

Biological Transmission
The transfer of a disease agent from a host to a susceptible animal after the pathogen has undergone some part of its life cycle within the host.

Biosecurity
A series of management practices designed to prevent the introduction or spread of disease agents on a premises.

Capture Myopathy
A potentially fatal condition associated with the stress of capture, restraint and/or transport; the disease is characterized by degeneration and necrosis of skeletal and cardiac muscle; numerous species of birds and mammals are susceptible.

Case Definition
A common definition of the disease agent for all responders; identifies criteria for suspect case, presumptive positive case, and confirmed positive case. May evolve over course of outbreak.

Control Area
Consists of an Infected Zone and a Buffer Zone. Has individual premises quarantine for Infected Premises, Suspect Premises, and Contact Premises and movement controls for At-Risk Premises and Monitored Premises.

Epidemiology
The study of disease in populations and of factors that determine its occurrence.

Feral
Domestic animals (e.g., cats, horses, pigs) that are not confined or under control.

Fomites
Inanimate objects (e.g., boots, clothing, equipment) that can carry an infectious disease agent and may spread the disease through mechanical transmission.

Foreign Animal Disease
A terrestrial animal disease or pest, or an aquatic animal disease or pest, not known to exist in the United States or its territories.

Incident Command System
A standardized, on-scene, all-hazards incident management approach that allows for the integration of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure; enables a coordinated response among various jurisdictions and functional agencies, both public and private; and establishes common processes for planning and managing resources.

Infected Premises
Premises where presumptive positive case or confirmed positive case exists based on laboratory results, compatible clinical signs, case definition, and international standards.

Infected Zone
The Zone that immediately surrounds an Infected Premises.

Mechanical Transmission
Transfer of a disease agent to a susceptible animal via external body parts of a host species; the pathogen does not undergo any development or multiplication while on the host species.

One Health
The collaborative efforts of multiple disciplines working locally, nationally, and globally, to attain optimal health for people, animals, and our environment.[AVMA One Health Task Force]

Outbreak
The occurrence of more cases of disease than expected in a given area, or among a specific group, over a particular time period.

Prevalence
The total number of cases of a disease in a given population at a specific time.

Reservoir
The environment in which a pathogen lives, grows, and multiplies. It can include humans, animals, and the physical environment. The reservoir is often, but not always, the source of infection.

Risk Factor
An aspect of behavior, an environmental exposure, or a hereditary characteristic that is associated with an increase in the occurrence of a particular disease.

Sentinel
A susceptible population, farm, or animal that is repeatedly sampled in order to assess health status over time; the 'sentinel' must be representative of the at-risk populations, farms, or animals.

Surveillance
An intensive form of data recording that encompasses gathering, documenting, and analyzing data. Information is then disseminated so that action can be taken to evaluate disease status and eradicate or control a disease.

Surveillance Zone (SZ)
Zone outside and along the border of a Control Area.

Susceptible Animal
Any animal that can be infected with and replicate the disease pathogen of concern.

Vector
Any insect or living carrier that transports an infectious agent from an infected individual to a susceptible individual or its food or immediate surroundings; transmission can occur mechanically or biologically.

Wildlife
All free-ranging animals, including native, and exotic wildlife species, as well as feral domestic animals.

Wildlife Reservoir

Population of free-ranging or free-living species in which an infectious agent/vector has become established, lives and multiplies and is therefore a potential source of infection/infestation to other domestic and free ranging species. (VS Memo 573.1)

Zoonotic Diseases/Zoonoses

Diseases that are transmissible between animals to humans under natural conditions.

Acronyms

AHPA
Animal Health Protection Act

APHIS
Animal and Plant Health Inspection Service

CFR
Code of Federal Regulations

CSF
classical swine fever

CSFPH
Center for Food Security and Public Health

EPA
Environmental Protection Agency

ESF
Emergency Support Function

FAD
foreign animal disease

FAD PReP
Foreign Animal Disease Preparedness and Response Plan

FMD
foot-and-mouth disease

GPS
global positioning system

HPAI
highly pathogenic avian influenza

ICS
Incident Command System

IRT
Incident Response Teams

NAHEMS
National Animal Health Emergency Management System

NRF
National Response Framework

NWDP
National Wildlife Disease Program

OIE
World Organization for Animal Health

PPE
personal protective equipment

SERS
Surveillance and Emergency Response System

U.S.C.
U.S. Code

USDA
United States Department of Agriculture

vNDV
Virulent Newcastle disease virus

VS
Veterinary Services; a division of USDA APHIS

WHO
World Health Organization

APPENDIX A: THE IMPERATIVE FOR FOREIGN ANIMAL DISEASE PREPAREDNESS AND RESPONSE

Why Foreign Animal Diseases Matter

Preparing for and responding to foreign animal diseases (FADs)—such as highly pathogenic avian influenza (HPAI) and foot-and-mouth disease (FMD)—are critical actions to safeguard the nation's animal health, food system, public health, environment, and economy. FAD PReP, or the *Foreign Animal Disease Preparedness and Response Plan*, prepares for such events.

Studies have estimated a likely national welfare loss between $2.3–69 billion[3] for an FMD outbreak in California, depending on delay in diagnosing the disease.[4] The economic impact would result from lost international trade and disrupted interstate trade, as well as from costs directly associated with the eradication effort, such as depopulation, indemnity, carcass disposal, and cleaning and disinfection. In addition, there would be direct and indirect costs related to foregone production, unemployment, and losses in related businesses. The social and psychological impact on owners and growers would be severe. Zoonotic diseases, such as HPAI and Nipah/Hendra may also pose a threat to public health.

Challenges of Responding to an FAD Event

Responding to an FAD event—large or small—may be complex and difficult, challenging all stakeholders involved. Response activities require significant prior preparation. There will be imminent and problematic disruptions to interstate commerce and international trade.

A response effort must have the capability to be rapidly scaled according to the incident. This may involve many resources, personnel, and countermeasures. Not all emergency responders may have the specific food and agriculture skills required in areas such as biosecurity, quarantine and movement control, epidemiological investigation, diagnostic testing, depopulation, disposal, and possibly emergency vaccination.

Establishing commonly accepted and understood response goals and guidelines, as accomplished by the FAD PReP materials, will help to broaden awareness of accepted objectives as well as potential problems.

[3] Carpenter TE, O'Brien JM, Hagerman AD, & McCarl BA. 2011. "Epidemic and economic impacts of delayed detection of foot-and-mouth disease: a case study of a simulated outbreak in California." *J Vet Diagn Invest.* 23:26-33.
[4] Estimates based on models may vary: Ekboir (1999) estimated a loss of between $8.5 and $13.5 billion for an FMD outbreak in California. Ekboir JM. 1999. "Potential Impact of Foot-and-Mouth Disease in California: the Role and Contribution of Animal Health Surveillance and Monitoring Services." *Agricultural Issues Center.* University of California, Davis.

Lessons Learned from Past FAD Outbreaks

The foundation of FAD PReP is lessons learned in managing past FAD incidents. FAD PReP is based on the following:

- Providing processes for emergency planning that respect local knowledge.
- Integrating State-Federal-Tribal-industry planning processes.
- Ensuring that there are clearly defined, obtainable, and unified goals for response.
- Having a Unified Command with a proper delegation of authority that is able to act with speed and certainty.
- Employing science- and risk-based management approaches to FAD response.
- Ensuring that all guidelines, strategies, and procedures are communicated effectively to responders and stakeholders.
- Identifying resources and trained personnel required for an effective incident response.
- Trying to resolve competing interests prior to an outbreak and addressing them quickly during an outbreak.
- Achieving rapid FAD detection and tracing.

FAD PReP Mission and Goals

The mission of FAD PReP is to raise awareness, expectations, and develop capabilities surrounding FAD preparedness and response. The goal of FAD PReP is to integrate, synchronize, and deconflict preparedness and response capabilities as much as possible before an outbreak by providing goals, guidelines, strategies, and procedures that are clear, comprehensive, easily readable, easily updated, and that comply with the National Incident Management System.

In the event of an FAD outbreak, the three key response goals are to: (*1) detect, control, and contain the FAD in animals as quickly as possible; (2) eradicate the FAD using strategies that seek to stabilize animal agriculture, the food supply, the economy, and to protect public health and the environment; and (3) provide science- and risk-based approaches and systems to facilitate continuity of business for non-infected animals and non-contaminated animal products.* Achieving these three goals will allow individual livestock facilities, States, Tribes, regions, and industries to resume normal production as quickly as possible. They will also allow the United States to regain FAD-free status without the response effort causing more disruption and damage than the disease outbreak itself.

FAD PReP Documents and Materials

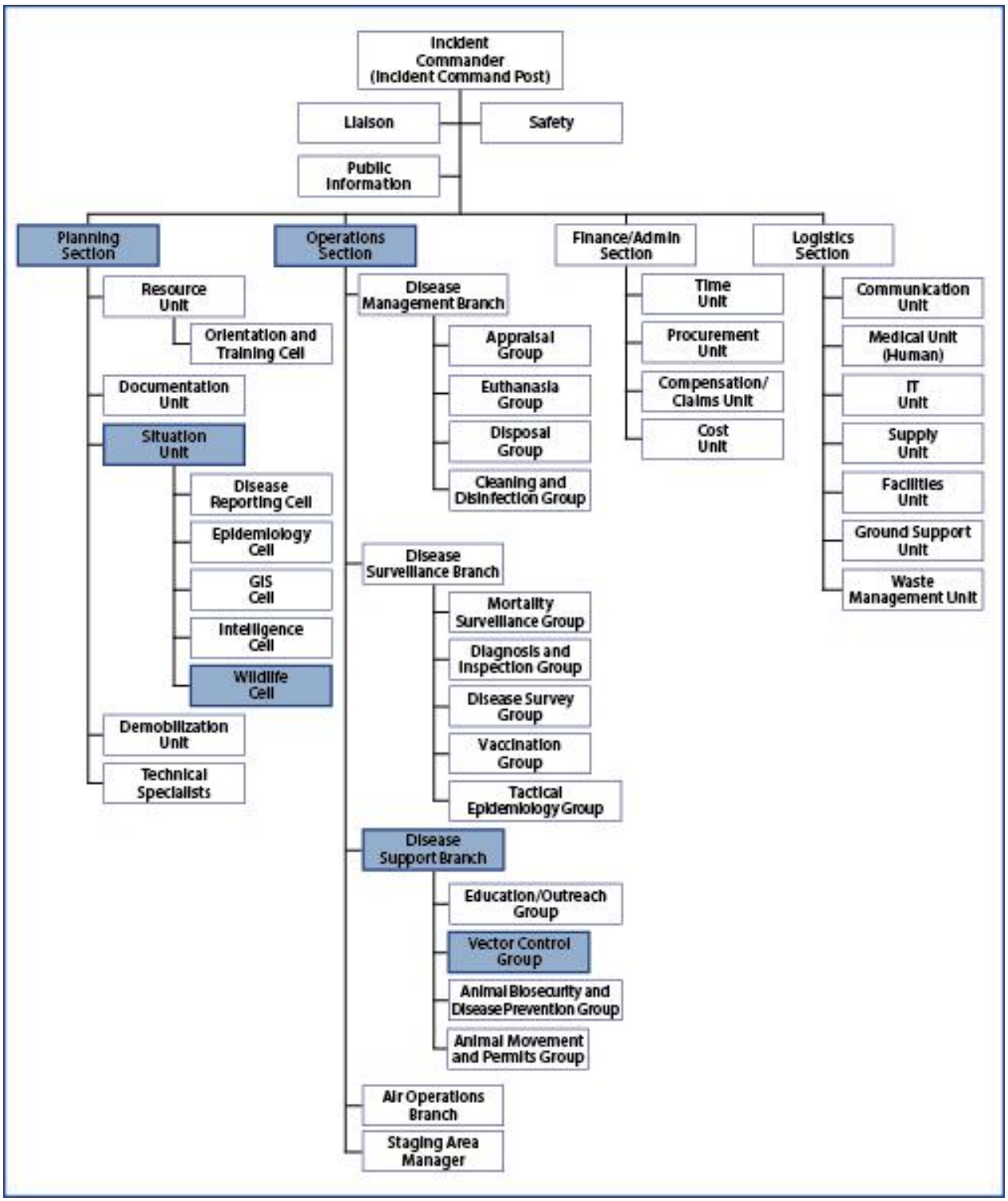
FAD PReP is not just one, standalone FAD plan. Instead, it is a comprehensive U.S. preparedness and response strategy for FAD threats, both zoonotic and non-zoonotic. The following section provides examples of the different types of FAD PReP documents available.

- Strategic Plans—Concept of Operations
  - *APHIS FAD Framework: Roles and Coordination* (FAD PReP Manual 1-0): This document provides an overall concept of operations for FAD preparedness and response for APHIS, explaining the framework of existing approaches, systems, and relationships.
  - *APHIS FAD Framework: Response Strategies* (FAD PReP Manual 2-0): This document provides significant detail on response strategies that will be conducted in an FAD outbreak.
  - *Incident Coordination Group Plan* (FAD PReP Manual 3-0): This document explains how APHIS headquarters will organize in the event of an animal health emergency.
  - *FAD Investigation Manual* (FAD PReP Manual 4-0): This field-ready manual provides detailed information on completing an FAD investigation from start to finish.
  - *A Partial List of FAD Stakeholders* (FAD PReP Manual 5-0): This guide identifies key stakeholders with whom the National Preparedness and Incident Coordination (NPIC) Center collaborates.

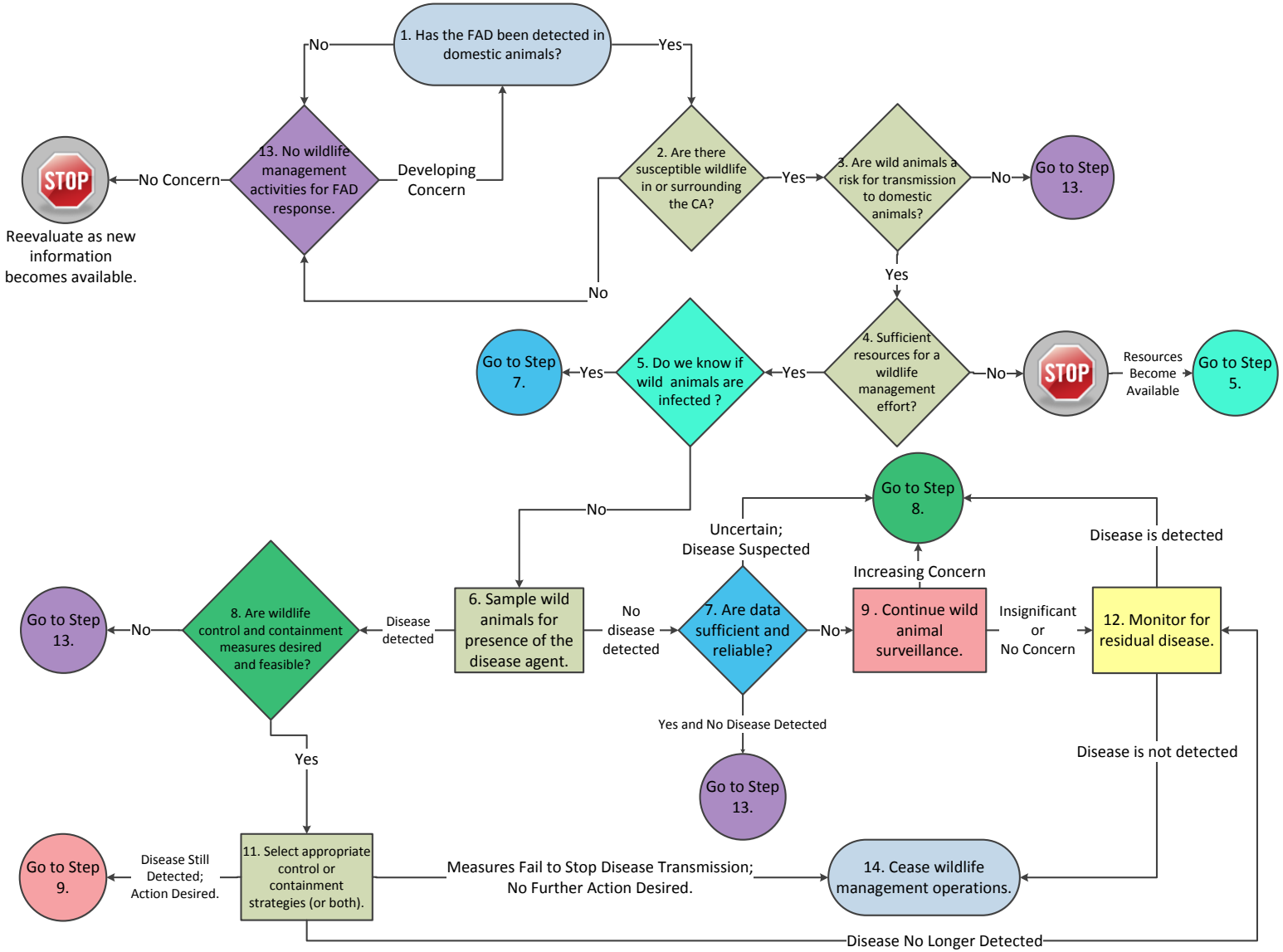
- NAHEMS Guidelines
  - These documents describe many of the critical preparedness and response activities, and can be considered as a competent veterinary authority for responders, planners, and policy-makers.
- Industry Manuals
  - These manuals describe the complexity of industry to emergency planners and responders and provide industry a window into emergency response.
- Disease Response Plans
  - Response plans are intended to provide disease-specific information about response strategies. They offer guidance to all stakeholders on capabilities and critical activities that would be required to respond to an FAD outbreak.
- Standard Operating Procedures (SOPs) for Critical Activities
  - For planners and responders, these SOPs provide details for conducting critical activities such as disposal, depopulation, cleaning and disinfection, and biosecurity that are essential to effective preparedness and response to an FAD outbreak. These SOPs provide operational details that are not discussed in depth in strategy documents or disease-specific response plans.
- Continuity of Business Plans (commodity specific plans developed by public-private-academic partnerships)
  - Known as the Secure Food Supply Plans, these materials use science- and risk-based information to facilitate market continuity for specific products in an outbreak.
  - More information on these plans can be found at the following: www.secureeggsupply.com, www.securepork.org, www.securemilksupply.org, www.securebroilersupply.com.
- APHIS Emergency Management
  - APHIS Directives and Veterinary Services (VS) Guidance Documents provide important emergency management policy. These documents provide guidance on topics ranging from emergency mobilization, to FAD investigations, to protecting personnel from HPAI.

For those with access to the APHIS intranet, these documents are available on the internal APHIS FAD PReP website: http://inside.aphis.usda.gov/vs/em/fadprep.shtml. Documents are also available publicly, at http://www.aphis.usda.gov/fadprep.

APPENDIX B: SAMPLE INCIDENT COMMAND DIAGRAM FOR ANIMAL HEALTH EMERGENCIES



APPENDIX C: ASSESSING WILDLIFE INVOLVEMENT IN AN FAD OUTBREAK OF DOMESTIC LIVESTOCK



APPENDIX D: STATE WILDLIFE AGENCIES REFERENCE GUIDE

Contact information for state wildlife agencies, current as of June 2014.

State	Wildlife Management	Contact	Web Address
Alabama	Alabama Department of Conservation and Natural Resources Wildlife and Fresh Water Fisheries Division 64 N. Union Street, Suite 468 PO Box 301457 Montgomery, AL 36130	334-242-3469 Fax: 334-242-3032	www.outdooralabama.com
Alaska	Alaska Department of Fish and Game PO Box 115526 1255 W. 8th Street Juneau, AK 99811	907-465-4100 Fax: 907-465-2332	www.adfg.alaska.gov
Arizona	Arizona Fish and Game Department 5000 W. Carefree Highway Phoenix, AZ 85086	602-942-3000	www.azgfd.gov
Arkansas	Arkansas Game and Fish Commission 2 Natural Resources Drive Little Rock, AR 72205	501-440-1477 askAGFC@agfc.state.ar.us	www.agfc.com
California	California Department of Fish and Game 1416 9th Street, 12th Floor Sacramento, CA 95814	916-445-0411 director@dfg.ca.gov	https://www.wildlife.ca.gov/
Colorado	Colorado Division of Wildlife Headquarters 1313 Sherman Street, 6th Floor Denver, CO 80203	303-297-1192	http://wildlife.state.co.us
Connecticut	Connecticut Department of Energy and Environmental Protection Bureau of Natural Resources, Wildlife Division 79 Elm Street Hartford, CT 06106	806-424-3011 dep.wildlife@ct.gov	www.ct.gov/dep/cwp/view.asp?a=2723&q=325726&depNav_GID=1655&depNav=|
Delaware	Delaware Division of Fish and Wildlife 89 Kings Highway Dover, DE 19901	302-739-9910 Fax: 302-739-6157	www.dnrec.delaware.gov/fw/Pages/FWPortal.aspx
Florida	Florida Fish and Wildlife Conservation Commission Farris Bryant Building 620 S. Meridian Street Tallahassee, FL 32399	850-488-4676	http://myfwc.com/

State	Wildlife Management	Contact	Web Address
Georgia	Georgia Wildlife Resources Division 2070 U.S. Hwy 278 SE Social Circle, GA 30025	770-761-3035 Fax: 706-557-3030	www.georgiawildlife.com
Hawaii	Hawaii Division of Forestry and Wildlife 1151 Punchbowl Street, Room 325 Honolulu, HI 96813	808-857-0200 Fax: 808-857-0205	http://hawaii.gov/dlnr/dofaw
Idaho	Idaho Department of Fish and Game PO Box 25 Boise, ID 83707	208-334-3700 Fax: 208-334-2148	http://fishandgame.idaho.gov/public/wildlife/
Illinois	Illinois Department of Natural Resources One Natural Resources Way Springfield, IL 62702	217-782-6384	http://dnr.state.il.us/orc/wildliferesources/
Indiana	Indiana Department of Natural Resources Division of Fish and Wildlife 402 W. Washington Street, Rm W273 Indianapolis, IN 46204	317-232-4200 dfw@dnr.in.gov	www.in.gov/dnr/fishwild
Iowa	Iowa Department of Natural Resources Wallace State Office Building 502 E. 9th Street, Des Moines, IA 50319-0034	515-281-5918 Fax: 515-281-8895	www.iowadnr.gov/Environment/WildlifeStewardship.aspx
Kansas	Kansas Department of Wildlife, Parks, & Tourism 512 SE 25th Avenue Pratt, KS 67124	620-672-5911	www.kdwpt.state.ks.us
Kentucky	Kentucky Department of Fish and Wildlife Services #1 Sportsman's Lane Frankfort, KY 40601	800-858-1549 info.center@ky.gov	http://fw.ky.gov/
Louisiana	Louisiana Department of Wildlife and Fisheries PO Box 98000 2000 Quail Dr. Baton Rouge, LA 70898	225-765-2800	www.wlf.louisiana.gov/wildlife
Maine	Maine Department of Inland Fisheries and Wildlife 41 State House Station Augusta, ME 04333	207-287-8000 Fax: 207-287-8094 or 207-287-6395	http://www.maine.gov/ifw/
Maryland	Maryland Department of Natural Resources Wildlife and Heritage Services Tawes State Office Building E-1 580 Taylor Avenue Annapolis, MD 21401	410-260-8540 Fax: 410-260-8596	www.dnr.state.md.us/wildlife

State	Wildlife Management	Contact	Web Address
Massachusetts	Massachusetts Division of Fisheries and Wildlife1 Rabbit Hill RoadWestborough, MA 01581	508-398-6300 Fax: 503-398-7890	http://www.mass.gov/eea/land-use-habitats/fisheries-and-wildlife/
Michigan	Michigan Department of Natural Resources, Wildlife Division Mason Building, 530 W. Allegan PO Box 30444 Lansing, MI 48909	517-373-1263	www.michigan.gov/dnr/0,4570,7-153-10370---,00.html
Minnesota	Minnesota Department of Natural Resources 500 Lafayette Road St. Paul, MN 55155	651-296-5484 info.dnr@state.mn.us	www.dnr.state.mn.us/wildlife/index.html
Mississippi	Mississippi Department of Wildlife, Fisheries, and Parks 1505 Eastover Dr. Jackson, MS 39211	601-432-2400	http://home.mdwfp.com/
Missouri	Missouri Department of Conservation 2901 W. Truman Blvd. Jefferson City, MO 65109	573-751-4115 Fax: 573-751-4467	www.mdc.mo.gov
Montana	Montana Fish, Wildlife, and Parks 1420 E. 6th Avenue PO Box 200701 Helena, MT 59620	406-444-2612 Fax: 406-444-4952	http://fwp.mt.gov/fishAndWildlife/
Nebraska	Nebraska Game and Parks Commission 2200 N. 33rd St. Lincoln, NE 68503	402-471-5410	http://outdoornebraska.ne.gov/conservation/wildlife_species.asp
Nevada	Nevada Department of Wildlife 1100 Valley Rd. Reno, NV 89512	775-688-1500 Fax: 775-688-1595	www.ndow.org
New Hampshire	New Hampshire Fish and Game Department 11 Hazen Dr. Concord, NH 03301	603-271-2461 or 603-271-2462 wildlife@wildlife.nh.gov	www.wildlife.state.nh.us
New Jersey	New Jersey Division of Fish and Wildlife Mail Code 501-03 PO Box 402 Trenton, NJ 08625	609-292-6685 Fax: 609-292-8207	www.state.nj.us/dep/fgw/wildlife.htm
New Mexico	New Mexico Game and Fish Department 1 Wildlife Way PO Box 25112 Santa Fe, NM 87504	505-476-8038 ispa@state.nm.gov	www.wildlife.state.nm.us

State	Wildlife Management	Contact	Web Address
New York	New York State Department of Environmental Conservation 625 Broadway Albany, NY 12233	518-402-8920 Fax: 518-402-9027 fwwildlf@gw.dec.state.ny.us	www.dec.ny.gov
North Carolina	North Carolina Wildlife Resources Commission 1701 Mail Service Center Raleigh, NC 27699	919-707-0050 wrccomments@ncwildlife.org	www.ncwildlife.org
North Dakota	North Dakota Game and Fish Department 100 N. Bismarck Expressway Bismarck, ND 58501	701-328-6305 Fax: 701-328-6352 ndgf@nd.gov	http://gf.nd.gov/
Ohio	Ohio Division of Wildlife 2045 Morse Rd., Bldg G Columbus, OH 43229	1-800-945-3543 wildinfo@dnr.state.oh.us	http://www2.ohiodnr.com/soilwater/
Oklahoma	Oklahoma Department of Wildlife Conservation 1801 N. Lincoln PO Box 53465 OKC, OK 73152	405-521-1739 info@odwc.state.ok.us	www.wildlifedepartment.com
Oregon	Oregon Department of Fish and Wildlife 4034 Fairview Industrial Drive SE Salem, OR 97302	503-947-6000 odfw@state.or.us	www.dfw.state.or.us/wildlife
Pennsylvania	Pennsylvania Game Commission 2001 Elmerton Avenue Harrisburg, PA 17110	717-787-4250 pgccomments@pa.gov	www.pgc.state.pa.us
Rhode Island	Rhode Island Division of Fish and Wildlife Wildlife Management and Hunter Education 277 Great Neck Rd West Kingston, RI 02835	401-789-0281	www.dem.ri.gov/programs/bnatres/fishwild/
South Carolina	South Carolina Department of Natural Resources 1000 Assembly Street PO Box 167 Columbia, SC 29202	803-734-3886 Fax: 803-734-6020	www.dnr.sc.gov/wildlife.html
South Dakota	South Dakota Game, Fish and Parks 523 East Capitol Avenue Pierre, SD 57501	605-733-3387 Fax: 605-733-6245	http://gfp.sd.gov/

State	Wildlife Management	Contact	Web Address
Tennessee	Tennessee Wildlife Resources Agency Ellington Agricultural Center 440 Hogan Rd.Nashville, TN 37220	615-781-6610ask.TWRA@tn.gov	www.tn.gov/twra
Texas	Texas Parks and Wildlife Department 4200 Smith School Rd. Austin, TX 78744	512-389-4828	www.tpwd.state.tx.us/huntwild/wild
Utah	Utah Division of Wildlife Resources 1594 W North Temple, Suite 2110 Box 146301 Salt Lake City, UT 84114-6301	801-538-4700 Fax: 801-538-4745	www.wildlife.utah.gov
Vermont	Vermont Department of Fish and Wildlife 10 South 103 South Main Street Waterbury, VT 05671	802-241-3700 Fax: 802-241-3295 fwinformation@state.vt.us	www.vtfishandwildlife.com
Virginia	Virginia Department of Game and Inland Fisheries 4010 West Broad Street PO Box 11104 Richmond, VA 23230	804-367-1000 dgifweb@dgif.viginia.gov	www.dgif.virginia.gov/wildlife
Washington	Washington Department of Fish and Wildlife 600 Capitol Way N. Olympia, WA 98501-1091	360 902-2515 Fax:360-902-2162 wildthing@dfw.wa.gov	http://wdfw.wa.gov/
West Virginia	West Virginia Division of Natural Resources Building 74 324 Fourth Avenue South Charleston, WV 25303	304-558-2771 dnr.wildlife@wv.gov	www.wvdnr.gov
Wisconsin	Wisconsin Department of Natural Resources 101 S. Webster Street PO Box 7921 Madison, WI 53707	608-266-2621 Fax: 608-261-4380	http://dnr.wi.gov/
Wyoming	Wyoming Fish and Game Department 5400 Bishop Blvd Cheyenne, WY 82006	307-777-4600 wgfdwebmaster@wyo.gov	http://gf.state.wy.us/