

# Foreign Animal Diseases and the Consequences of their Introduction

## overview 1

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The United States produces approximately \$250 billion in agricultural products annually. Through exportation to other nations, the market for U.S. agricultural sales is greatly expanded; thus a major mission of the United States Department of Agriculture (USDA) is to protect existing export markets and investigate future expansion into new markets. If a foreign animal disease enters the U.S., there may be extensive market losses and even more costly export barriers, causing severe economic impacts.

The risks of introduction today are greater than ever because of expanding international trade and travel. The amount of agricultural imports has doubled over the last decade and, in the climate of free trade, will certainly continue to grow. A highly transmissible foreign animal disease can spread ferociously if undetected or not reported. Animal production today is much more intensified, with approximately 95 percent of agricultural products produced on about five percent of the farms. Also, animals today are transported extensively throughout the nation. For instance, it is common for a steer to cross several state lines between birth and slaughter—born in one state, weaned in a second, fattened in a third, and slaughtered in a fourth. At each of these way stations there is possibility of contact with numerous other animals, with tremendous potential for disease spread and dissemination.

### The Consequences of Introducing a Foreign Animal Disease

What are foreign animal diseases and why the potential for such devastation? A **foreign animal disease (FAD)** is an important transmissible livestock or poultry disease believed to be absent from the United States and its territories. Many diseases which are considered foreign were present in the U.S. at one time, but have been eradicated. Foreign animal diseases are sometimes called **exotic animal diseases**. **Transboundary diseases** is a new term used in many international documents to describe FADs. A foreign animal disease introduced into the United States could have far-reaching impacts on the health of livestock, pets and poultry, as well as on the economy.

*A foreign animal disease could devastate naïve livestock or poultry populations through high morbidity or mortality.* In 1997, an outbreak of classical swine fever, a highly contagious and often fatal systemic disease of pigs, occurred in the Netherlands. To eradicate this exotic disease from their swine population, the Dutch were forced to slaughter approximately eight million pigs.

**Foreign Animal Disease (FAD)**—an important transmissible livestock or poultry disease believed to be absent from the United States and its territories

**Exotic Animal Disease (EAD)**—animal diseases which are unusual, including foreign animal diseases

**Transboundary Diseases**—a new term used in many international documents to describe FAD

**Emerging Infectious Diseases**—diseases that have the potential for significant health impacts in animals or humans, and whose incidence has recently increased or is likely to increase

*The presence of a foreign animal disease in the U.S. could result in export bans on animals and related animal products.* These bans are imposed because other countries want to protect their agricultural industry. In 1998, virulent Newcastle disease, a foreign animal disease that causes diarrhea and death in poultry, was found in game chickens in downtown Fresno, California. Rapid recognition and response limited the spread of the disease, and commercial poultry operations remained free of the disease. However, even this limited presence caused poultry exports to be seriously curtailed, costing a minimum of US\$400 million in lost revenue because of embargoes levied by countries concerned about importing the disease in meat products. In 2003, authorities once again battled an outbreak of exotic Newcastle disease in California.

*Millions or possibly billions of dollars could be spent to control or eradicate the disease, even if it is localized to a small region.* Estimates of the cost of a foreign animal disease outbreak are staggering. The largest animal disease outbreak in recent U.S. history was an epizootic of highly pathogenic avian influenza that occurred in Pennsylvania and neighboring states in 1983–84. The highly pathogenic strains of the avian influenza virus, which cause a severe and often fatal illness in poultry, are exotic to the U.S. and can devastate commercial poultry operations. Over six months, all infected chickens were depopulated and the premises decontaminated, with a price tag of US\$63 million paid by the federal government. Other foreign animal diseases could be even more costly. It is estimated that if foot and mouth disease entered the US and spread for any length of time, it would cost at least US\$2 billion to depopulate and disinfect. Lost trade costs during the detection and clean-up process have been estimated at US\$27 billion.

*A foreign animal disease could spread into a susceptible wildlife population, which would complicate, or worse, prohibit eradication of the disease.* The West Nile virus, which was discovered in the eastern United States in 1999, is an example of a foreign animal disease that has now become established in wildlife populations. Humans, horses, many species of birds, and other wild animals are hosts for the virus, which can cause severe encephalitis and even death in susceptible species. The virus is particularly devastating to our corvid bird populations, especially crows. To date, millions of dollars have been spent to investigate the disease and its geographic sprawl. A special West Nile virus surveillance program operates through partnerships with the Centers for Disease Control and Prevention, U.S. Department of Agriculture, U.S. Geological Survey, Department of Defense, Environmental Protection Agency, state and local health departments, state veterinarians and wildlife biologists. Data are

continually collected to determine the prevalence and transmission of the virus in human, animal, wild bird, and mosquito populations.

Heartwater is another vector-borne disease of concern to the U.S. This foreign animal disease, caused by *Cowdria ruminantium*, is an important tick-transmitted disease of livestock in Africa. Heartwater can affect all ruminants, causing fever, respiratory distress, and neurologic signs. There are serious concerns that *C. ruminantium* could be introduced into the U.S. at any moment, carried on a tick-infested wild bird. If it is not detected at the earliest possible incursion, heartwater is likely to become established in the wild deer population, in which case it will be impossible to eradicate.

### The World Organization for Animal Health and Its Role

Not all foreign animal diseases are of equal concern to the United States. Currently, the U.S. has the diagnostic capability for approximately 50 different foreign animal diseases. The most important of these are the high-priority diseases on lists maintained by the **World Organization for Animal Health**, formerly known as the **Office International des Epizooties (OIE)**.

In 1920, rinderpest was introduced in Belgium when zebus, originating in India and destined for Brazil, passed through the port of Antwerp. The outbreak spread to other countries in Europe. This led to the formation of the Office International des Epizooties in 1924 by 24 countries. The OIE is an international animal health organization that helps countries coordinate animal disease information and decrease the potential for epidemics. Over the last 20 years, the OIE has expanded and is indeed a global organization. Currently there are 164 member nations and each country has equal representation in the organization.

The most important function of the OIE is to inform governmental veterinary services of the occurrence and course of epizootics that could endanger animal or human health. The urgency of dispatching information varies according to the classification of the disease. The OIE has established a warning system that allows member countries to take rapid action should the need arise. Within 24 hours of the occurrence of the first outbreak of an infectious disease that could have serious repercussions on public health or on the economy of animal production, the affected country reports the incident to the OIE Central Bureau. The OIE then disseminates the information to its member countries. The OIE also promotes and coordinates research into the surveillance and control of animal diseases throughout the world.

In addition, the OIE sets the standards for diagnostic methods and vaccine methodologies in international trade. In the world economy, the unimpeded flow of international trade in animals and animal products

**World Organization for Animal Health, or Office International des Epizooties (OIE)**—an international animal health organization that was established to help countries coordinate animal disease information and decrease the potential for epidemics

requires veterinary regulations designed to prevent the spread of transmissible diseases to animals and to human beings. To avoid unjustified trade barriers, these requirements must be harmonized between countries. The advent of the World Trade Organization (WTO) in 1995 has expanded the influence and importance of the OIE. The WTO was established as the implementing body for the Sanitary and Phytosanitary Measures Agreement (SPS Agreement) of the General Agreement on Tariffs and Trade (GATT). Member nations of the WTO must respect the SPS Agreement, which defines the requirements for food safety and animal and plant health as they relate to international trade. Any country that feels that its products are being unreasonably blocked by another country may appeal to the WTO. To decide the merits of a case, the WTO relies on the standards set by the OIE. Consequently, policies and decisions by the OIE can have reverberating consequences for international trade. Barriers to trade must now be scientifically justified and must not arbitrarily or unjustifiably discriminate among nations.

### Infectious Diseases Considered To Pose a Threat For Introduction

The OIE maintains lists of the diseases it considers to be of the highest concern for transmission across international borders. It currently classifies animal diseases, based on their relative socio-economic and public health significance, into two lists. **List A diseases** are “transmissible diseases that have the potential for very serious and rapid spread, irrespective of national borders, that are of serious socio-economic or public health consequence and that are of major importance in the international trade of animals and animal products.” List A diseases receive the highest priority for exclusion as their presence can rapidly dictate closing of international exports. At present, List A contains 15 diseases (Table 1), most of which are caused by viral agents. Currently, bluetongue is the only List A disease that is endemic in the U.S. Vesicular stomatitis virus occasionally occurs in the U.S. For each of these diseases, some strains are considered endemic to the U.S. and other strains are foreign. In 2003, there was an outbreak of exotic Newcastle disease in California, Nevada, and Texas.

**List B diseases** are defined by the OIE as “transmissible diseases that are considered to be of socio-economic and/or public health importance within countries and that are significant in the international trade of animals and animal products.” Currently List B contains approximately 90 diseases (Table 2). In the future, the OIE may likely remove the designation of diseases as list A or B and maintain a single list that contains all diseases of concern.

**OIE List A Diseases**—transmissible diseases that have the potential for serious, rapid spread, irrespective of national borders, that are of serious socio-economic or public health consequence and that are of major importance in the international trade of animals & animal products

**OIE List B Diseases**—transmissible diseases that are considered to be of socio-economic and/or public health importance within countries and that are significant in the international trade of animals and animal products

*In the future, the OIE may likely remove the designation of diseases as list A or B and maintain a single list that contains all diseases of concern.*

### Emerging Infectious Diseases

In addition to the foreign animal diseases on the OIE lists, the U.S. is concerned about a number of emerging infectious diseases. **Emerging infectious diseases** are diseases that may have significant health impacts in animals or humans, and which were recently introduced to a specific geographic area or whose incidence has recently increased or is likely to increase. These emerging diseases are, in general, not yet found on the official OIE lists. Examples of emerging diseases include postweaning multisystemic wasting syndrome (PMWS) in pigs and avian vacuolar myelinopathy in wild waterfowl and bald eagles. Some emerging diseases such as Hendra, Nipah, and bovine spongiform encephalopathy cause disease in both animals and humans while others—for example, hantaviruses, Ebola, Marburg, and *E. coli* O157:H7—seem to threaten mainly humans and related primates.

A variety of factors, often in combination, can result in an emerging disease. Sometimes new diseases are recognized when a pathogen enters a new host or becomes more virulent as the result of a mutation. New hosts are often infected as a result of increased contact with insect vectors, animal reservoirs, or environmental reservoirs for the pathogen. For this reason, emerging diseases are sometimes seen when human settlements or agriculture expand into previously undeveloped areas. The emerging disease may appear as sporadic cases, in limited outbreaks, or as a massive epidemic. In 1994, 1995, and 1999, Australia experienced small outbreaks of a new respiratory disease in horses; in all, 23 horses became ill and 16 of these animals died. Three humans in contact with the sick horses also became infected and two died as the result of their illness. The pathogen, called the Hendra virus, seems to have spread to the horses from flying foxes (a type of fruit bat). The Nipah virus in Malaysia also appears to have entered pigs from fruit bats; however, this virus was recognized when it caused an epizootic of respiratory and neurologic disease in pigs and an epidemic of fatal encephalitis in humans. To control the outbreak, more than a million pigs were culled and pig farming was banned in some parts of the country. Other emerging diseases that seem to result from contact with the pathogen's natural host include hantaviruses, which are contracted from various rodent hosts, and Ebola and Marburg, which spread to humans and other primates from unknown natural hosts.

In some cases, emerging diseases may be diseases that were simply not recognized before. It is quite possible that cases of Hendra, Nipah, or even Ebola occurred before the syndrome was described and the pathogen isolated. Bovine spongiform encephalopathy was recognized only in the mid-1980s but appears to have existed in cows since the 1970s. Emerging diseases also include infections that have expanded their geographic range

and appeared in a new region; the West Nile virus, which entered the U.S. in 1999, can be considered an emerging disease

### Bioterrorism

Exotic diseases are usually introduced accidentally into a country or emerge as the result of natural factors. However, pathogens could also be introduced deliberately. **Bioterrorism**, or biological warfare, is defined as the intentional use of microorganisms or toxins derived from living organisms or viruses to cause death or disease in humans, other animals, or plants in civilian settings. Chemical weapons, in contrast, are human-made poisonous substances that kill or incapacitate. In veterinary medicine, we are also concerned about **agroterrorism**, which is a specific form of bioterrorism in which the biological weapons target animal or crop agriculture to cause economic damage and instability. Some but not all of the agents that could be used in agroterrorism are foreign animal diseases.

The consequences of bioterrorist attacks directed at humans differ considerably from consequences of agroterrorist attacks. The effects of an attack directed against public health would be measured in human morbidity and mortality and the costs associated with decontamination, surveillance, control, and eradication if possible. The effects of an attack directed at the health of livestock or poultry would be measured in animal morbidity and mortality and associated clean up costs as for human diseases. In addition, astronomical costs associated with disruption of animal and animal product exports would likely accrue. If the biological agent used were a zoonotic agent, both sets of costs could be incurred, and the situation could be far worse. *Bacillus anthracis* is an example of a zoonotic agent. This spore-forming bacterium causes anthrax, a potentially fatal disease that can affect most mammals, including humans. The spores of *B. anthracis* can be used by bioterrorists to cause illness in humans or animals, spread fear, and disrupt the economy. During World War II, the German military allegedly used anthrax to contaminate horses and mules in Mesopotamia and France. In a more recent situation, anthrax spores sent through the U.S. mail caused fatal inhalation anthrax in several people and spread panic throughout the country.

One alarming aspect of bioterrorism is the relative ease of availability of pathogens and biological toxins and the lack of complicated equipment and technology required to use them. Bioterrorists could introduce the pathogen itself, infected animals or animal products, or insect vectors. How likely a pathogen is to be used as a bioterrorism agent is dictated by how easily it can be acquired as well as by its innate infectiousness, contagiousness, virulence, and pathogenicity. However, the magnitude of a bioterrorist attack is most heavily influenced by how quickly the agent is

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recognized, a response mobilized, and the agent contained, as well as by the availability of control and treatment options. Below are two lists of biological agents and diseases that are thought to pose the greatest threat to animal and public health. Although some agents are common to both lists, most of them are not. It is important to remember that the agents useful to the agroterrorist are primarily those that detrimentally impact agricultural trade, whereas the agents used in bioterrorist attacks against humans are chosen to elicit human mortality and cause fear.

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