

# Agroterrorism: A Potential Threat to US Animal Agriculture -I

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The agricultural industry in the United States contributes about 13% to the gross annual domestic product.<sup>1</sup> The United States Department of Agriculture reported that the cash receipts for livestock, poultry, and crops for 1996 exceeded 200 billion dollars.<sup>2</sup> Over the last 3 decades, improved agricultural technology, farm efficiency and practices has benefited Americans; an average American paid about 11 cents per dollar of disposable income on food in 1996, as compared to about 14 cents per dollar in 1970. The cost of food is lowest in the United States as compared to the rest of the world.<sup>2,3</sup> The recent terrorist attack on United States has raised serious concerns on the vulnerability of plant and animal agriculture in the United States. The deliberate introduction of a pathogen (fungus, bacterium, virus, or insect pest) into U.S. livestock, poultry, or crops could cause a disease outbreak. The outcome of an outbreak could be devastating, resulting in loss of livestock, disruption of animal agriculture industry and decreased food production. This would drive food prices up, halt valuable exports, and ultimately cost taxpayers billions of dollars in lost revenue and industry renewal costs.

This paper is the first of a two part series that seeks to address and inform veterinarians about agroterrorism. In this paper, we attempt to introduce the overall impact of agroterrorism and the potential biological agents about which we need to be concerned. Information presented in this paper is adopted from a discussion paper developed by Anne Kohlen " *Responding to the Threat of Agroterrorism: Specific Recommendations for the United States.*" *BCSIA Discussion paper 2000-29, EDSP Discussion paper EDSP-2004-04, John F. Kennedy School of Government, Harvard University, October 2000.* The second paper will describe in detail the diseases of importance to US interests with reference to epidemiology, pathology, treatment and control.

Past natural outbreaks clearly indicate that economic losses due to an outbreak include not only loss of agricultural products, but also the cost of the disrupted trade. The same can be envisaged to occur in the event of an act of agroterrorism. The most recent example is the British outbreak of FMD in 2001. By most accounts this was overwhelmingly a large outbreak. It is estimated that about 3.90 million animals were destroyed at a direct cost of about over 6.5 billion dollars. This does not include the losses due to imposed trade barriers and other related animal agriculture commodities. The cost of recovering from this outbreak is much higher than just the cost of disposing of the infected animals. To effectively control the spread of FMD, animals suspected to have been exposed to FMD were also destroyed. In some cases this included all of the animals within a geographic radius, as well as those that were exposed through common transportation routes. The precise impact of the FMD outbreak is still unclear. Economists have indicated that the cost of slaughtering and disposing of this increased number of animals will be only a fraction of the total cost of disease eradication, the greater part being that of disrupted production and trade. Another notable outbreak was the highly pathogenic avian influenza infection which occurred in Pennsylvania in 1983. As a result of this outbreak, about 17 million chickens had to be disposed of. The cost of eradication was estimated to be about \$86 million.<sup>5</sup> This outbreak increased the price of chicken in the retail market; which cost consumers another \$548 million. The incident cost an additional \$7 million in lost wages.<sup>6</sup>

The Office International des Epizooties/ Epizootics (OIE), of the World Organization for Animal Health, is an intergovernmental organization with 155 member countries. The OIE maintains and tracks animal diseases and outbreaks from several member countries. The World Trade Organization recognizes the OIE as the international agency for setting animal health standards for conducting international trade. The OIE maintains a list of "transmissible diseases". Diseases under List A are diseases which have the potential for very serious and rapid spread, irrespective of national borders, which are of serious socio-economic or public health consequence and which are of major importance in the international trade of animals and animal products. The List A diseases (Table 1) could severely damage the U.S. agricultural market, since an outbreak of one of these diseases is internationally recognized as grounds for export embargo. The OIE also describes other diseases under List B (Table 2) that are considered to be of socio-economic and/or public health importance within countries and that are significant in the international trade. The OIE website at [http://www.oie.int/eng/maladies/en\\_classification.htm](http://www.oie.int/eng/maladies/en_classification.htm) can be accessed to obtain information diseases described under List A and B. In this paper, diseases placed under List A are described.

The diseases under List A (Table 1) are predominately viral diseases and are transmitted in different ways. Most viruses can be transmitted through direct contact. Some can be spread through the air over great distances in aerosol form. Others, such as bluetongue and African swine fever, are spread by insect vectors. There are three primary transmission modes of these animal diseases.

**1. Airborne Transmission Mode of Animal Diseases.** Foot-and-mouth disease, avian influenza, and Newcastle disease all can spread via airborne aerosols over long distances. In 1981, three days after an outbreak of FMD in Brittany, France, single cases appeared across the English Channel on the Isle of Wight. Prevailing wind patterns corroborate the hypothesis that the virus traveled a distance of 175 miles as an airborne aerosol.<sup>6</sup> Airborne diseases are extremely difficult to contain and thus would present an enormous challenge to emergency responders in the event of an outbreak. These diseases can also be transmitted by direct contact.

**2. Direct Transmission Mode of Animal Diseases.** Diseases such as rinderpest, vesicular stomatitis, hog cholera, and African swine fever can be spread by direct contact among animals, as well as by contact with contaminated objects. For example, feed troughs, water troughs, and milking machines that are used by an infected animal can transmit a virus to other animals. In addition, these viruses can travel on people's clothes, shoes, and equipment. This presents the necessity of biosecurity measures—keeping animal facilities clean and restricting human and vehicle traffic around animals.

**3. Vector Transmission Mode of Animal Diseases.** Some diseases are transmitted by insect vectors. A tick or a mosquito acquires an agent from one animal and transmits it to another through a subsequent bite. In these cases disease control depends on insect control. Vaccination against most List A disease agents is practiced in endemic areas of the world.

## **Zoonotic Diseases**

Zoonotic diseases are those diseases that are shared between animals and humans. Some of the diseases under List A (Table 1) can cause illness in humans. However, except for Rift Valley fever, none of them are true zoonotic diseases, but of more concern is contact with extremely large dose of virus, while working with infected animals. For example, foot-and-mouth disease, vesicular stomatitis, and Newcastle disease can be transmitted to humans, but the resulting illness is mild and not considered dangerous to human health. Nevertheless, a few of the pathogens, such as the highly pathogenic avian influenza virus have been shown to seriously harm humans. Six people died in Hong Kong in 1997-98 as a result of the highly pathogenic avian influenza outbreak.<sup>6</sup> Although the threat of agroterrorism is primarily an economic concern, the emergence of new zoonotics, such as the recent Nipah virus in Malaysia and West Nile virus in New York City, raises serious human health considerations as well. Some of the diseases Listed under List B (Table 2) are true zoonotic diseases and can be severe and on occasions be fatal.

## **Farm Biosecurity**

A livestock producer can reduce the epidemiological risk by increasing biosecurity measures at his/her facilities. New animals should be isolated from the rest of the herd for several days to let potential symptoms appear. Currently most cattle diseases are introduced through the purchase of infected animals.<sup>7</sup> Vehicles and people should be kept away from livestock buildings because they could introduce or transmit diseases.<sup>8</sup> Not all farms adhere to these general guidelines. A survey of 252 farms that raise hens for egg production, some with more than 200,000 egg layers, found that almost one-third of the sites allow nonbusiness visitors into the laying houses.<sup>9</sup> More than 85 percent of dairy farms do not isolate new cows from the rest of the herd for any period of time.<sup>10</sup> Heightened biosecurity will not only reduce the chance that a terrorist could introduce a disease into farm facilities, but will also reduce the spread of naturally occurring diseases and pests. This program would help counter the threat of agroterrorism at the front line: the farm. The Veterinary Extension Group at Penn State in collaboration with Pennsylvania Department of Agriculture, Bureau of Animal Health and Diagnostic Services has developed a on-farm biosecurity training program. The biosecurity program not only focuses on education but also provides training for veterinarians, food animal producers, and animal health specialists in implementing on-farm biosecurity practices. Several biosecurity training sessions will be conducted over the next six months in several counties in Pennsylvania.

## **Current Emergency Management Procedures**

Disease outbreaks among plants or animals fall under the auspices of APHIS, a division of the USDA's Marketing and Regulatory Programs. Within APHIS, animal disease outbreaks are handled by Veterinary Services (VS), while plant disease outbreaks are handled by Plant Protection and Quarantine (PPQ).

**Emergency Procedure for Animal Disease Outbreaks.** Within thirty-six hours of a serious disease outbreak, a national USDA team can be mobilized to handle the situation. The following is a summary of what would happen if a FAD broke out:

- 1) A farmer notices a sick animal, or a herd manager of a large production operation notices a higher mortality rate than normal or unique symptoms in a group of animals and call the local or corporate veterinarian. This recognition could also begin at a port, sale barn, or other place of animal concentration.
- 2) The veterinarian either makes a diagnosis of a domestic disease or suspects something abnormal based on clinical signs or epidemiology.
- 3) If abnormal, the veterinarian will notify a representative of the state veterinarian or APHIS area veterinarian in charge, who will begin the investigation.
- 4) Within twenty-four hours, a foreign animal disease diagnostician (FADD) visits the premises and begins an investigation. The FADD may be a state or federal veterinary medical officer. The FADD works with the labs to describe the situation and takes the appropriate samples to confirm the disease.
- 5) The Early Response Team (ERT) may be called within twenty-four hours to characterize an unconfirmed or emerging disease or to describe the pathogenesis and epidemiology of the disease. The ERT makes recommendations that may lead to either a return to routine control and surveillance measures or an escalation of response.
- 6) If a disease is confirmed, local and State resources are used to contain, control and eradicate the disease if possible. If those resources are exceeded or the state requests assistance, the Regional Emergency Animal Disease Eradication Organization (READEO) is activated to integrate with the state's response. The READEO's role is to give additional technical support, coordinate national communication, and manage national consequences and federal response resources.

## **CONCLUSION**

Biological weapons are not just a threat to human health. A terrorist armed with animal or plant pathogens also threatens the livestock, poultry, and crops of the agricultural sector, a vital part of the U.S. economy. The fact that a single, determined individual or small group could bring all U.S. animal and animal product exports to a halt underscores the need for increased defense against this threat. U.S. agriculture is particularly vulnerable to foreign diseases, to which domestic animals have not built up a natural resistance. In

addition, animals concentrated in fewer production facilities, and with the frequent transportation of animals among these facilities, a single pathogen introduction could cause very widespread infection. An outbreak of a foreign disease could prompt the international community to impose export restrictions on U.S. agricultural goods, resulting in severe financial losses for U.S. producers. The public reaction to an agroterrorist attack may further amplify these financial losses, if food safety concerns prompt voluntary boycotts of domestic agricultural products.

## References

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Table 1. OIE List A diseases affecting primarily cattle, swine and poultry

<b>Disease</b>	<b>Primary Modes of Transmission</b>	<b>Primary Animals Affected</b>	<b>Vaccine (use and availability in endemic areas)</b>	<b>Location</b>	<b>Affect humans?</b>
<sup>v</sup> <b>Foot-and-mouth disease</b>	Aerosols; direct or indirect contact (via human clothing, equipment, vehicles, or through milk or partially cooked meat)	Cloven-hoofed animals, esp. cattle and swine	Yes	Asia, Africa, Middle East, South America *	Occasionally after very close contact, humans can develop mild symptoms.
<b>Vesicular Somatitis</b>	Direct contact (i.e. shared feed and water troughs, milking machines); insect vectors	Cattle, swine, horses	Yes	U.S., Mexico, Canada, the Caribbean, Central and South America	During epidemics humans can get a version resembling flu
<b>Swine Vesicular Disease</b>	Ingestion of infected meat	Swine	No	Hong Kong, Japan *	Occasionally causes flu-like symptoms
<b>Rinderpest</b>	Direct contact with any animal secretions; airborne droplets	Cattle, sheep, goats	Yes	Africa, Middle East, Asia	No
<b>Contagious bovine pleuro-pneumonia</b>	Inhalation of droplets of infected animal secretions	Cattle	Yes	Asia, Central Africa, Spain, Portugal	No
<b>Lumpyskin disease</b>	Insect vectors	Cattle	Yes	Africa	No
<b>Rift Valley fever</b>	Insect vectors, esp. mosquitoes; direct contact with blood or tissue	Sheep, cattle		Africa *	Humans very susceptible; disease is sometimes fatal
<b>Bluetongue</b>	Insect vectors	Sheep, cattle	Yes	U.S., Africa, Europe	No
<b>African Swine Fever</b>	Insect vectors (ticks); ingestion of infected meat; direct contact; airborne	Swine	No	Africa, Iberian Peninsula, Sardinia	No
<b>Newcastle disease</b>	Direct contact with animal secretions, esp. feces; contaminated feed, water, equipment, human clothing, etc.	Poultry, wild birds	Yes	Worldwide	Occasionally causes transitory conjunctivitis after extensive exposure
<b>Classical Swine ("hog cholera")</b>	Direct contact with animal secretions; indirect contact via shoes, clothing, equipment	Swine	Yes	Africa, Asia, South and Central America, parts of Europe	No
<b>Highly pathogenic avian influenza ("fowl plague")</b>	Direct contact; airborne aerosols	Chickens, turkeys	Yes	Worldwide	Usually rare, but 1997 Hong Kong epidemic killed six with influenza-like illness

<sup>v</sup> Recent outbreaks in Europe, \* Recent outbreaks

Table 2. OIE List B diseases \*

<p>Multiple Species diseases</p> <ul style="list-style-type: none"> <li>• <u>Anthrax</u></li> <li>• Aujeszky s disease</li> <li>• <u>Echinococcosis/ hydatidosis</u></li> <li>• Heartwater</li> <li>• <u>Leptospirosis</u></li> <li>• New world screwworm (Cochliomyia hominivorax)</li> <li>• Old world screwworm (Chrysomya bezziana)</li> <li>• Paratuberculosis</li> <li>• <u>Q fever</u></li> <li>• <u>Rabies</u></li> <li>• <u>Trichinellosis</u></li> </ul>	<p>Cattle diseases</p> <ul style="list-style-type: none"> <li>• Bovine anaplasmosis</li> <li>• Bovine babesiosis</li> <li>• <u>Bovine brucellosis</u></li> <li>• <u>Bovine cysticercosis</u></li> <li>• Bovine genital campylobacteriosis</li> <li>• <u>Bovine spongiform encephalopathy</u></li> <li>• <u>Bovine tuberculosis</u></li> <li>• <u>Dermatophilosis</u></li> <li>• Enzootic bovine leukosis</li> <li>• Haemorrhagic septicaemia</li> <li>• Infectious bovine rhinotracheitis/infectious pustular vulvovaginitis</li> <li>• Malignant catarrhal fever</li> <li>• Theileriosis</li> <li>• Trichomonosis</li> <li>• <u>Trypanosomosis (tsetse-borne)</u></li> </ul>
<p>Sheep and goat diseases</p> <ul style="list-style-type: none"> <li>• Caprine and ovine brucellosis (excluding B. ovis)</li> <li>• Caprine arthritis/encephalitis</li> <li>• Contagious agalactia</li> <li>• Contagious caprine pleuropneumonia</li> <li>• Enzootic abortion of ewes (ovine chlamydiosis)</li> <li>• Maedi-visna</li> <li>• Nairobi sheep disease</li> <li>• Ovine epididymitis (Brucella ovis)</li> <li>• Ovine pulmonary adenomatosis</li> <li>• <u>Salmonellosis (S. abortusovis)</u></li> <li>• Scrapie</li> </ul>	<p>Equine diseases</p> <ul style="list-style-type: none"> <li>• Contagious equine metritis</li> <li>• Dourine</li> <li>• Epizootic lymphangitis</li> <li>• Equine encephalomyelitis (Eastern and Western)</li> <li>• Equine infectious anaemia</li> <li>• Equine influenza</li> <li>• Equine piroplasmosis</li> <li>• Equine rhinopneumonitis</li> <li>• Equine viral arteritis</li> <li>• <u>Glanders</u></li> <li>• Horse mange</li> <li>• Horse pox</li> <li>• <u>Japanese encephalitis</u></li> <li>• <u>Surra (Trypanosoma evansi)</u></li> <li>• <u>Venezuelan equine encephalomyelitis</u></li> </ul>

Swine diseases	Avian diseases
<ul style="list-style-type: none"> <li>• Atrophic rhinitis of swine</li> <li>• <u>Enterovirus encephalomyelitis</u></li> <li>• <u>Porcine brucellosis</u></li> <li>• <u>Porcine cysticercosis</u></li> <li>• Porcine reproductive and respiratory syndrome</li> <li>• Transmissible gastroenteritis</li> </ul>	<ul style="list-style-type: none"> <li>• Avian chlamydiosis</li> <li>• Avian infectious bronchitis</li> <li>• Avian infectious laryngotracheitis</li> <li>• Avian mycoplasmosis (M. gallisepticum)</li> <li>• <u>Avian tuberculosis</u></li> <li>• Duck virus enteritis</li> <li>• Duck virus hepatitis</li> <li>• Fowl cholera</li> <li>• Fowl pox</li> <li>• Fowl typhoid</li> <li>• Infectious bursal disease (Gumboro disease)</li> <li>• Marek s disease</li> <li>• Pullorum disease</li> </ul>

\* Diseases that are underlined are zoonotic diseases