

Foot and Mouth Disease: Are We Ready if an Outbreak Occurs?

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Abstract

North American red meat industries are highly integrated. Most of this integration has been driven to maximize efficiency and historically, animals have been cheaper to move to the sources of coarse grain than the transport of feeds to the origin of animals. When a foreign animal disease occurs in a previously disease-free area, certain pre-existing trade patterns may result in the massive killing of healthy animals as a consequence of loss of access to live animal markets in other states or countries. In Canada, time-sensitive and resource demanding livestock, such as early weaned piglets (10 lb; 4.5 kg) and feeder pigs (50 lb; 22.7 kg), will be critically affected. Cattle movement is far less time-sensitive than swine. Governments of European countries have anticipated welfare slaughter as part of their disease eradication preparedness. The concept of welfare slaughter, and the resource implications thereof, have not been included in current published disease emergency planning documents in Canada or the United States. Public outcry related to a disease eradication crisis will be focused on the animal welfare problem, and not disease eradication. If the disease is foot and mouth or classical swine fever, the nature of the emergency will be focused on animal welfare, not disease eradication. The national veterinary infrastructure in both Canada and the USA currently tasked to prepare for animal emergencies have been planning for the wrong emergency.

Résumé

L'industrie nord-américaine de la viande rouge est fortement intégrée. Le plus souvent, cette intégration a eu pour but de maximiser l'efficacité et, historiquement, il a toujours été plus économique d'amener les animaux vers les sources de céréales secondaires que de transporter celles-ci dans le lieu d'origine des animaux. Lorsqu'une maladie animale étrangère fait irruption dans une région exempte de cette maladie, on peut assister à des abattages massifs d'animaux en bonne santé liés à la perte des marchés d'exportation traditionnels de ces animaux. Au Canada, le bétail à durée de vie critique et exigeant en ressources, tel que

les porcelets sevrés hâtivement (10 lb ou 4,5 kg) et les porcs à l'engrais (50 lb ou 22,7 kg), sera fortement affecté. Le mouvement des bovins est beaucoup moins sensible aux limites de temps que les porcs. Les gouvernements des pays d'Europe ont prévu d'intégrer l'abattage par compassion dans leurs plans d'éradication des maladies animales. Le concept d'abattage par compassion et les ressources que cela implique ne font pas partie des documents officiels d'intervention d'urgence du Canada et des États-Unis en cas d'épidémie. Le tollé du public soulevé lors d'une crise d'éradication de maladie sera axé sur le problème du bien-être animal, non sur celui de l'éradication de la maladie. Si la maladie en question était la fièvre aphteuse ou la peste porcine classique, on axerait l'urgence sur le bien-être animal, non sur l'éradication de la maladie. Au Canada et aux États-Unis, l'infrastructure vétérinaire nationale mandatée pour affronter les épidémies animales axe donc sa planification sur la mauvaise urgence.

Introduction

In western industrialized countries, where the stamping-out of Foreign Animal Disease (FAD) has recently been applied, there has been heightened public debate over the extreme costs required to achieve eradication and the ethical issues inherent in the process³. The 2001 Foot and Mouth Disease (FMD) epizootic in the United Kingdom gave rise to three major post-apocalyptic forums for public discussion of the disease eradication response in particular, and agricultural practices related to the production of human food of animal origin in general^{1,15,20}.

When considering lessons provided by other countries' FAD eradication experiences, and current livestock marketing patterns, the introduction of FMD into the US-Canadian red meat complex would result in three separate crises:

1. a small scale crisis related to the control of animals on infected and high-risk farms (stamping-out effort) for which the Canadian Food Inspection Agency (CFIA) has the legislative mandate and fiscal resources to address. A recent example is provided by the 2004, H₇N₃ avian influenza outbreak in British Columbia¹⁰.

2. an on-farm crisis related to welfare issues as a consequence of animal movement restrictions put in place by both the stamping-out response and the international border closure, and lastly,
3. a large, generalized on-farm financial crisis related to the loss of export market access, which in part would be manifest as an acute fall in livestock value, for example, the price of slaughter cows in Canada subsequent to bovine spongiform encephalopathy (BSE).^{7,27,45}

In FAD response, the animal welfare crisis is closely interconnected with the stamping-out effort as the two responses occur concurrently and compete for the same veterinary expertise (disease identification and animal welfare assurance), animal killing and carcass disposal resources. If FMD was identified in Canada, triggering the closure of the USA-CAN border, the most critical animal welfare problem would be an immediate (within 96 hours) inability to provide housing for thousands of isowean piglets.⁸ This crisis could also result if a single US state, such as Iowa, closed its borders to live animal movement.

Unlike recent experience with avian influenza in British Columbia, with an introduction of FMD into Canada or a significant trading region in the USA, the agri-emergency and media attention would center on the animal welfare emergency, and not the disease eradication effort.

Structure of Pig Farming in the Canada-United States Region

Swine production has undergone a worldwide revolution in recent years. A major contributing factor has been the introduction of the practice of multiple sites for pig production.²² Multi-site pig production is the most profound change to have occurred in swine production methodology in many years. The “isowean” principle is the building block of various multi-site pig production methodologies. Isowean, loosely defined as the removal of piglets from the environment of the dam prior to piglet colonization by common pathogens, was developed specifically for the elimination of infectious diseases. This method of production has been used to control or reduce severity of the nine major diseases: atrophic rhinitis, *Actinobacillus pleuropneumoniae*, pseudorabies virus, swine dysentery, transmissible gastroenteritis virus, mycoplasmal pneumonia, porcine respiratory and reproductive syndrome virus, *Hemophilus parasuis* and streptococcal meningitis.²²

Multi-site production has been instrumental in the eradication of pseudorabies in the United States.³⁶ Aujeszky's Disease (pseudorabies virus) was reported as a clinical disease of swine in the United States in the

late 1960s and spread widely, becoming a serious limitation on economic efficiency of the industry. During this time, Canada, for unknown reasons, remained free of this disease. In 1989, the state and federal governments established a program for eradication. In 1999, additional federal funds were made available to pay a per-animal bonus to producers who depopulated their infected herds (Accelerated Pseudorabies Eradication Program).³⁷ Herd depopulation is an ideal time to make structural changes in livestock farming.

Iowa had 23% of the US sow herd in 1978, which decreased to 17% in 2002. There were 2.11 million breeding swine in Iowa in 1978, and in 2007 there were only 1.08 million breeding swine.^{23,46} During the debulking of the Iowa sow herd by half, Iowa remained the state producing the most slaughter hogs.

The breeding and farrowing of sows and the managing of young pigs is the most labor-intensive, and is often viewed as the more management-intensive phase of pig production. Many disease-free isowean piglets produced in Canada were available to fill previous sow barns that had been converted into feeder barns in the central midwest states (Figure 1). Iowa and Pennsylvania were the last two states to achieve pseudorabies freedom in 2004.⁴¹

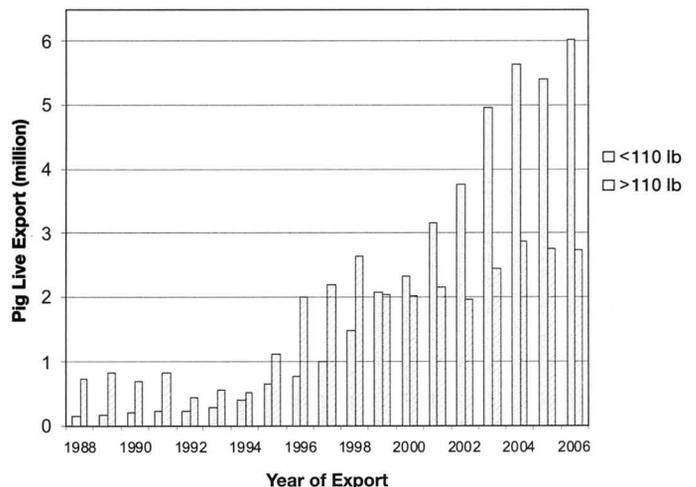


Figure 1. Annual export of Canadian live pigs, non-breeding, to the United States, from January 1988 to December 2006. In Statistics Canada data reports pigs >110 lb. (50kg) includes purpose grown market pigs and cull sows and boars. Pigs <110 lb are primarily newly weaned pigs (11 lb) and feeder pigs (60 lb). The pseudorabies eradication program started in the United States in 1989 but did not gain significant ground in the most concentrated states such as Iowa until 1998 with the introduction of the Accelerated Pseudorabies Eradication Program. Pseudorabies was eradicated from commercial swine in the US in 2004.

Foreign Animal Disease Eradication: Describing Incursions

In describing the consequences of FAD epizootics, financial impacts are often classified as direct costs or indirect costs. Costs are considered direct if emergency responders must pay out the cost to achieve the disease control goal, such as the verification and enforcement of mandatory cease movement, compensation for animals ordered destroyed and costs of carcass disposal. Indirect costs are losses incurred by individuals and sectors of the industry consequential to the disease occurrence, such as down time on empty farms and a loss of export market for meat products and live animals. A major part of contingency planning is, therefore, anticipating the type and magnitude of the direct costs and identifying the corresponding resources required for effective response and impact mitigation.

Animal movement restrictions severely disrupt the affected production systems. Animals located in quarantine zones most often cannot be salvaged for human consumption, and are strategically killed to relieve overcrowding or otherwise deteriorating animal husbandry conditions which occur on farms placed under movement restriction.^{18,19,30,44} "Welfare slaughter" is a term used in FAD eradication efforts to describe non-infected animals killed during the operational response to avoid on farm animal suffering. Analyses of previous events indicate that the magnitude of welfare slaughter subsequent to an FAD incursion is magnified under certain conditions: a) if the pre-incursion animal production industry is focused on export, b) the incursion is prolonged, c) the effects occur in a wide geographic area or d) the incursion involves intensified livestock production.^{4,29,30} Welfare slaughter will also be magnified where a time-sensitive livestock commodity, such as isowean piglets, is affected.⁸ Welfare slaughter is, therefore, a direct cost of FAD eradication.^{1,17,24,28,29,35}

Canadian experts indicated that a FMD incursion into Canada, under the best possible scenario, would result in a prolonged US border closure.^{30,44} Classical swine fever (CSF, hog cholera) was identified on August 8, 2000 in East Anglia and resulted in the infection of 16 farms, with the last restricted area lifted in December 2000.^{31,43} The final rule for the US to recognize East Anglia free of CSF occurred on October 16, 2003,³⁹ three full years after the disease was eradicated.

Compared to other red-meat producing countries, Canada is heavily dependent on export of live animals, as well as pork and beef. Foot and Mouth disease is a virus affecting both species, and the trade of products from both species. For 2001, the Canadian ratio of meat produced compared to meat consumed domestically was 1.29 for beef and 1.59 for pork. Similar 2001 ratios for

the US were 0.97 for beef and 1.03 for pork and for Australia, 3.18 for beef and 1.05 for pork.³⁰

Statistics Canada³⁴ changed their swine export reporting structure for 2004 to separate feeder pigs, previously reported as "swine, non-breeding, less than 110 lb (50 kg)" into three weight cohorts. In previous years all exported, non-breeding live swine less than 110 lb were lumped together in official reports. This weight range of pigs contains both iso-weaned (11 lb; 5 kg) at around 19 days of age and feeder pigs (55 lb; 25 kg) at around 60 days of age.²² These two types of pigs represent different stages in the production system. Manitoba exports primarily early weaned piglets (Figure 2), and is also by far the primary Canadian origin of feeder pigs for the US market (Figure 3, Figure 4).

Welfare Assurance: Scope

The proportional cost of animal welfare assurance in comparison to the disease control efforts has been accounted for in the financial analysis of previous FAD incursions. However, complete accurate documentation of the financial impacts of FAD incursions is difficult to establish, even in retrospect.²⁹ In recent incursions of FAD into Office Internationale des Epizooties (OIE) member countries, with stamping-out as the national policy, the scale of welfare slaughter was one-half to 10 times the cost of eradicating the disease on infected farms.^{9,17,29,35,43}

Even in the case of very moderate-sized FAD incursion, welfare slaughter operations will exceed the cost of disease control. In Europe for incursions of CSF, if eight or more herds are infected on the day of the index

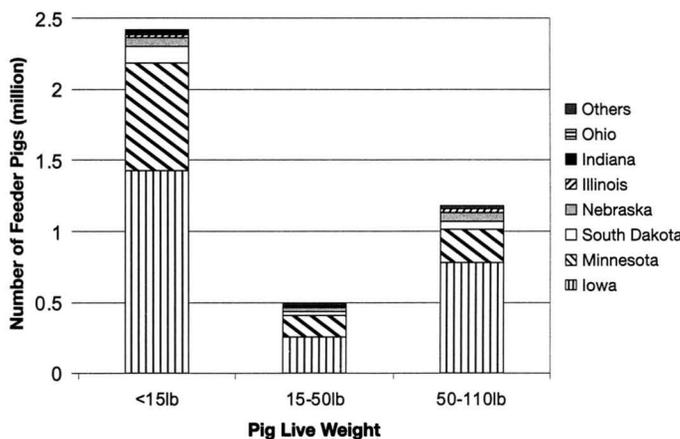


Figure 2. Live piglet and feeder pigs exported from Manitoba to the United States by the state of destination for the 2006 year. In 2006 of the just over 6 million pigs in this export category Manitoba exported 4.1 million piglet and feeder pigs. Over 99% went to the seven states listed with 60% going to Iowa.³⁴

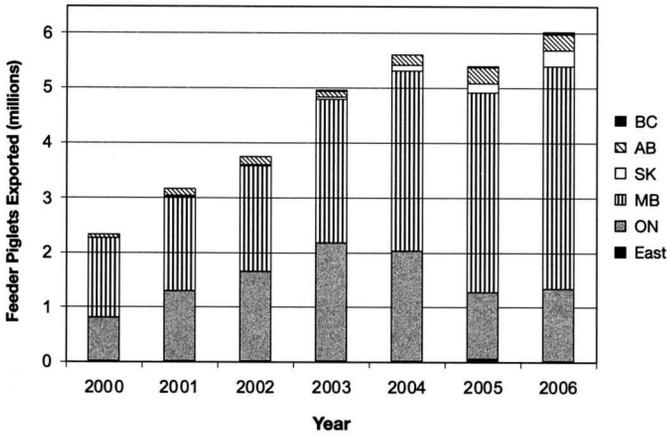


Figure 3. Annual total of live swine, non-breeding, less than 110 lb (feeder pigs), exported to the United States from Canada by province.³⁴ There has been recent slowing in export of feeders from Canada largely by reduced growth in Ontario feeder export market starting in 2004. Manitoba (68%) and Ontario combined, account for about 90% of the total feeder pig exports to the USA in 2006.

case, the costs of welfare slaughter are expected to exceed the cost of stamping-out.²⁹ In Canada, considering the 2001 trading patterns in live animals and animal products, it was estimated that in a small FMD outbreak with 50 infected herds, under the eradication effort 4.2 million animals would be killed, while under welfare slaughter programs, only 10,000 infected animals would be killed. The financial expenditure to control disease would be less than 1% of the overall cost/loss of the incursion.³⁰

**Current Canadian Infrastructure:
The FAERS System**

The Canadian Food and Agriculture Emergency Response System (FAERS) was developed largely in response to the January 1998 Ontario-Québec ice storm. It is an attempt to describe a foundation for developing contingency plans to potential agriculture disasters, while assuring such plans are coherent with the Emergency Preparedness Act, Emergencies Act, National Support Plan and the Federal Policy for Emergencies. Provincial departments of agriculture and other agri-food sector stakeholders, Agriculture and Agri-Food Canada (AAFC), and the CFIA have jointly established the FAERS to facilitate federal-provincial-industry collaboration.¹³

For the purpose of FAERS, “an emergency” (agri-food emergency) is defined as an abnormal situation requiring prompt action beyond normal procedures in order to prevent injury or damage to people, plants, livestock, property or the environment.¹³ The FAERS is, or

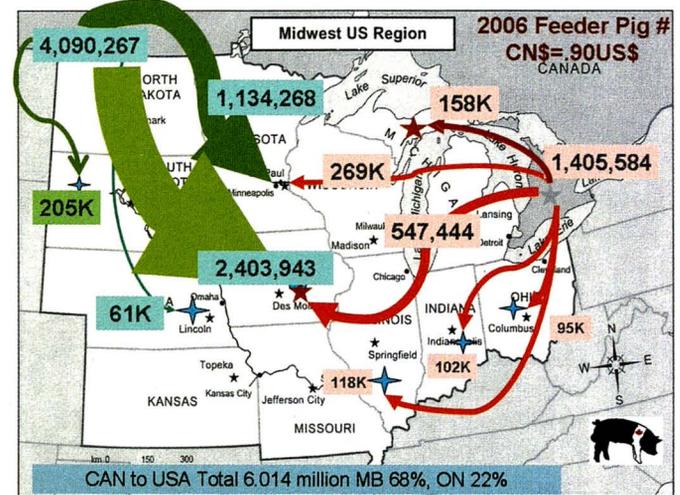
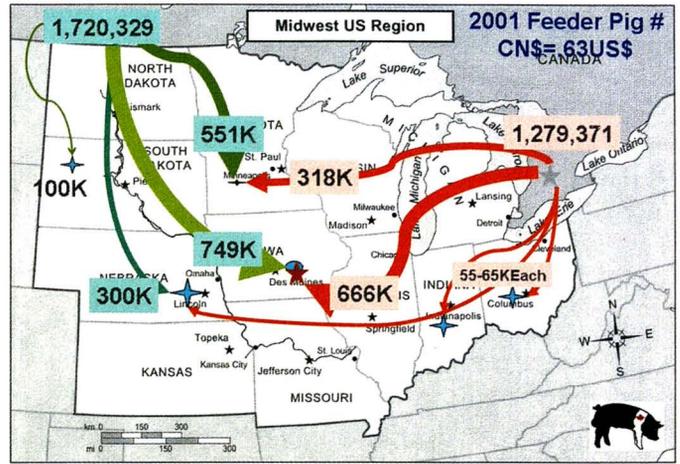


Figure 4. Increase in feeder pig flow from Ontario and Manitoba to the Midwest US region from 2001 to 2006.

purports to be, an all-hazards crisis management system designed to link the federal, provincial and private sectors in order to better manage and coordinate response to agriculture and food emergencies.

There are five types of agri-food crisis situations described in the FAERS manual, based on whom the lead agency would be. A FAD incursion is a “mandated emergency” under the FAERS system, where the jurisdictional responsibility is clearly with the CFIA as the lead agency. The CFIA component of FAD eradication, as described by disease eradication plans,^{12,14} however, does not follow the FAERS management principles of a comprehensive bottom-up contingency planning and response system. The CFIA disease eradication strategy documents describe in detail how infected animals and premises will be dealt with. These strategy documents do not consider consequential impacts of the presence of disease on the agricultural trade of a region and, therefore are not comprehensive crisis management approaches.

In Canada, animal welfare concerns related to a FAD response currently represent a non-mandated disaster (no federal agency has the lead), as the CFIA does not have the legislative responsibility nor the contingency plans in areas other than infected herd eradication. Under the FARES model, in non-mandated agriculture emergencies, AAFC and the CFIA will jointly determine which of the two organizations will take the lead and which will provide a support function. In general, AAFC is expected to take the lead when the emergency support primarily relates to providing financial compensation to farmers, which is a major component of welfare slaughter/market support programs.¹³

Current Canadian Infrastructure: The FADES Plan(s)

Many provinces have recently completed a review of Foreign Animal Disease Eradication Support Plans (FADES).^{5,6} These federal-provincial agreements are essentially designed to recruit provincial resources to assist the CFIA in the stamping out of infected herds. These plans have worked well in poultry, a supply managed commodity.¹⁰ In supply managed industries² (dairy in Canada), regulatory control has severely limited growth and export opportunities. In swine production regions, which are export-dependent, the nature and predominant activity of the FAD emergency response will be focused on how to deal with critical overcrowding on uninfected farms, and not in stamping out the disease.

An additional problem lies in the fact that the current FADES plans may appear to producers as comprehensive emergency response plans (and give producers a false sense of security) when, in fact, they are provincial agreements to support the federal disease eradication effort.⁶

There is no provision within the FADES initiative to discuss animal welfare slaughter or other consequential effects of dealing with regional animal health crises.²¹ During the activation of a FADES plan, there will be concurrent demands on provincial and industry resources related to administration of disease control efforts and maintaining animal welfare. Therefore, if a Canadian emergency response to CSF or FMD were to develop as currently proscribed, only a miniscule part of the management would be planned for, funded and have line responsibilities clearly defined under FADES; that is, the CFIA has committed to deal with the infected and high-risk animals. The welfare slaughter and consequential market effects of the incursion would, in theory, be managed according to the FAERS principal (i.e. local authority, municipality/province has first responder obligations).

Pork production in the US has also developed based on a massive interstate trade in live animals.³² That

trade would cease immediately upon identification of a FAD.^{28,38} The stoppage of interstate trade would trigger a massive demand for welfare slaughter which is not alluded to in readily available American response plans.^{16,26,40}

Predicting the Future

The 1997-98 CSF epizootic in The Netherlands was largely responsible for triggering a re-structuring (compulsory reduction) of the pork production sector in the country.⁴² The Pig Production Restructuring Act (Netherlands) came into force on September 1, 1998 with the intention of reducing pig herds by up to 25%. This restructuring reflects a significant change in public attitude towards the livestock sector, and in particular pig production. Livestock farming has fundamentally changed in The Netherlands from a "right" to a licensed activity.¹¹

At present, it is unclear how government support of either the real operational demands of FMD response or recovery assistance to farmers subsequent to an incursion would be valued and delivered in Canada. For the export-dependent beef and pork sectors, the lesson provided by Taiwan in failing to eradicate the 1997 FMD incursion is that, overall, FAD contingency planning should include the worst-case scenario of not eradicating the disease and eventual collapse of the industry.⁴⁷

Under a real FAD crisis, it will be impossible to immediately eradicate the FAD from a region and concurrently demonstrate the region is disease-free. A significant time period of border closure is inevitable. If costs are federally-provincially shared in response and recovery, some regions will be severely affected on a per capita basis. For example, regions of Canada vary greatly in their dependence on export markets for live pigs and pork products (Figure 5).

There could also be a very substantial livestock crisis/disaster in Canada without ever having an FAD identified here. Animal disease or other crisis in the US could trigger international border closure in a time sensitive production system. This situation would not constitute a mandated emergency under the current FAERS agreement and therefore, no immediate mandated federal response.^{13,14} The current plan only includes disease control in Canada. A FAD limited to a single US state, such as Iowa, and a single species, such as swine, would have significant repercussions in live-animal markets and farm animal welfare in Canada. Iowa draws feeder pigs from all over the continental US, in addition to Canada.³²

Individuals are often unable or unwilling to imagine the potential devastation that could be caused by low frequency catastrophic events, and will not take precautionary measures to protect against the poten-

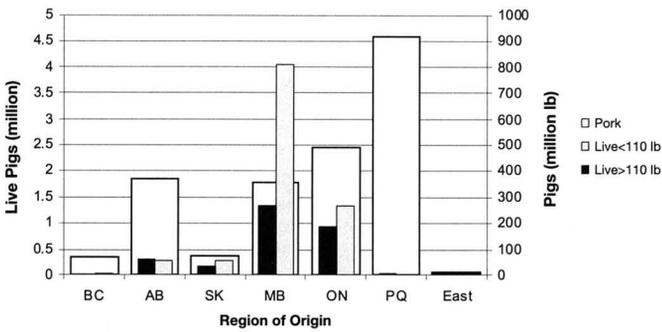


Figure 5. Export volumes of Canadian pork and live pigs by region, from Pacific to Atlantic for 2006. Open bar is pork export in million pounds (right axis) Solid bars are live pigs exported in million animals (left axis). Québec (PQ) has a long history of provincial government involvement in livestock production. Québec has a mature pork production chain with predominantly finished product exported, where Manitoba (MB) and Ontario (ON) are large exporters of pork products and live pigs. Alberta (AB) is working toward a Québec model where slaughter capacity grows with production. British Columbia (BC) and the Atlantic Region provinces (East) have relatively small export volumes.³⁴ Regions would differ significantly on a per capita basis in the financial impact of a FAD incursion into Canada or the USA. Manitoba contains about 3% of the Canadian population and half of the live animal exports. Pork may be diverted to other international markets as opportunity may arise, however; live swine production is contingent on dedicated facilities in the USA.

tial loss.³³ In the insurance field, this behavior is referred to as “cognitive failure”.^{25,33} Our collective, current level of preparedness to respond to the risk to animal welfare posed by the threat of a FAD incursion is similar in nature to “cognitive failure” displayed by individuals in similar circumstances.

Discussion

Based on lessons provided by other countries’ FAD eradication experiences, introduction of FMD into Canada would result in three separate types of crisis situation, which are:

- a crisis related to stamping out disease on infected farms;
- animal welfare impacts of disruption to export market access; and
- fiscal impacts of export market disruption.

The CFIA has the responsibility to deal with infected farms exclusively. The federal agricultural minister, through AAFC and provincial partnering, has

traditionally delivered income support to farmers in times of unforeseen financial disaster and would be the apparent lead agency on rural economic stabilization and recovery. Currently, there is insufficient Canadian operational infrastructure to rapidly respond to animal welfare concerns inherent in a FAD incursion into North America. There is currently no obvious leadership, legislative framework or pre-authorized funding to meet direct costs that government and industry would incur to assure an effective animal welfare component of FAD response.

Animal welfare assurance is part of the FAD emergency response, and manifests itself as a direct cost. Lack of preparedness to concurrently assure animal welfare and eradicate infected livestock may result in failure to eradicate the FAD. Existing national FAD disease eradication strategies deal only with infected farms. It is a gross error to misconstrue these disease eradication plans as effective and comprehensive agri-emergency management programs for CSF and FMD.

An important lesson provided from the British and Dutch experiences is that livestock production systems exist (are tolerated) because of public goodwill. This goodwill is predicated on the belief held by the public that farmers are responsible and the national veterinary infrastructure is competent and prepared. The response to this reality in the United Kingdom and The Netherlands has been for the public to irrevocably withdraw their support for livestock production. It is unlikely that FMD will emerge in a location where there is a low density of livestock. All FAD plans and modeling should include the effects of FMD infection in Iowa and Texas.

Conclusion

If North America were to experience an FMD incursion, massive animal welfare issues would be generated. Through the media coverage of the event and the industry call for free disaster relief, the average citizen would be able to comprehend the structural issues which should have been identified and avoided as part of responsible emergency preparedness. Not only will the veterinary regulatory authorities in North America be severely challenged to control the disease outbreak; they have not even recognized the actual nature of the emergency.

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