

**Developing Risk Management Strategies to
Mitigate a Major Animal Disease Outbreak
in Canada**

prepared for the
Canadian Animal Health Coalition

by

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Agriculture and Agri-Food Canada is pleased to participate in the production of this report of the project undertaken by the Canadian Animal Health Coalition within the Private Sector Risk Management Partnerships program and is committed to working with our industry partners to increase public awareness of the importance of the agri-food industry to Canada. Findings, conclusions, and opinions expressed in this document are those of the Canadian Animal Health Coalition and do not necessarily reflect those of the department or the Government of Canada.



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Executive Summary

The Canadian Animal Health Coalition (CAHC) received funding from the Private Sector Risk Management Partnerships (PSRMP) program to assess risk management strategies that could address a major animal disease outbreak in Canada. PSRMP is a federally-funded initiative within the Agricultural Policy Framework (APF) that encourages the expansion of private sector risk management solutions to address producer-perceived gaps in government-sponsored programs or products offered by the private sector.

While considerable income protection is provided to producers through either Business Risk Management (BRM) programs or private sector products, agricultural producers may perceive gaps in protection, program design limitations, or operational restrictions that impact the effectiveness of these risk transfer mechanisms. Recent outbreaks of bovine spongiform encephalopathy (BSE) and avian influenza (AI) in Canada have attracted interest in planned strategies for livestock disease outbreaks. These outbreaks have created an impression with producers that current government and private sector risk transfer tools do not cover all potential losses experienced by the affected industry. High profile outbreaks of contagious major animal diseases in other countries like the United Kingdom (UK) and the Netherlands fuel producers concern over the size of the potential losses and consumers concern for public health and food safety.

While there is considerable attention focused on planned strategies for livestock disease outbreaks, the issue is complex and potentially overwhelming unless it can be compartmentalized. CAHC chose one foreign animal disease (FAD), specifically a foot and mouth outbreak (FMD), to focus discussion for this project. Different livestock sectors (e.g. beef, dairy, hogs, and poultry) are impacted to a greater or lesser extent in a FMD outbreak. For example, supply managed sectors like poultry will not be impacted to the same extent by an international border closure due to FMD that would significantly affect the beef and hog sectors. However, these sectors that are not directly impacted by the disease may be severely disadvantaged with competitive pressures from a surplus supply of animal-based proteins in the domestic market that may occur when the international market is closed to the export of other livestock species. Accordingly, impact variations across livestock sectors can introduce a thoughtful perspective to the assessment process.

Canada has a tradition of providing public support to the agricultural sector. However, the financial commitment of governments to agriculture is limited due to pressures from other social commitments, both domestic and international. International experience suggests that governments may ‘fatigue’ after several animal disease outbreaks and look for ways to limit their exposure from this risk. The current APF is structured to define the government role in support of agriculture. Presently, the federal government is examining the potential to strengthen the BRM component of the APF with a disaster fund. The role of this fund is not currently known but it may cover some aspects of a future livestock disease outbreak. Many disaster situations beyond livestock disease could draw on this fund and there will always be limits to the total financial assistance available from government. The manner in which a disaster fund interacts with other BRM programs and private sector products is not yet defined.

The original purpose of this project was to identify key risks facing the livestock sector in the event of a foreign animal disease outbreak like FMD. With producer input, the project was to identify the most plausible private sector risk management solutions that could mitigate farm income pressures due to the occurrence of specific risks. These solutions would complement existing government initiatives and address producer perceived gaps in protection. However, during the project, it became apparent that many producers are only peripherally aware of government programs and their role/effectiveness in responding to foreign animal diseases. This lack of awareness makes it difficult to focus on defining private sector solutions to complement government-sponsored initiatives.

In addition, it became apparent throughout the project that producers could not provide credible responses to risk management solutions that were not fully designed and included costs to producers in terms of transferring risk to a third party, on-farm underwriting protocols and administrative processes including providing data to the program management process. The appropriate level of detail and analysis to provide full designs with associated actuarial costs and underwriting provisions was not envisaged in the original scope of this project. Consequently, the project work plan was redefined to provide a high level over view of risks and risk management solutions in the event of a FMD outbreak and to define issues for industry and government to address within the context of a second and more detailed analytical phase to follow.

1.0 Introduction

The CAHC received funding from the PSRMP program to assess risk management strategies that could address a major animal disease outbreak in Canada. PSRMP is a federally-funded initiative within the APF that encourages the expansion of private sector risk management solutions to address producer-perceived gaps in government-sponsored programs or products offered by the private sector.

The APF agreement, signed by federal, provincial and territorial governments, established the future direction of government assistance for the agricultural sector. The APF agreement consists of five main “chapters” that include BRM, Food Safety and Food Quality, Environment, Science and Innovation and Renewal. Within the APF, the largest share of funding from governments is allocated to BRM programs directed at reducing the impacts of natural perils, commodity price variability and input cost fluctuations that impact primary producer incomes in the agricultural sector. The main components of the government-sponsored suite of programs include: production insurance (formerly crop insurance), Canadian Agricultural Income Stabilization (CAIS) and Cash Advances.

While considerable income protection is provided to producers through either BRM programs or private sector products, agricultural producers may perceive gaps in protection, program design limitations, or operational restrictions that impact the effectiveness of these risk transfer mechanisms. Recent outbreaks of BSE and AI in Canada have attracted interest in planned strategies for livestock disease outbreaks. These outbreaks have created an impression with producers that current government and private sector risk transfer tools do not cover all potential losses experienced by the affected industry. High profile outbreaks of contagious major animal diseases in other countries like the UK and the Netherlands fuel producers concern over the size of the potential losses and consumers concern for public health and food safety.

The purpose of this CAHC project is to:

- examine the specific risks that face the livestock sector in Canada as a result of a major animal disease outbreak;
- identify potential risk management solutions that could be developed to mitigate these risks;
- determine if industry perceives there to be significant gaps in the current government and private sector risk protection schemes that warrant their attention; and
- if there is interest in closing risk gaps that currently exist, gather input from producers to move forward with the design of practical solutions in future phases of the project.

This paper provides a synopsis of the project work to date and acts as a discussion document for industry to focus on key issues that will provide direction for next steps.

2.0 The Risk Management Process

Risk management involves measuring the risk associated with a particular event and then developing strategies to manage that risk. A typical risk management process has several phases that include:

- framing the context – define the objective(s) and scope for the overall process and consider the basis on which risks will be assessed and prioritized in order to evaluate realistic options;
- identifying the potential cause of the risk – events that create a potential risk should be clearly identified. Given that programs are in place to mitigate a variety of risks facing primary producers, this phase is crucial to understanding whether the focus is to address a gap in risk management protection or a perceived limitation in existing public or private sector tools;
- assessing the likelihood and impact of the risk(s) – quantify the actual extent of the risk(s) in terms of the likelihood of an event, its impact on a primary producer or the industry as a whole and factors that contribute to either the likelihood of an event occurring or the size of its impact;
- developing appropriate strategies to manage a risk – management strategies fall into four primary categories that include:
 - **risk reduction** – taking action to reduce the impact of the cause of the risk to a manageable level within the business operation;
 - **risk avoidance** – taking action to avoid the cause of the risk, thereby eliminating its impact;
 - **risk transfer** – transferring the risk through a negotiated agreement to a third party willing to accept the risk transfer. The extent of the risk transfer will be dependent on the capacity for the third-party to accept risk; and
 - **risk acceptance** – retaining the risk and accepting its potential impact within the business operation;
- creating and implementing a risk management plan – once the risks facing the business operation are fully evaluated, prioritized and an appropriate strategy or combination of strategies identified, a workable plan should be put in place to implement the strategy.
- evaluating the risk management plan – after a defined period any risk management strategy should be evaluated in relation to any contextual changes and in light of the original objectives.

While the phases in this process are presented in sequential order, actual work in various phases often progresses simultaneously. Section 3.0 summarizes the risks identified in the study and provides an assessment of their potential impact on the livestock industry. Section 4.0 briefly describes potential solutions in place in other jurisdictions as examples that might be possible in Canada. Section 5.0 presents a summary of the issues that require input from the livestock sector to determine the next steps of this project.

3.0 Risk Assessment

3.1 Context of Study

Recent outbreaks of BSE and AI in Canada have attracted interest in planned strategies for livestock disease outbreaks. However, the issue is complex and potentially overwhelming unless it can be compartmentalized. CAHC chose one FAD, specifically a FMD, to focus discussion for this project. Different livestock sectors (e.g. beef, dairy, hogs, and poultry) are impacted to a greater or lesser extent in a FMD outbreak. For example, supply managed sectors like poultry will not be impacted to the same extent by an international border closure due to FMD that would significantly affect the beef and hog sectors. However, these sectors that are not directly impacted by the disease may be severely disadvantaged with competitive pressures from a surplus supply of animal based proteins in the domestic market that may occur when the international market is closed to the export of other livestock species. Accordingly, impact variations across livestock sectors can introduce a thoughtful perspective to the assessment process.

Canada has a tradition of providing public support to the agricultural sector. However, the financial commitment of governments to agriculture is limited due to pressures from other social commitments, both domestic and international. International experience suggests that governments may ‘fatigue’ after several animal disease outbreaks and look for ways to limit their exposure from this risk. The current APF is structured to define the government role in support of agriculture. Presently, the federal government is examining the potential to strengthen the BRM component of the APF with a disaster fund. The role of this fund is not currently known but it may cover some aspects of a future livestock disease outbreak. Many disaster situations beyond livestock disease could draw on this fund and there will always be limits to the total financial assistance available from government. The manner in which a disaster fund interacts with other BRM programs and private sector products is not yet defined.

Within the context of this PSRMP-funded project, the livestock industry needs to assess the various sources of risk caused by a FAD outbreak like FMD and determine what responsibility and resources the industry has to mitigate the negative financial impacts. Some risk impacts may be so significant that they require government assistance and are appropriate for a disaster fund response. But with limited government resources, livestock producers must rely on other available risk management strategies to address any shortfalls regardless of origin.

The intent of this project is to identify sources of risk that could be managed by the industry through private sector solutions that can supplement existing and potential government programs and any private sector offerings that might be currently available. In order to move forward with the study livestock producers will need to consider which risks are of greatest concern and what responsibility the industry can take to mitigate their impact. Defining risk management alternatives that are practical for industry will indirectly define what may have to revert to government.

3.2 Sources of Risk in a FMD Outbreak

The first phase of this project, conducted by Serecon Management Consulting Inc. (Serecon), provided a cursory or “high level” assessment of risks facing the livestock industry as a result of a FMD outbreak. The following represents a summary of this risk assessment component of the study.

3.2.1(a) Scope of FAD Outbreak – Canadian Examples

A summary of past FAD outbreaks helps to frame the potential magnitude of a FMD outbreak in Canada. For example, in 1951-52 Canada had an outbreak of FMD that affected 2,000 animals and cost \$2.0 million for eradication. Trade losses into the US market were \$2.0 billion at that time. In 2002 Serecon completed a major economic impact study of FMD in Canada that suggested direct and indirect economic losses for the industry could range from \$11.5 to \$45.9 billion. Agriculture and Agri-Food Canada (AAFC) also estimated that the economic impacts of a FMD outbreak could total \$30 billion.

The BSE outbreak in Canada in 2003, which is not a contagious animal disease, is estimated to have cost the industry in the range of \$7.0 billion. A major portion of this resulted from the loss of meat and cattle exports. In addition, the AI outbreak in British Columbia in 2004 resulted in the destruction of nearly 17 million birds, with estimated economic and recovery costs at over \$300 million. Two feed-mills were closed and 3,000 jobs lost.

3.2.1(b) Scope of FAD Outbreak – International Examples

The United Kingdom experienced a FMD outbreak in 2002 resulting in the slaughter of over nine million farm animals with a direct farm loss of £3.1 billion. The outbreak lasted 337 days and involved cases on 2,026 farms. Healthy animals, in excess of those actually infected, were slaughtered to align domestic supply with a demand that could no longer include export shipments. In this case, more animals were slaughtered due to excess supply than as a result of a direct disease infection.

Taiwan’s FMD outbreak in 1997 resulted in an export revenue loss equivalent to \$6.9 billion CDN, the slaughter of over four million hogs, and the disposal of 500,000 tonnes of pork. Taiwan went from being the largest pork exporter in the world to an insignificant player.

The Netherlands had an outbreak of classical swine fever in 1997 that created direct losses of \$2.3 billion CDN, and the slaughter of 11 million animals. Both the Netherlands and Taiwan governments imposed strict limitations on their export industries after repeated FAD outbreaks.

These domestic and international examples of FAD outbreaks like FMD indicate that the impacts to the livestock industry can be severe and have a wide impact beyond the farm gate. Table 1 on the following page identifies the financial scope of a FMD outbreak in

Canada. The extent of the outbreak; small, medium or large, is a function of the severity of the disease outbreak, the capacity within the industry to curtail losses with pre-planned control strategies and the actions taken by trading partners that curtail export shipments.

3.3 Risk Identification

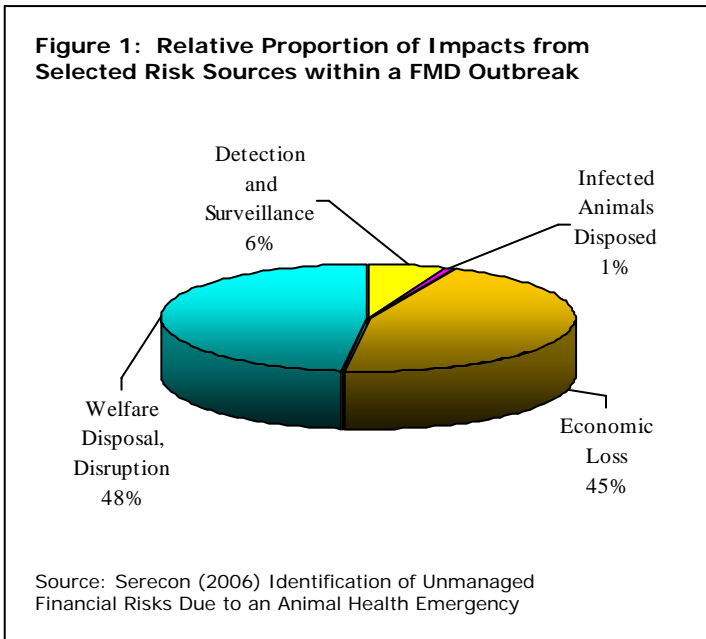
Within this study, eighteen distinct sources of risk facing the livestock industry are identified that could originate with a FMD outbreak. The financial impact of these causes of risk varies greatly. Public and private sector programs are currently in place to offset some of the financial distress. For example, the costs of disease detection, surveillance and control are paid under the Health of Animals Act, administered by the Canadian Food Inspection Agency (CFIA). However, according to previous work by Serecon (2002) shown in Figure 1, these costs may represent only seven percent of the total costs facing industry as a result of a FMD outbreak.

Table A1 in the appendix provides a brief summary of the entire list of risk sources identified in the study and suggests which are covered to some extent by existing risk management programs. However, the scope of this study is to focus on risks which are not fully compensated by existing private or government programs and that, for the most part, impact primary producers. These criteria provide a reduced list of risk sources for further risk assessment within the study that include:

- **Business Disruption** – the costs associated with a short term loss of revenue and increased operating costs to maintain a livestock herd or flock during a period of restricted market access or eradicate infected livestock. Costs could include additional feed and inputs, labour disruption, on-farm cleaning and disinfection costs, reduced prices and quantity of sales (domestic and export), collapse of market, flight of capital, reduced consumption, loss in equity, lost productivity and unused productive capacity.

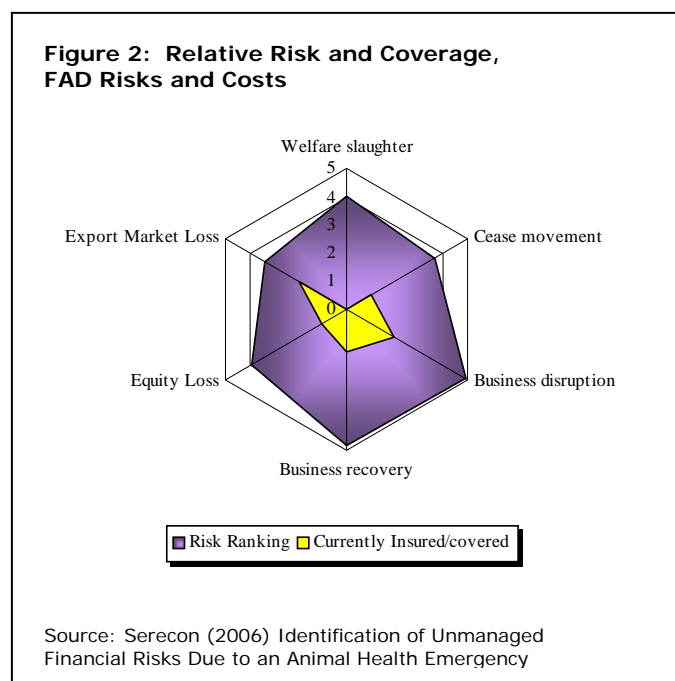
	Small	Medium	Large
Direct Farm Impact	2.4	3.0	5.3
Indirect Farm Impact	2.1	2.6	4.6
Direct Processing Impact	3.1	4.1	6.9
Trade Losses	3.9	10.6	19.6
Welfare Disposal (# of livestock, millions)	4.2	5.8	10.3

Source: Serecon (2006) Identification of Unmanaged Financial Risks Due to an Animal Health Emergency



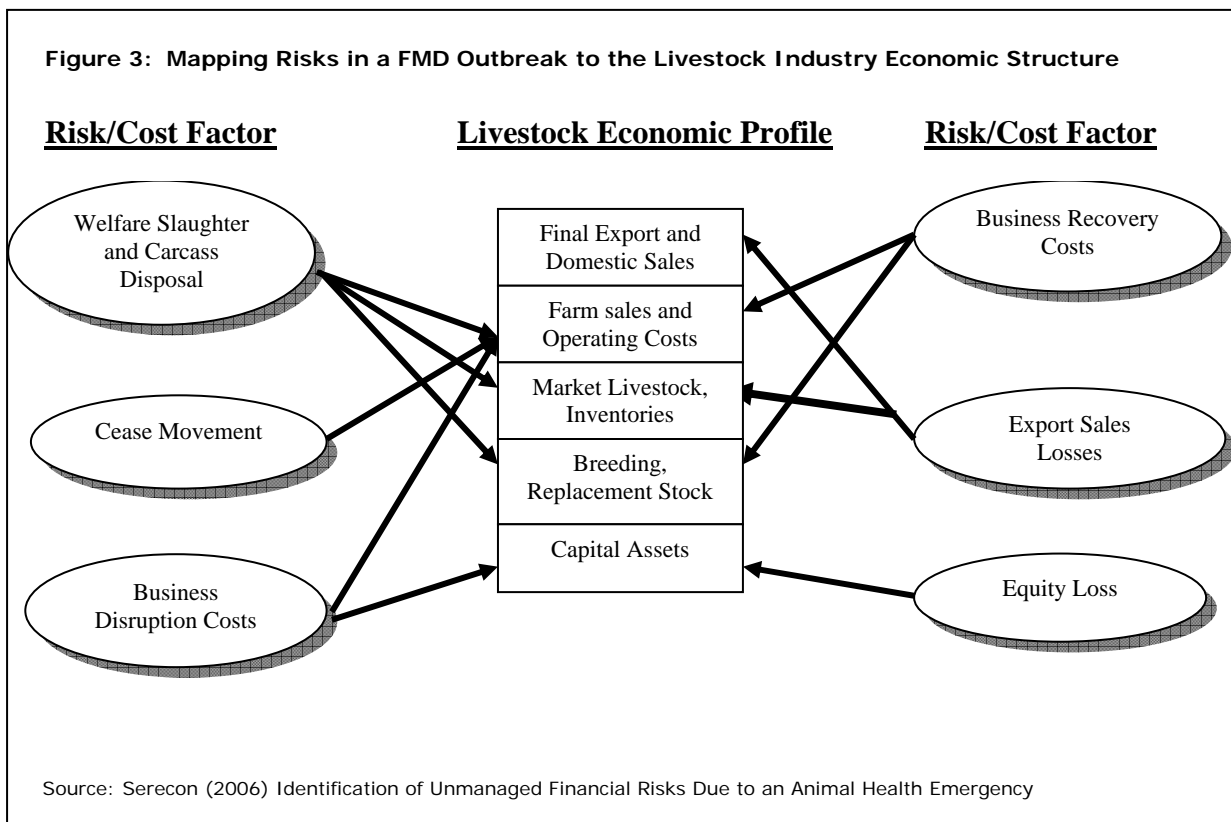
- **Business Recovery** – the costs and added investment to re-establish the business productive capacity that could include replacement of lost breeding or market livestock, market re-establishment costs, personnel hiring and training costs, capital attraction to the industry, increased marketing costs and increased shipping costs if the outbreak impacted slaughter/processing plants.
- **Welfare slaughter and disposal** – the slaughter and disposal of healthy livestock due to reduced demand for livestock products as a result of trade restriction. Costs include the value of animal disposed and the costs associated with disposal (establishing disposal sites, securing disposal equipment and personnel, environmental assessment of sites and acquisition costs of appropriate technologies for disposal).
- **Export Market Loss** – the loss of export markets for livestock like cattle and hogs where a major portion of production is exported to the US and other international destinations. While scientific evidence may suggest the situation is under control and livestock and by-products are safe for domestic and export consumption, political pressures based on consumer concern for public health / safety can adversely impact export sales and domestic prices for considerable duration.
- **Equity Loss** – the reduced value of livestock herds or flocks, land and equipment associated with the farming enterprise as a result of a FMD outbreak causing reduced productivity and access to markets, particularly if the impact is felt over an extended period of time.
- **Cease Movement** – the movement of livestock, feed, meat and by-product commodities is restricted by CFIA during the early stages of a FAD outbreak until the extent of the geographic extent of the outbreak can be determined. Cease movement could affect all movements within a ‘control zone’ affecting farm premises, sale yards, auction markets, auctions, border crossings, and slaughter/processing facilities.

Figure 2 is a schematic representation of these primary risks and the degree to which potential losses would be covered under existing public and private sector offerings.



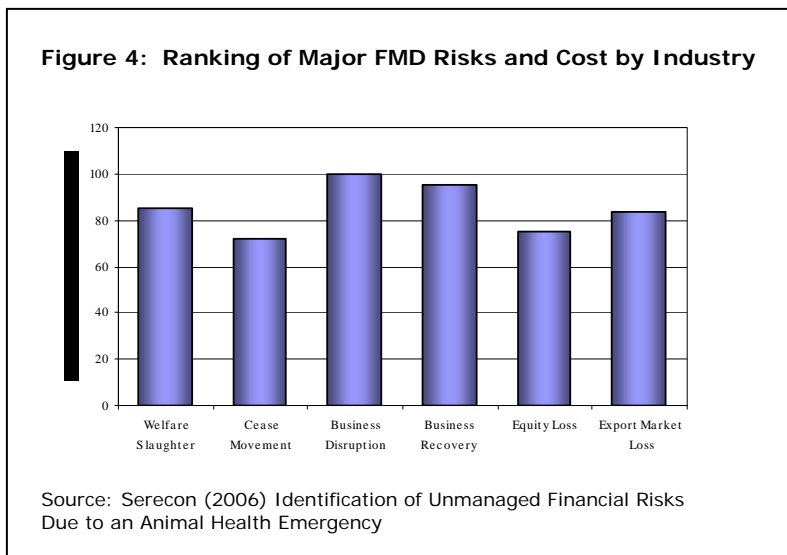
3.4 Risk Ranking

Figure 3 is a “schematic map” that cross-references different risks associated with a FMD outbreak to components of the economic structure of the livestock industry. For example, the costs of welfare slaughter and carcass disposal are expected to have direct impacts on farm operating costs, in the value of investment in market and breeding livestock. A cease movement order is most likely to cause losses in farm sales, and impacts on operating costs. Business disruption costs will have a wide range of impacts on both farm sales, operating costs and on the value of capital assets. Business recovery costs will most directly affect farm sales, operating costs, and the needed re-investment in breeding stock that may have been destroyed due to a FAD outbreak. Export sale losses, which are considered as a sub-cost with respect to overall business disruption costs, will directly impact export sales, and the export sale of breeding stock. Finally, equity loss, which is also part of the business disruption risks, directly impacts the value of the capital assets.



A limited information gathering process with industry representatives was used to rank the importance of the primary sources of risk in a FMD outbreak to the industry. Figure 4 on the following page provides the results of this exercise and shows that business disruption and recovery are most important to those surveyed. Welfare slaughter and export market loss are next important but it is likely that the risks may vary in ranking depending on the livestock sector responding. For example, production in the poultry industry in Canada is regulated by supply management and geared to domestic consumption. Therefore, loss of export markets and welfare slaughter to match supply to

demand will be less important in that sector. However, those risks may be of greater concern to the hog and beef sectors where a major portion of domestic production is exported to the United States. In these cases, a FMD outbreak may restrict international market access causing export market losses and require a welfare slaughter to match the reduced demand to production supply.



3.5 Quantifying the Primary Risk Sources

Quantifying the impact of segregated risks within a FMD outbreak is difficult in absolute terms since these outbreaks are not common and historical data is limited. However, the financial impact of a risk is a function of its likelihood to occur (frequency) and the severity of the loss when it does. With livestock disease, there is a real danger of transmittal from one infected animal or herd to others. Therefore, the density of farms in an area can impact the transmittal rate and that density of livestock has a bearing on the potential severity of the financial loss. In a similar fashion, the on-farm management practices of individual producers can influence the likelihood of an outbreak and the national or regional planned response to an outbreak will impact severity. For these reasons, the results of this study can only indicate the overall cost range of a FMD outbreak and the relative impact of segregated risk types.

3.5.1(a) Density Impact

In a livestock dense area, it is much more difficult to control the speed by which an infection may be spread. A Swedish study¹ defines a relationship between the intensity of an animal disease outbreak to the density of animals as:

$$\text{Intensity (\%)} = \text{Density} + (1 + \text{Density})^2$$

Where:

Intensity = % of total animals infected or that are destroyed due to the FAD outbreak

Density = number of animals per hectare

² = squared (multiplied by itself)

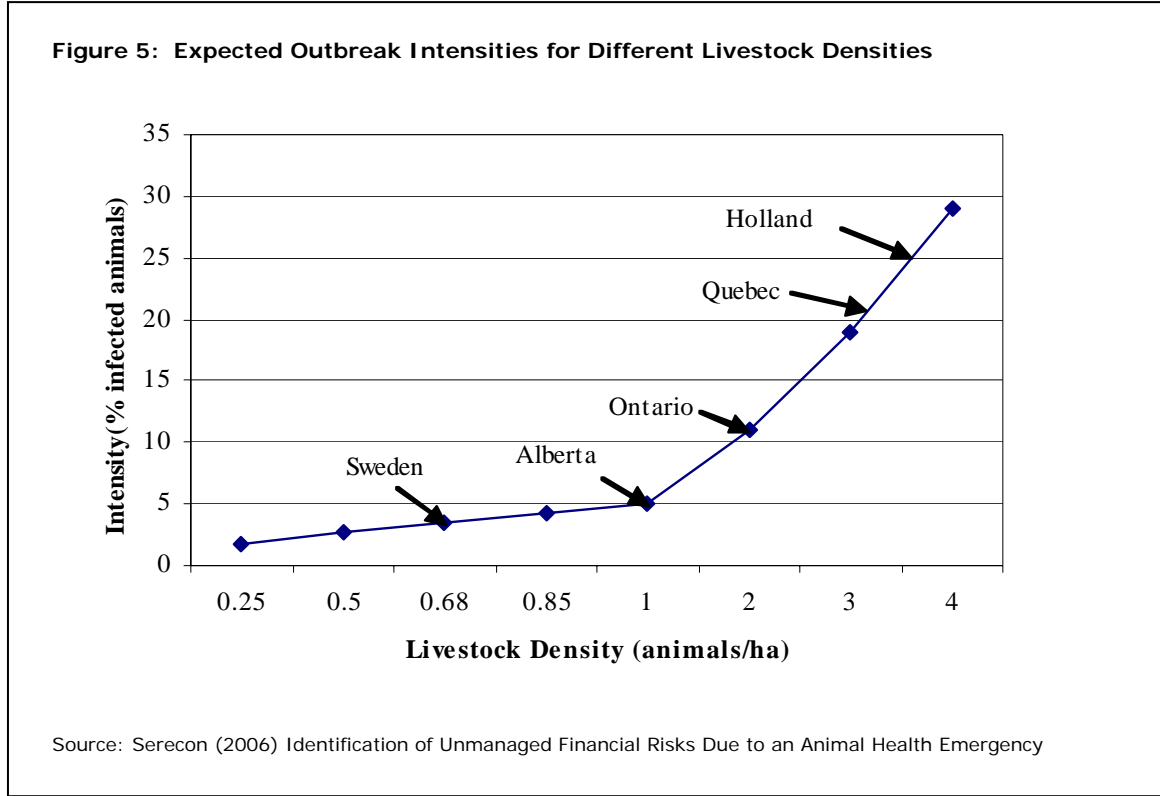
¹ Jansen, et. al, Modeling the Impact of Compulsory FMD Insurance, 2005

Table 2: Samples of Expected Intensity of a FMD Outbreak in Regions with Selected Animal Densities

Livestock Density	Expected Intensity
0.25	1.81
0.50	2.75
0.68	3.50
1.0	5.00
2.0	11.0
3.0	19.0
4.0	29.0

Table 2 provides a sample of expected intensities for a range of livestock densities using the previous equation. For example, the expected intensity of a livestock outbreak in a region that has 1.0 animal per hectare is $1 + (1+1)^2 = 5.0$ percent. In other words, in this region we might expect that five percent of animals would be infected with the livestock disease in an area where there is an outbreak and there is a density of one animal per hectare.

Figure 5 shows the expected outbreak intensities for different regions in Canada compared to other international jurisdictions.



3.5.1 (b) Quantifying Relative Risk

The final stage of the risk assessment process is to quantify the financial impact of the primary sources of risk of focus in the study. Values for segments of the economic structure of the three main livestock sectors at the national level (dairy, beef and hogs) were loosely assigned to the primary risks of focus in this study – columns 2 to 4 in Table 3 – to determine a risk exposure by risk type. Next a risk factor (frequency multiplied by

expected intensity) was applied to the risk exposure for each livestock sector by risk source to attain a relative potential loss. The assumed frequency of the FMD is a one-in-ten-year event and the expected intensity is derived from a “high level” livestock density for Canada following the formula outlined in Section 3.5.1(a).

FMD Risk/Cost	Total Risk Exposure(\$1000)			Risk Factor (freq X intensity)			Potential Loss(\$1000)		
	Dairy	Beef	Hog	Dairy	Beef	Hog	Dairy	Beef	Hog
Welfare slaughter	2,692,340	7,272,968	1,065,964	0.0016	0.00275	0.0023	4,308	20,001	2,452
Cease movement	163,010	2,952,321	631,745	0.0016	0.00275	0.0023	261	8,119	1,453
Business disruption	4,591,194	5,070,201	4,263,152	0.0016	0.00275	0.0023	7,346	13,943	9,805
Business recovery	4,591,194	5,070,201	4,263,152	0.0016	0.00275	0.0023	7,346	13,943	9,805
Equity loss	2,529,330	4,320,647	434,220	0.0016	0.00275	0.0023	4,047	11,882	999
Export market loss	310,333	2,900,000	3,353,105	1.0	1.0	1.0	<u>310,333</u>	<u>2,900,000</u>	<u>3,350,105</u>
Density (per ha)	0.16	0.5	0.32	Total Cost (\$1000)			\$333,641	\$2,967,887	\$3,377,619
Intensity	0.016	0.0275	0.023	Annual Cost/Animal (\$)			\$21.16	\$17.71	\$22.76

Source: Serecon (2006) Identification of Unmanaged Financial Risks Due to an Animal Health

The results of this simple quantification exercise should be kept in context. While dollar estimates are calculated they are rudimentary at best and should only be considered as a means to rank the cost of risk sources in a relative manner. It is obvious that for these three livestock sectors, export market loss is far and away the most significant financial impact in a FMD outbreak. For example, in hog production, the total impact of a FMD outbreak is estimated to be \$3,377,619,000. Export market loss accounts for 99 percent of the FMD generated loss to the hog sector. In dairy and beef export market loss accounts for 93 and 98 percent of total potential losses respectively. The total potential losses to the dairy sector in a FMD outbreak is understandably less than for beef and hogs since there is much less financial impact of international border closures to revenue generation within a supply managed commodity.

4.0 Potential Risk Management Solutions

The second phase of the study, conducted by Vose Consulting, examined potential options that could be used to transfer the risk of financial losses caused by a FMD outbreak to third parties beyond the farm. For the most part, the examination concentrated on European countries where there has been considerable experience with FAD outbreaks.

4.1 Potential Risk Transfer Options

Four potential risk transfer options were identified in the course of the study that includes:

- a) **Insurance** – a mechanism whereby the livestock producer (insured) can transfer a risk to a third-party for a premium. In most instances, those transferring risk want to remove as much of the negative impact of a potential event as possible. Those who

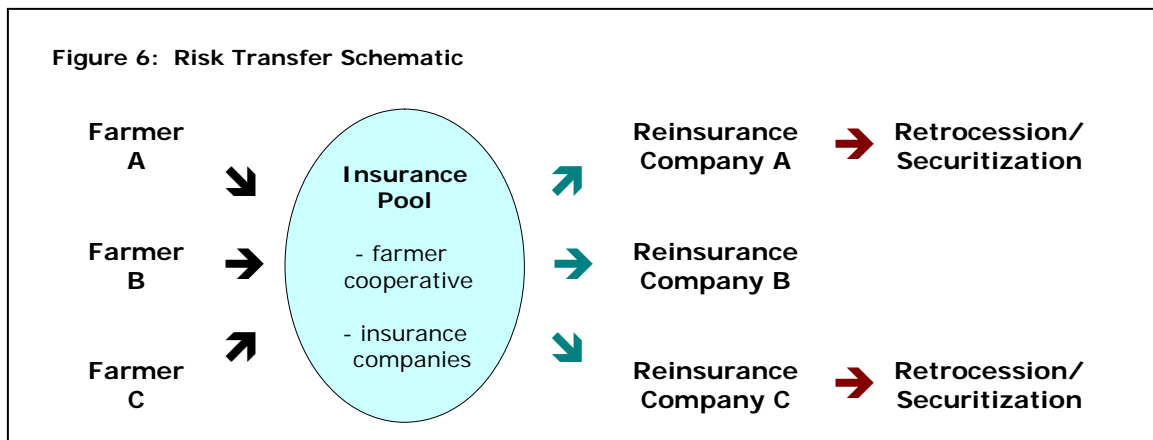
are willing to accept a risk transfer do so if the potential reward they receive is commensurate with the risk they will accept and, if they are profit motivated, that there is a realistic expectation the transaction will generate positive returns over time. This is similar to other business propositions and each party needs to find value in the transaction before it will proceed. In this way, risk becomes an item to be traded, not unlike a computer, a vehicle, a livestock herd or a farm. The greater the value and complexity of the item being traded, the more information is sought by the parties to the trade. In an insurance context, those who are in the business of accepting risk want as much information as possible about both the risk and those who are initiating the transfer (the agricultural sector impacted by the risk).

In general, for a risk to be transferred through insurance it should be:

- quantifiable – it must be possible to assess the likelihood of an event occurring as well as the extent of its impact;
- identifiable – an insurance loss needs to be tied to/identified with a specific event, an insured peril and a time period;
- random – the timing of an insured event should not be predictable or influenced by the insured; and
- appropriately priced – the insurance transaction must be able to generate a premium commensurate with the risk being transferred and accepted.

The insurance concept is based on a principle of “pooling” premiums among insurance participants to cover losses due to specific risk events. In exchange for the premium, risk is transferred or spread to other insurance participants (the pool) over both time and geography. Annual surpluses accumulate in good years to pay for losses that could exceed annual premium in bad years and provide a return on investment where profit is a motivator. Each individual producer, through the insurance policy, is transferring or spreading their risk geographically and over time (between years) to other producers and to the insurance industry. This pooling of risks is most effective if individual risks are totally independent (e.g. car accidents in Canada are fairly independent of each other), where if risks are more dependent, pooling has less effect (e.g. a large hurricane in Florida will cause losses to many properties at the same time).

Reinsurance is essentially “insurance for insurance companies” and many reinsurance firms operate globally and in multi-lines of insurance business (e.g. life, home, auto, marine, aviation, workers’ compensation, agriculture, etc.). As a result, reinsurance provides an opportunity to spread risk and acts as a diversification strategy for insurance companies. In addition, reinsurance firms will often spread their acquired risk even further to other reinsurance/insurance providers. This is known as “retrocession” or, to capital markets, as “securitization” (see Figure 6 on the following page). If private firms are unwilling to accept risk transfer for some livestock disease exposures, government may act as a source of reinsurance.



- b) **Levy System** – a mechanism whereby the livestock producer makes a compulsory payment to a fund to transfer a risk to the entire population of livestock producers. In the case of a livestock disease outbreak, the money that has accumulated in the fund can be used to compensate the livestock producers for the risks that have been identified for coverage. Payments to the levy fund can be made up front, after a loss event occurs, or both. In a levy system, livestock producers take responsibility for all losses covered by the fund.

Just like insurance, a levy system is based on the principle of pooling. However, when the risks involved are to some extent dependent (as is the case with losses due to welfare slaughter and carcass disposal after FAD outbreaks), there is a probability that the claims will exceed the size of the fund. In these cases, a levy system can be supported with:

- *government financing*, where the government will finance the losses that exceed the size of the fund. In most cases, this government financing would be repaid by the fund over time, however, alternate arrangements could be envisioned; or
- *private solutions* such as a bank guarantee, where in a loss event (such as an outbreak) the bank will finance the losses that exceed the size of the fund. In this case, any capital provided by the bank will have to be paid through additional levy payments over a specified time horizon.

- c) **Futures, Forwards and Options** – futures and forwards are contracts between a buyer (e.g. dealer) and seller (e.g. producer) that set the price of specified amount of an asset (e.g. pork meat or grain) at a specific future date. For instance, a producer could agree with a dealer to deliver 10,000 bushels of wheat at the end of June for a set price. That way, the farmer knows how much he would be paid for his wheat, and the dealer knows his costs in advance.

There are two main differences between futures and forwards. *First*, futures contracts are standardized contracts that are widely traded while forward contracts are customized. *Second*, under a future contract delivery of the asset normally does not take place while with a forward contract it does.

Future and forward contracts are used to hedge risks such as exchange risks or commodity (e.g. pork or beef) price risks. Although in principle, a producer could completely eliminate any price risks with futures or forwards, in practice there will always be some “basis risk” left to the producer resulting from:

- locational differentials – for example, a cattle farmer in Ontario who hedges with a cattle futures contract that calls for delivery in British Columbia has the uncertainty of the closeout differential between the Ontario price and the British Columbia steer price; or
- time differentials – with most futures contracts, the seller has the choice of the date of delivery within the delivery month.

Futures and forwards are contracts that oblige the buyer to deliver a specific asset for a specified price at a specific future date. Options are contracts that provide the buyer with a *right* (not an obligation) to buy (in case of a call option) or sell (in case of a put option) a specific asset for a specified price at or before a specific future date. In agriculture, most options have a future contract as the underlying asset. However, there are options on many assets, including stocks, interest rates, exchange rates and even catastrophic events like hurricanes.

Futures and forward contracts could provide some price protection to producers in the event of an animal disease outbreak if the futures market or index reflected the Canadian price for livestock. However, for livestock species with dependency on export markets the Canadian price is based on the US markets, particularly the Chicago Board of Trade. If price declines in Canada are not reflected in the US prices, futures and forwards may be of little value. In addition, market prices will react to any negative impact of a major livestock disease and the price protection offered to producers may quickly erode.

- d) **Catastrophic (Cat) Bonds and Options** – catastrophic bonds and options are typical examples of alternative risk transfer (ART) solutions that are being used more frequently for risks that are difficult to insure but also not closely linked with the stock market or economic conditions. Both instruments “securitize risks” or package catastrophe risk so that other parties such as pension funds and investors can sell. As such, they can be a risk management tool for insurance or reinsurance companies. For risks that are not widely understood within the insurance industry like the potential for a foreign animal disease, Cat bonds can provide security for the insurance industry and make them more amenable to accepting livestock disease transfer.

A Cat bond is a bond that is meant to raise money in case of a catastrophe such as a hurricane or earthquake. It has a special condition that states that if the issuer (often an insurance or reinsurance company) suffers a loss from a particular pre-defined catastrophe (e.g. FMD), then the issuer's obligation to pay interest and/or repay the principal is either deferred or completely forgiven, depending on the specific Cat bond contract.

A Cat option is a standardized contract bought and sold through an organized exchange market. However, unlike “traditional” options, Cat options give the purchaser the right to a cash payment if a specified (index of) catastrophe losses reaches a specified level (for example, a certain amount of losses caused by a hurricane). An insurer could buy such Cat options to hedge catastrophe risks through exchange or commodities markets.

While Cat bonds or options are not currently available for outbreaks of FMD, there may be applications in the future. The two main determinants for this development will be that risk-bearing parties (such as insurance firms) find that securitization is a cost-effective means of spreading their risk and that investors find that catastrophe bonds or options can offset risk within their current portfolios.

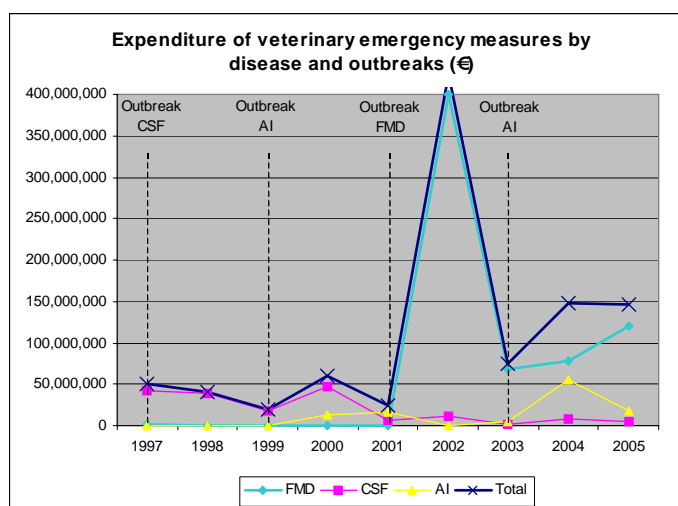
4.2 FMD Risk Transfer Options in Other Jurisdictions

A variety of risk transfer options for livestock diseases are in place throughout the world. For the most part, these schemes specify the livestock diseases that are covered, are limited to specific risk sources (direct or consequential losses) within a FAD outbreak, and may contain both public and private sector support. The review of options in other jurisdictions focused on the European Union (EU) since they have had considerable experience.

a) **Direct Losses** – Within the EU, there is a specified amount of compensation paid by governments for the direct losses associated with a foreign animal disease like FMD. Direct losses include the costs of culling diseased animals and the welfare slaughter of healthy animals in contact animal populations *within a cease movement restricted area or surveillance zone*. The EU Expenditures of Veterinary Emergency Measures (Figure 7 shows recent expenditures by year and disease outbreak) flows to producers through compensation levels that include:

- 50 percent of the cost for animals that are diseased or recommended to be slaughtered within a “veterinary- prescribed” pre-emptive slaughter;

Figure 7: EU Expenditures of Veterinary Emergency Measures by Disease and Outbreak



Source: Compensation Rules and Mechanisms in the EU; Showcasing Risk Management Innovations Event; Ottawa, Ontario; September 2006

- 70 percent of the cost of animals slaughtered for welfare reasons (restricted movement) within the defined surveillance area; and
- 50 percent of the organizational costs of the control measures.

Additional loss compensation is available to farmers in some EU countries for different components of these direct losses and can vary by livestock sector and defined disease outbreak. Among the different direct loss compensation approaches in EU countries:

- the Netherlands has introduced a levy system where farmers contribute on a compulsory basis to a fund that compensates farmers for the direct losses of a disease outbreak. The government arranges a loan for the fund with banks to a maximum amount over a five-year period if losses exceed the accumulated fund balance. Levies increase after a loss with the expectation that farmers will fully repay the loan;
 - the Denmark government pays for the value of animals that are compulsorily slaughtered. If a whole herd is slaughtered the producer receives an additional 20 percent payment to recognize the loss of income from the herd. No payment is made for the commercial loss of income for movement restrictions within a surveillance zone. No levy system is in place to build an emergency fund and producers are not expected to repay this additional compensation from governments;
 - Greece operates a compulsory insurance scheme to provide additional compensation for direct losses due to livestock disease for producers of breeding stock, poultry or domestically produced products and by-products of animal origin. The premium is 0.5 percent of the value of livestock production sales;
 - Germany and Austria provides additional protection through a mandatory levy program administered by regional authorities with governments and producers cost-sharing the emergency fund on a 50/50 basis. The fund only compensates for veterinary prescribed culling of livestock;
 - Italy provides no additional compensation to producers for direct losses due to a FAD outbreak; and
 - Spain provides insurance for limited livestock disease protection through Agroseguro (private sector insurance pool with government program design, premium rating and premium cost sharing).
- b) Consequential Losses** – Public or private sector coverage for consequential losses (business disruption, equity loss, herd replacement, etc.) are not as common as those to compensate producers for the direct losses. Programs that do exist are generally in the form of a public-private partnership and again are focused on protection to producers *within a cease movement or surveillance zone*. A sample of different consequential loss approaches in the EU includes:

- Finland pays ad hoc compensation to producers whose livestock herds are culled due to a livestock disease but it is limited to the available budget at the time of the loss. Producers are not guaranteed any financial assistance;
- In Germany, insurance for a broad range of coverage is available including market loss due to cease movement orders. Coverage for business interruption is limited to 12 months based on the difference between actual gross margin after the loss and that before the loss. Market losses due to cease movement are paid at 50 percent of gross margin differential;
- Italy has insurance protection for business interruption losses for specified diseases in cease movement restricted zones but participation by producers is very low;
- Insurance is available in the Netherlands for limited business interruption losses in cattle as a percentage of the value of the culled animals under the direct losses levy coverage;
- Spain offers government-supported insurance for breeding stock to boost the value the producer receives for prescribed slaughter to a full market value;
- Sweden compensates producers at a pre-defined percentage (from 50 to 100 percent based on the disease) of the difference between actual profit after the disease outbreak and the expected profit prior to the outbreak; and
- The United Kingdom pays a 25 percent increase on top of direct loss payments to insured producers to recognize business interruption losses.

This brief summary of risk transfer options for livestock producers in other jurisdictions emphasizes a combined public and private role and a limit to risk exposures for those accepting risk from the livestock sector by: covering only specific risks (disease perils), limiting coverage to certain livestock species and/or limiting coverage to pre-defined cease movement or surveillance zones. For the most part, “welfare slaughter” in these jurisdictions refers to culling of healthy animals within a certain zone due to cease movement restrictions and not a country-wide loss of market access that might occur due to an international border closure. Throughout this paper, the term welfare slaughter includes the extermination of livestock to equate supply to a restricted demand caused by a border closer due to a FMD outbreak. This is an important distinction in the Canadian livestock industry since a major portion of domestic livestock production is destined for international markets, primarily the US.

5.0 Key Issues for Next Steps

5.1 General Discussion

The original purpose of this project was to identify key risks facing the livestock sector in the event of a FAD outbreak like FMD. With producer input, the project would identify the most plausible private sector risk management solutions that could mitigate farm income pressures due to the occurrence of specific risks. These solutions would

complement existing government initiatives and address producer perceived gaps in protection. However, during the project, it became apparent that many producers are only peripherally aware of government programs and their role/effectiveness in responding to foreign animal diseases. This lack of awareness makes it difficult to focus on defining private sector solutions to complement government-sponsored initiatives.

This situation is understandable given that:

- major FAD outbreaks are infrequent (perhaps only occurring once or twice in a 50-year period) and government programs, while effective for minor and more common plant and animal disease outbreaks, are often perceived to be inadequate or out-dated when responding to a major event, especially where border closures or widespread livestock herd eradication is an outcome;
- during the time-span of this project governments have announced a number of reviews of their current suite of programs (production insurance, CAIS, CFIA compensation) that respond to foreign animal disease outbreaks. In addition, the federal government announced the formation of a new Initiative Fund that could potentially address some of the perceived gaps in the current suite of government-sponsored programs; and
- recent FAD outbreaks have emphasized the need to strengthen on-farm and integrated food-chain mitigation strategies that include zoning, bio-security, animal identification, traceability, etc. These initiatives are encouraged by government and are a focus of APF chapters other than Business Risk Management.

The financial scope of potential FAD outbreaks like FMD can have devastating impacts on the livestock sector in Canada that could even go beyond what has recently been experienced with BSE and AI. Several components of government-sponsored programs in combination with private sector initiatives offer protection to producers in the event of a major animal disease. However, defining solutions for specific gaps in protection is problematic when government programs (mitigation and reduction) are in a state of flux and perceived by producers to be expanding in scope. This lack of clarity impacts the next steps for projects that focus on identifying private sector solutions to address perceived gaps in government programs.

Producer led solutions require the support of third-party risk transfer agents such as the insurance sector. The involvement of these groups depends on their perception of the risks inherent in the agriculture sector which is unique in that many forms of agricultural risk are highly correlated among farms. During a FAD outbreak the entire livestock sector can be impacted at once to varying degrees. Cease movement orders can impact all farms within a defined area and border closures due to an outbreak in one species can have negative impacts on others across the country. This potential for the accumulation of risk exposure across many farms is in contrast to other forms of risk like house fires or vehicle accidents. The likelihood of a wide segment of vehicles sustaining losses simultaneously is remote to non-existent and specific events like war or conflict which

might generate such losses are usually excluded from risk transfer solutions like insurance.

Agricultural production is highly technical and specialized, susceptible to weather, pests and diseases, impacted by an international trade environment and dependent on management techniques employed by each individual producers (e.g. on-farm bio-security measures). The unique aspects of agricultural risk impact the way in which the third-party risk transfer agents (e.g. the insurance/reinsurance industry) view their participation in this market. For example, private insurance firms are interested in offering insurance protection against property damage on farms but insurance policies to cover losses to crops, livestock or farm income are not as readily available. This lack of acceptance for agricultural risk transfer by the private sector may be due to a variety of factors including:

- the nature of the risk(s) in the agricultural sector and need for financial capacity to cover widespread and accumulated losses;
- the role of the public sector in risk management within the agricultural industry both in a planned fashion and in ad hoc assistance;
- the ability to derive sufficient and consistent income over time that is commensurate with risk exposures;
- the “political reaction” (e.g. border closure) to certain risk occurrences and the significant consequential impacts to internationally trade-dependent agriculture economies; and
- the ability to spread risks they acquire outward to a reinsurance industry in order to reduce risk exposures.

While agricultural risk presents many challenges to the insurance industry, it is not without opportunity. The risks facing farms in Canada are often not correlated with agricultural risks in other regions of the world and with other insurance markets. This means that agricultural risk can be attractive as an offset to other forms of portfolio risk within the insurance/reinsurance industry which operates on a global scale. However, the private sector is reluctant to invest in research and design of risk transfer programs when government-sponsored initiatives are uncertain. The initial costs of design and administration can be considerable and can only be recouped with revenue generated from product sales to producers. While the PSRMP mandate helps to defray development costs, the expansion of government programs into risk transfer areas where the private sector might venture could deplete revenue from private sector sales and diminish the opportunity to recoup the initial start-up costs and generate profits. Lack of clarity with respect to government programming deters private sector enthusiasm.

A number of initiatives are currently underway in Canada to increase the bio-security of food production throughout the livestock chain. These worthwhile initiatives serve two roles. First, sound bio-security measures beginning with cost effective on-farm protocols in combination with a structured emergency response to livestock disease can reduce (but not eliminate) both the frequency and severity of the financial impact to industry. Second,

these same measures can form the basis of any risk underwriting procedures for pre-planned industry led risk transfer initiatives to address gaps in protection. Many producer groups are actively involved in promoting the expansion of practical on-site risk mitigation strategies among their membership and beyond. Implementation of these strategies will create costs for producers. Risk transfer tools need to be well and fully designed with accurate cost estimates in order to generate a credible reaction from producers who are already aware of the cost and potential benefits of on-farm risk mitigation strategies.

Several sources of financial risk within a FMD outbreak have been identified within this study. The most significant of these are related to market losses as a result of international border closures that can create significant over-supply and/or under-utilized capacity and sector equity loss in Canada. Canada is unique in this regard since much of the domestic production is destined for international markets, primarily the US. Producer driven risk management solutions can not be expected to address the full scale impact of financial losses in the livestock sector resulting from a widespread and prolonged border closure. Governments in Canada need to define with some certainty and consistency the extent to which they will assist producers in these situations if private sector solutions are to be defined as part of an overall protection scheme. Governments in some international jurisdictions that have experienced significant FAD outbreaks are defining their role in supporting agriculture in these situations. This has allowed producers to make sound decisions regarding what they can do collectively to transfer or accumulate risk in conjunction with government and what risks they will have to accept as a result of doing business.

5.2 Feasibility and Benefits of Risk Transfer Solutions

5.2.1 Feasibility

This paper identified four main risk transfer solutions – insurance, levy systems, the futures markets and catastrophic bonds, which actually reflect broad risk management tools and/or a supporting administrative structure. Outlining a specific design and administration structure with sufficient detail to support accurate cost estimations for presentation to producers is beyond the scope of this project. The most feasible of these options within the short term are likely to be insurance and levy systems. Canadian specific futures markets for livestock or not well defined at present. Considerable domestic production is destined for US markets and, in normal situations, the US futures market reflects pricing trends to a large degree in Canada. However, in the event of a border closure due to a major animal disease outbreak, US markets do not reflect prices in Canada and consequently cannot form the basis of a risk transfer tool. A PSRMP project is underway to develop a Canadian market that reflects beef cattle prices for insurance purposes, however, the outcome of that endeavour is not yet known.

The catastrophic bond market is a source of risk transfer capacity similar to that of the reinsurance industry. It works in a similar fashion to any other bond market but is relatively new to agricultural risk transfer. While there is significant potential for the bond market to be utilized to support or “back stop” an insurance or levy system it should

be viewed as insurance for an insurance firm or system. In this way, any preparation to access the bond market would be similar to that to access the reinsurance market.

In summary, the most feasible approaches for supporting risk transfer solutions for a major animal disease appear to be levy systems or insurance designs, both of which have similar characteristics – risk is transferred to a third-party in insurance and/or shared among many farmers in a levy system. In both cases, risk may be further transferred to reinsurance markets, catastrophic bond markets or governments.

5.2.2 Benefits

Managing the risks associated with a major animal disease outbreak like FMD can be likened to building a brick wall to protect the livestock sector. Many bricks with a sound foundation and well-laid mortar are required to build the wall given the complexity of the issue. In the absence of risk management tools, livestock producers are entirely responsible for laying each brick themselves. With the current suite of tools many of the bricks are in place but the wall is not yet complete and the bricks or sections of the wall are not clearly linked.

The main benefit to industry, government and society at large is that a pre-planned approach to major animal disease outbreaks ensures that effective processes are in place to protect the economic viability of the industry and the food safety of the public. Insurance and/or levy systems require considerable data, planning, coordination among stakeholders and effort to develop successfully. Involving third-party risk transfer agents (reinsurance, catastrophic bonds markets) brings a rigour to the exercise that may not be present if it were left to government and industry alone. At the same time though, government-initiated risk reduction efforts currently underway (e.g. development of on-farm bio-security standards) are integral components in any risk transfer solution. Third-party agents to the process will want to know that producers and other stakeholders to the production process are utilizing standard disease prevention protocols. Verifying the use of these standard practices is a key element in the integrity of an insurance or levy approach.

In the absence of risk management tools, livestock producers are entirely responsible for laying each brick in the wall of risk management protection themselves. A pre-planned approach to a major livestock disease outbreak that links all aspects of a risk management strategy – reduction, avoidance, transfer and acceptance – would provide long-term certainty to the livestock industry.

5.2.3 Next Steps

5.2.3(a) Issues for Industry Input

Different risk transfer strategies are possible for the next phase of this project that should concentrate on the complete design with supporting administration options to present to producers for credible feed back. For example, the livestock sector could focus on one specific risk source within an FMD outbreak. Or a national industry-led initiative to

handle a small proportion of the financial risks from the entire set of risk sources may be an option. A third option may be to mimic strategies developed in the EU and other countries like Australia where the industry focuses on pre-planned initiatives that mitigate the financial impacts of specific risks for specific livestock diseases within defined zones surrounding the initial site of a livestock disease outbreak.

Regardless of the approach, the livestock sector needs to understand that considerable work has to be done to develop a sound initiative and that costs in premium and/or levies would be required in any risk transfer process. Administrative processes would have to be developed to support a risk transfer initiative that could require the establishment of a farm mutual entity to manage product delivery. Adherence to on-farm bio-security measures would be required to either ensure a farm's eligibility to a risk transfer program or to distinguish the cost of participation. In addition, cost of risk transfer may vary by livestock species and known parameters that impact loss exposures like livestock density. Design decisions would need to include whether a program should be voluntary or mandatory as in some of the levy systems in the EU and in either case, how an industry-led private sector initiative would interact with government sponsored programs.

During the next steps of the project the livestock sector needs to consider:

- how strong a defense against a major animal disease outbreak needs to be;
- the proper balance between risk reduction and risk transfer strategies;
- whether ad hoc government assistance (subject to fiscal limitations) should be replaced or supplemented with industry-led responses that they can control and that are targeted at specific risks they can manage;
- how much capacity within the current economic environment the livestock sector has to support risk reduction and risk transfer strategies;
- how much capacity (e.g. surplus funds from an insurance premium or levy) is required to develop a practical industry-led solution(s) against a major animal disease;
- whether an industry-led planned approach to risk transfer would be a useful tool to define the government role in a major animal disease outbreak;
- whether industry-led pre-planned initiatives provide reassurances of food safety to the public and maintain a societal resolve to assist an industry that is willing to help itself; and
- whether there is unified support throughout the livestock industry and/or within livestock species sectors to develop and support a coordinated approach to pre-planned responses for major animal disease outbreaks.

5.2.3(b) Work Plan Elements

The next steps in this project (second phase) should focus on an examination of potential design(s) and supporting administration structure(s) in order to present practical and detailed solutions to producers for credible feedback. This analysis should include a complete actuarial cost for different options with supporting “underwriting procedures” and input from the reinsurance industry.

Workplan elements of a second phase project should focus on a specific livestock species (e.g. hogs) that is susceptible to international trade restrictions in the event of a foreign animal disease for legitimacy and to narrow the scope of the project to a manageable level. A work plan for the second phase should at a minimum address these following primary elements:

Program Design:

- build risk models that effectively describe actual livestock production systems and the impact that current government and private sector programs would have to mitigate losses in the event of a major foreign animal disease;
- interact with the appropriate authorities currently reviewing government programs to introduce changes to program design to the risk models to identify gaps in coverage;
- meet with producers to confirm gaps in coverage and priority ranking of risks to address in the further design of risk management tools;
- access available data in Canada as well as international data and experience to support plausible actuarial methods for insurance and/or levy premium cost estimates for design ;
- specifically describe alternative program design characteristics to address gaps in coverage including the risks to be covered and excluded, methods to define the geographic zone of coverage, on-farm protocol standards for farm eligibility and/or premium adjustment, payment caps per animal, farm and event, the duration of coverage for business interruption/disruption elements in design and design links to government-sponsored programs; and
- develop actuarial methodologies to rate insurance alternatives and/or guide the assessment of producer contributions to a levy based system.

Operational Parameters:

- specifically describe operational characteristics of the insurance/levy program including on-farm monitoring procedures to ensure compliance to protocol standards, procedures to reduce moral hazard and adverse selection, the rules of insurance engagement (ex. length of the insurance contract, mandatory versus voluntary participation, data to be provided by producers) and operational links to government programs;

- review provincial regulations governing insurance and/or producer managed levy systems and ensure proposed policy wordings are in compliance;
- define the characteristics of a potential delivery agent(s) and search out credible groups that can effectively manage and support either an insurance or levy structure.

Reinsurance:

- attain program design input/reaction from potential third-party risk transfer agents (reinsurance firms, capital markets) as well as indications of capacity in support of the designs.

Producer Input

- gather credible input from producers as to preferences for a specific risk management alternative(s) that should move to implementation in a third phase of the project given:
 - the producers clear understanding and the risks covered by existing government and private sector programs;
 - the cost of premium/levies for different risk transfer alternatives;
 - the underwriting protocols required for various risk transfer alternatives; and
 - the administration requirements of participation in an alternative risk transfer solution.

Appendix

Table A1: Identification and Description of FAD Risks and Costs		
Risk and Cost Factor	Description	Current Degree of Compensation
Outbreak Control Costs/Risks		
1) Detection and surveillance	Costs associated with initial detection and surveillance in the infected zone	Full
2) Cleaning and disinfection of premises	Direct on-farm costs for cleaning of premises, disinfection of buildings and facilities	Partial
3) Disposal of infected feed or animal products	Led by CFIA, the disposal of milk or feed that is suspect, or disposed of due to limited market access	Partial
4) Pre-emptive, and infected animal slaughter	Slaughter of animals that are infected, suspected, or for purposes of control	Full
5) Disposal site development	Selection, preparation and maintenance of sites	Partial
6) Infected animal disposal	Led by CFIA, physical disposal of infected animals	None
7) Animal cease movement due to disease control or border closure, or market closure	Cost incurred due to situation where animal movement is restricted or trapped in transit. Includes possible costs of feeding, water, storage, and possible disposal at sites	None
8) Quarantine of animals	Costs associated with holding animals on-farm or in CFIA quarantine	Partial
9) Environmental costs	Costs of environmental compliance, of meeting provincial and federal environmental laws, costs of delay due to receiving environmental approvals.	Partial to none
Direct Primary Sector Costs/Risks (Subsequent to Outbreak Period)		
10) Failure of farm organizations	In ability of farm organizations to sustain membership and funding	Partial
11) Development of disposal sites	Identifying disposal sites, developing them, conducting environmental compliance standards	None
12) Welfare slaughter and disposal	Disposal of market animals for which there are no markets and surplus to market needs – value of animals disposed, and slaughter cost	None
13) Technical resource limitation	Inability to access disposal equipment, supplies, personnel	none
14) Lower output prices	Potential for lowered market prices due to no markets or surplus supply for domestic markets	Partial
15) Market collapse	Severe and sustained market impacts due to border closure, and loss of export/domestic market confidence, abandonment. Sustained shift of the demand and supply curve to the left, rather than a shift along the demand curves	None
16) Flight of capital	Due to loss of confidence in sector, reduction in supply of	None

Table A1: Identification and Description of FAD Risks and Costs		
Risk and Cost Factor	Description	Current Degree of Compensation
	investment and/or debt capital, inability to reinvest, recover	
17) Increased cost of feed, supplies	Higher costs of feed due to lack of supply, distance	Little
18) Loss of export sales	Due to closure of markets – reflects both in price and quantity of sales	None
19) Reduced productivity of herds	Results from disposal of quality breeding stock	None
20) Vacant processing plants	Plants shut down, bankrupt	None
21) Unused productive capacity	Vacant barns, land, due to need to control disease	None
22) Loss in equity	Loss in equity in land, equipment value, loss of security	None
23) Restocking costs	Costs of repurchasing breeding and feeder stock, materials	None
24) Market re-establishment costs	Cost to re-establish market sales, particularly export markets	None
25) Training and HR	Potential costs for hiring and training staff lost because of a FAD	Partial

Source: Serecon (2006) Identification of Unmanaged Financial risks Due to an Animal Health Emergency