

**POTENTIAL
ECONOMIC IMPACTS
OF A FOOT AND
MOUTH DISEASE
OUTBREAK IN
BRITISH COLUMBIA**

FINAL REPORT

**PREPARED FOR
LIVESTOCK WASTE
TISSUE INITIATIVE
INVESTMENT
AGRICULTURE
FOUNDATION OF BC
ABBOTSFORD, BC**

PREPARED BY

**SERECON MANAGEMENT
CONSULTING INC.
EDMONTON, ALBERTA**

FEBRUARY, 2010

Funding provided by:

Canada



**Investment
Agriculture
Foundation
of British Columbia**



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February 3, 2010

Mr. Rick Van Kleeck
Coordinator
Livestock Waste Tissue Initiative
1767 Angus Campbell Road
Abbotsford, BC
V3G 2M3

Dear Mr. Van Kleeck:

**RE: FINAL REPORT: ECONOMIC IMPACTS OF A FOOT AND MOUTH
DISEASE IMPACT ORGANIZE, HOST AND REPORT ON A BRITISH
COLUMBIA FOOT AND MOUTH DISEASE OUTBREAK IN BRITISH
COLUMBIA**

We are pleased to provide this final report for the Steering Committee.

We have taken account of the comments and reviews of the Steering Committee provided in February, 2010.

If you have any questions, please contact me at 403-216-2101 or rashmead@serecon.ca.

Yours truly,
SERECON MANAGEMENT CONSULTING INC.

Ralph Ashmead, Ph.D., MBA, B.Sc.
Calgary Office

Enclosure

/da

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DISCLAIMER

The Investment Agriculture Foundation of BC (IAF), the BC Ministry of Agriculture and Lands (BCMAL) and Agriculture and Agri-Food Canada (AAFC) are pleased to participate in the production of this publication funded through the Livestock Waste Tissue Initiative (LWTI). We are committed to working with our industry partners to address issues of importance to the agriculture and agri-food industry in British Columbia. Opinions expressed in this publication are those of Serecon Management Consulting Inc, and not necessarily those of IAF, BCMAL or AAFC.

GLOSSARY OF TERMS, DEFINITIONS AND ACRONYMS

Animal Identification

The combination of the identification and registration of an animal individually, with a unique identifier, or collectively by its epidemiological unit or group, with a unique group identifier.

Animal Identification System

The inclusion and linking of components such as identification of establishments/owners, the person(s) responsible for the animal(s), movements and other records with animal identification.

Animal traceability

The ability to follow an animal or group of animals during all stages of its movement.

Biosecurity

The means and policies that identifies potential pathways for the introduction and spread of disease in a zone or compartment, and describes the measures which are being or will be applied to mitigate the disease risks.

Cleaning and Disinfecting (C&D)

C & D involves removing all suspect material, cleaning buildings and equipment, and sanitizing the areas with appropriate disinfectants.

Contact premises

Contact premises are premises that contain susceptible animals which have been in contact with an infected premise or an infected animal. Direct contact implies the movement of an infected animal whereas indirect contact means the movement of a potentially contaminated thing (fomite).

Control costs

Control costs are defined to include the cost of detection, surveillance, disposal, Control area	destruction, and livestock/ livestock products movement and control. Legal definition under Section 27(1) of the <i>Health of Animals Act and Regulations</i> , and referred to in the Ministerial declaration. The control area would include the Infected Zone, Restricted Zone, and Security Zone.
Depopulation	To destroy all the susceptible animals on a premises and dispose of the carcasses.
Direct contact premises	Premises containing susceptible species that have had direct contact with an infected animal or a potentially infected animal that originated from a confirmed positive place. Disease control actions will be implemented on these premises.
Endemic	Disease regularly occurring in a particular region, country or population group.
Exposed premises	A contact premise which received animals (direct contact), products, by-products or things including animal feed and manure, vehicles or equipment from an infected premise (indirect contact).
Fomites	Objects or materials which are likely to be contaminated with the infective agent, such as clothing, machinery, etc.
FMD-free zone	Part of a country that has been established to be free of a FMD disease. To obtain recognition as a disease-free zone, countries must demonstrate that they have a reliable system of disease control, the disease is compulsorily notifiable, and that they have an effective veterinary organization. Within the zone and at its borders, appropriate official veterinary control is effectively applied for animals and their transportation in order to bring the definition in line with Office International des Epizooties (OIE) requirements.
Infected place	Legal term for a place which has been declared an infected place by an inspector (under section 22 of the <i>Health of Animals Act and Regulations</i>) and consequently restrictions have been imposed by section 25 of the <i>Health of Animals Act and Regulations</i> limiting the movement of animals, animal products and by-products, things, etc. A declared infected place may be an infected premise, an exposed premise, a contact premise, or more simply, a premise that is declared infected because of its close proximity to an infected premise. An infected place is suspected of having an infection, but not necessarily confirmed to have an infection.
Infected premise, infected herd	A premise, where a herd with the disease has been identified, with or without confirmation from laboratory results.
Infected zone	The zone established pursuant to the Ministerial declaration and which includes all infected premises. The outer boundary is at least three

kilometres from any infected premise adjusted to geography, epidemiology, climatology and resources to control the	epidemic. A restricted zone will separate the infected zone from the remainder of the country. Movement of susceptible livestock must be strictly controlled.
Movement controls	Restrictions placed on movement of animals, people and things to prevent the spread of disease.
Outbreak	Outbreak of FMD means an occurrence of foot-and-mouth disease virus infection in an agricultural establishment, breeding establishment or premises, including all buildings and all adjoining premises, where animals are present (source=OIE Code 2002).
Rendering	Destruction of the carcass or animal by-products by heating.
Significant contacts	An animal showing no clinical signs of disease but which will be, by reason of its possible exposure to disease, subject to disease control measures (which may include slaughter of all or some of such animals).
Special premises	Premises such as an abattoir, artificial insemination centre, sales yard, zoo, game farm, shipping yard or any other premises where animals are kept or assembled.
Specified Risk Materials	Refers to certain tissues of cattle aged 30 months or older, that are designated under section 7 of the Health of Animals Act as posing a negligible risk for Bovine Spongiform Encephalopathy.
Stamping out	Stamping-out policy means on confirmation of FMD, the killing of all susceptible animals, vaccinated or unvaccinated which are infected or suspected of being infected with FMD in a herd on an infected premise. And, where appropriate, killing of other herds, which have, been exposed to infection by direct animal to animal contact, or by indirect contact of a kind likely to cause the transmission of the causal pathogen under the competent authority (source=OIE Code 2002).
Surveillance (restricted) zone	The zone immediately surrounding the infected zone(s). For FMD, the limits of the surveillance zone must be at least 10 km from an infected premise, the generally accepted distance for airborne spread, depending on epidemiology, climatology, geography, etc. Vaccination is not permitted in this zone. Freedom from infection should be confirmed by appropriate tests. Animal movements must be strictly controlled. It must have an advanced degree of disease control and surveillance.
Trade losses (opportunity trade costs)	The costs of lost export sales until full recovery of export revenue to the levels experienced before the outbreak.
Veterinary Equivalency Agreement	An agreement between countries wherein the sanitary measure(s) proposed by the exporting country as an alternative to those of the importing country, achieve(s) the same level of protection.
Welfare slaughter and disposal	The slaughter and disposal of livestock due to the necessity of the industry to meet the reduced demand for livestock products as a result of trade restrictions from a FMD outbreak. These are not infected animals.

Zone/region

Is a clearly defined part of a territory containing an animal subpopulation with a distinct health status with respect to a specific disease for which required surveillance, control and biosecurity measures have been applied for the purpose of international trade.

LIST OF ACRONYMS

- ➔ AAFC: Agriculture and Agri-Food Canada
- ➔ AI: Avian Influenza
- ➔ CFIA: Canadian Food Inspection Agency
- ➔ CBGA: Canadian Beef Grading Association
- ➔ C & D: Cleaning and Disinfecting
- ➔ FAD: Foreign Animal Disease
- ➔ FMD: Foot and Mouth Disease
- ➔ GIS: Geographic Information System
- ➔ H of A: Health of Animals
- ➔ ID – as in livestock identification systems
- ➔ LFV: Lower Fraser Valley
- ➔ NAI – Notifiable Avian Influenza
- ➔ RoC: Rest of Canada
- ➔ SRM : Specified Risk Materials
- ➔ VEA: Veterinary Equivalency Agreement
- ➔ WHL: West Hawk Lake

EXECUTIVE SUMMARY

PURPOSE

This report has been prepared for the Livestock Waste Tissue Initiative of the Investment Agriculture Foundation of British Columbia. The report formed part of a FMD Workshop, October 27 and 28th 2009 in Abbotsford BC, at which the broad technical, policy, waste disposal and economic issues and implications of a potential Foot and Mouth Disease (FMD) outbreak in British Columbia were discussed.

The purpose of this report is *to provide an independent and comprehensive economic impact assessment of a potential Foot and Mouth outbreak in BC.*

There are few agricultural events that could impact the BC economy more than an outbreak of FMD anywhere in the province, but in particular, in the Lower Fraser Valley (LFV) area. The economic, environmental, and social impacts would be profound, affecting agricultural trade, meat consumption, the direct slaughter and disposal of animals affected and stamped out, the disruption of primary agricultural production and distribution systems, disruptions on meat processing operations, as well as impacts on allied industries, and tourism.

SCENARIOS

Three possible scenarios have been described and their impacts evaluated in this study. The small scale scenario reflects an anticipated “best case” situation, in which the outbreak is restricted to the LFV, a minimum number of livestock operations are affected (five), the disease control period is short, and disease management systems inclusive of biosecurity, zoning and containment, are effective.

A medium scale outbreak scenario was in turn evaluated, which may reflect a situation close to where the industry could be with minor improvements. The effectiveness of biosecurity, zoning, policies, and disease management systems are moderately effective. The outbreak is seen originating in the LFV, but not contained there, eventually spreading to Alberta. Zoning at West Hawk Lake in Manitoba was effective in preventing its spread to the rest of Canada. In this case 100 livestock operations were affected in BC and in Alberta.

The large scale outbreak scenario reflects a situation in which FMD spreads across Canada. The outbreak spreads either due to ineffective preventative disease management systems and practices, poor response management practices, or just bad luck. The scenario results in 1,000 herds being infected, and with an extensive period of trade disruption.

The size of these three scenarios, are similar to those which have occurred historically for FMD. Recent analysis suggests three distinct groupings of

SUMMARY RESULTS

epidemics: fewer than five (11 epidemics): between 15 and 150 infected premises (9 epidemics), and more than 2,000 infected premises (4 epidemics).¹

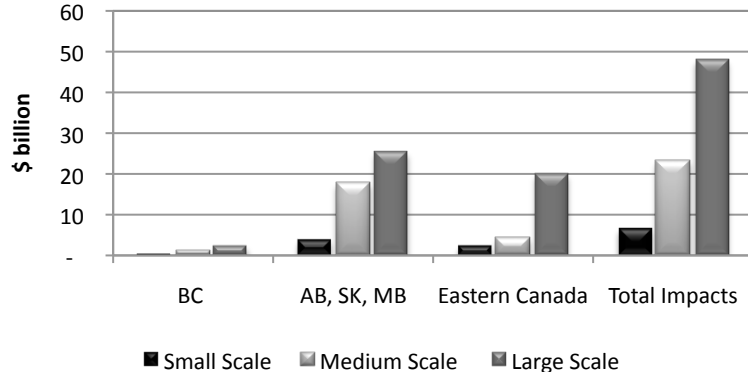
The overall impacts of the three scenarios were found to be significant, and the results are summarized in the figure below.

Under the small scale scenario, the estimated impacts of an FMD outbreak on Canada are in the range of \$6.6 billion. The total impacts of a medium scale scenario are estimated to be \$23 billion and a large scale scenario, of \$48 billion.

The impacts would be felt on all regions of Canada, just as BC would be impacted by an outbreak that occurred elsewhere in Canada.

Canada and each province would suffer an impact regardless of where FMD is found in Canada. However, the impacts will vary depending on the outbreak location and the size of the outbreak. This study only looks at impacts if the disease originates in BC.

Summary of FMD Scenario Economic Impacts



Of particular interest to this study, are the impacts on BC. As shown in the table and figure below, the impacts on BC are significant, even under the small scale scenario. With the small scale FMD scenario, the overall impacts on BC are anticipated to be about \$360 million. With the medium scale situation, the impacts increase threefold to \$1.2 billion. With the large scale outbreak the impacts are anticipated to be in the range of \$2.4 billion.

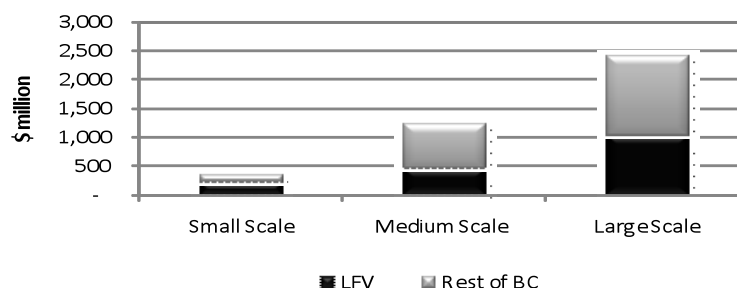
¹ McLaws, M., and Ribble, C. Description of recent foot and mouth disease outbreaks in nonendemic areas. CVJ. Volume 48. P 1051. October 2007

To put an outbreak of FMD in context, the impacts on BC alone from the small outbreak are comparable to the Avian Influenza outbreak in 2004. However, the impacts on the country as a whole – of the small outbreak – are some 20 times larger than the AI outbreak.

FMD Economic Impacts on British Columbia

	LFV	Rest of BC	Total BC
Small Scale (m)	\$229	\$132	\$361
Medium Scale (m)	\$465	\$759	\$1,224
Large Scale (m)	\$1,030	\$1,381	\$2,411

FMD Economic Impacts on BC



The economic analysis targeted on the prevention, control and the economic impacts of an outbreak. The summary results for BC and Canada are tabulated below.

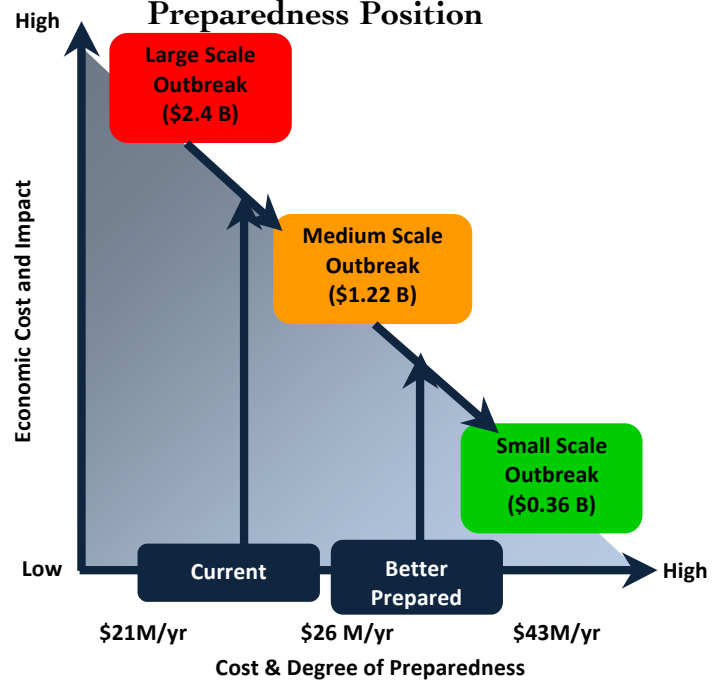
Summary of FMD Impacts and Costs

Scenario	Costs and Impacts	BC	Canada
Small Scale	Prevention Costs (million)	\$43	\$907
	Control Costs (million)	\$38	\$38
	Economic Impacts (million)	\$361	\$6,531
	Animals Depopulated (hd)	4,967	4,967
	Biomass Volume (cubic meters)	3,147	5,876
Medium Scale	Prevention Costs (million)	\$26	\$560
	Control Costs (million)	\$111	\$186
	Economic Impacts (million)	\$1,113	\$23,093
	Animals Depopulated (hd)	34,518	77,164
	Biomass Volume (cubic meters)	21,767	52,013
Large Scale	Prevention Costs (million)	\$21	\$458
	Control Costs (million)	\$234	\$1,184
	Economic Impacts (million)	\$2,177	\$46,686
	Animals Depopulated (hd)	82,014	543,686
	Biomass Volume (cubic meters)	51,976	245,988

PREPARED NESS INVESTMEN T

The figure below provides a conceptual summary of the estimated costs of the three outbreaks, the investment preparedness costs of each, and a representation of both where the industry may now be in this continuum, and where we may want to target industry and government resources.

The BC Foreign Animal Disease Risk and Preparedness Position



The degree of current preparedness of the BC industry with respect to the mitigation or prevention of the economic impacts and costs of a FAD outbreak is estimated to be about 60% in from the preventative costs of a large outbreak and a medium outbreak. This reflects an annual cost to industry and government in the range of \$24 million, or an equivalent one time annuity value of \$438 million. If it would be desired to improve the level of preparedness to the midpoint between the small and medium scale outbreak, the annual expenditures on preparedness would need to be increased to 146%, or to \$35 million. This would be equivalent to an annuity of \$639 million.

The analysis indicates that increasing the level of preparedness from the estimated current position to an improved position midway between the preparedness needs of a small and medium scale outbreak, would result in \$4.6 of benefit, for each dollar of annual expenditure to achieve this outcome.

SENSITIVITY ANALYSIS

Sensitivity analysis was completed on variables in the medium scale outbreak to measure the relative change in the impact that results from

changing the model assumptions/drivers. The following table summarizes the sensitivity analysis results.

Sensitivity Analysis of FMD Economic Impacts and Costs

Sensitivity Analysis	
Baseline Impacts of Medium Scale Outbreak in BC	
Impact, millions	\$1,224
Number of Animals (head)	34,518
Volume of Animals (cubic meters)	21,767
10% Change in Months out of Trade	
Impact, millions	\$1,177
10% Change in Disease Control Months	
Impact, millions	\$1,184
10% Change in Affected Farms	
Impact, millions	\$1,216
Number of Animals Slaughtered (head)	30,142
Volume of Animals (cubic meters)	19,291

From a purely economic perspective, decreasing the length of the event, either by accessing trade markets faster, or by controlling the length of time the disease is active, has the most significant impact on the financial magnitude of the outbreak. A 10% change in the number of months out of trade and a 10% change in the disease control period, results in a 4% and 3% change in the economic impact respectively.

A change in the number of affected farms does not have as significant an impact financially on the industry. A 10% change in the number of affected farms resulted in a 1% change in the impact. More significantly however, it substantially lowered the number of animals that would potentially be pre-emptively slaughtered and the volume of animals that would need to be disposed. These issues pose very important concerns to the BC livestock industry.

Additional scenarios have been run on the ability to gain trade access in all regions of Canada (affected and disease free zones) immediately following an outbreak. On the medium and large scale outbreaks modeled in this analysis, where trade restrictions of up to 24 months were assumed, there is potential to lower the economic impacts by perhaps as much as 46% through activities and policies that allow for immediate trade resumption. The presence of a Veterinary Equivalency Agreement (VEA) with the US may facilitate trade resumption.

This report presents the detailed findings of this study. The analysis provides the details to evaluate the benefits and costs for the industry and government for investing in effective preventive foreign animal disease control systems, animal carcass disposal capacity, zoning and containment, and biosecurity programs.



INTRODUCTION

PROJECT PURPOSE

The purpose of this report is to provide an independent and comprehensive economic impact assessment of a potential Foot and Mouth Disease (FMD) outbreak in BC.

This economic impact assessment was commissioned as factual background information that would facilitate informed decisions and recommendations by participants at the FMD Invitational Forum and Workshop, held October 27th and 28th 2009, in Abbotsford, BC.

Information from this assessment will also facilitate strategic policy decisions, and subsequent planning and preparation activities, relative to a range of disease outbreaks that might occur in BC or Canada. In particular, the assessment quantifies the potential number of animals that would require depopulation and resulting volumes of biomass for disposal in the Lower Fraser Valley, in the event of a potential FMD outbreak.

As important as the orders of magnitude of the size and impact of an FMD outbreak outlined in the assessment, is the measure that this information provides to stakeholders and decision makers regarding the benefit from an investment in mitigation and preparedness initiatives such as: Identification, Traceability, Zoning, Biosecurity, Cease Movement, and a US / Canada Veterinary Equivalency Agreement.

Finally, this assessment and its results are intended for discussions much broader than FMD preparedness. FMD is certainly a familiar hazard and therefore a useful scenario to work with. This information however, has direct benefit and application to many different animal emergency scenarios, including a broad range of disease preparedness scenarios extending from production limiting diseases, to highly contagious diseases that have not previously occurred in Canada, and perhaps to emerging diseases which have not yet appeared.

Two deliverables were defined:

1. A final report summarizing an independent and comprehensive economic impact assessment for an FMD outbreak originating in BC.

The assessment provides economic impacts of different outbreak scenarios, the potential effect of different mitigation and preparedness strategies in lessening these impacts, and the number of animals that would need to be depopulated – and resulting volume of biomass for disposal – for the Lower Fraser Valley.

2. A formal presentation of the impacts derived from this assessment, to participants at the FMD Invitational Forum and Workshop, held October 27 and 28th, 2009 in Abbotsford BC.

PROJECT DELIVERABLES

PROJECT CONTEXT

Funding for this economic impact assessment, and the FMD Invitational Forum & Workshop at which it was presented, was provided through the 'Livestock Waste Tissue Initiative' of the Investment Agriculture Foundation of BC. An earlier study funded by the same Initiative identified the difficulties of disposing of animal biomass from a potential FMD outbreak in the Lower Fraser Valley, and called for further work to quantify the potential numbers of animals and the volume of their biomass.²

Goals of the Forum / Workshop were to:³

1. Discuss options to reduce the possibility that FMD will be introduced into British Columbia
2. Evaluate mechanisms to implement existing federal policy on FMD, with emphasis on minimizing the need for emergency culling due to the existing constraints to mass mortality disposal especially in the Lower Fraser Valley;
3. Increase understanding of the roles and responsibilities and communication between all key stakeholders in preventing, eradicating and recovering from an FMD outbreak.
4. Formulate a set of recommendations that would address gaps in our current FMD control strategy, including roles and responsibilities of industry and the three levels of government to mitigate the social, environmental, and economic consequences.

These goals are relevant to this assessment, as well as the Forum / Workshop for which they are prepared. They suggest the necessary activities which – with the benefit of the assessment's background information – will enable better mitigation and preparedness for an outbreak of FMD or other disease in BC's livestock industry.

Economic impact assessments have been used in evaluating the impacts of animal disease outbreaks or incidents after they have occurred. These are frequently associated with or lead to public inquiries or examinations of wrong doings during the management of the event, and are therefore connected somewhat negatively with a sense of loss.

An alternate application of assessments – modeling the impacts prior to an event – typically has a quite different intent and outcome. These assessments are intended to facilitate a cost benefit analysis leading to a decision regarding preparedness policies and activities. In this context, assessments are positioned more positively as securing the status quo. It is

² Options and Challenges Related to Emergency Disposal of Large Animals in the Fraser Valley. April 2008. IAFBC.

http://www.iafbc.ca/funding_available/programs/livestock/documents/LWTI-23_CarcassDisposal.pdf

³ Information For Attendees. FMD Invitational Forum & Workshop, October 27th & 28th, 2009.

http://www.centreforcoastalhealth.ca/index.php?option=com_content&view=article&id=128&Itemid=135

PROJECT OVERSIGHT

in this latter light that this assessment was commissioned, i.e. to foster debate and enable future decisions regarding mitigation and preparedness initiatives for animal disease outbreaks.

This assessment was prepared under the direction and guidance of a Steering Committee comprised on subject matter experts and clients:

- ➔ **Dr. Paul Kitching**, Chief Veterinary Officer for BC, BC Ministry of Agriculture and Lands⁴
- ➔ **Gustav Rogstrand**, Waste Management Engineer, Sustainable Agriculture Management Branch, BC Ministry of Agriculture and Lands
- ➔ **Paul Littlewood**, Regional Director, BC Coastal Region, Canadian Food Inspection Agency
- ➔ **Paris Thomas**, Director of Communication and Planning, BC Milk Producers Association
- ➔ **Rick Van Kleeck**, Coordinator, Livestock Waste Tissue Initiative, Investment Agriculture Foundation
- ➔ **Leslie MacDonald**, Regional Manager Coast, Sustainable Agriculture Management Branch, BC Ministry of Agriculture and Lands.

REPORT STRUCTURE

This introduction section sets out the purpose and deliverables of the project. It is followed by a section entitled Background, in which contextual information is summarized regarding the industry, the disease itself plus its management and impacts, and implications of this information for BC. In the next section the Economic Model is described, including the scenarios used and the mitigation and preparedness initiatives modeled. Results are presented in the next two sections, entitled Economic Impacts and BC Impacts. Conclusions and Recommendations are presented in the final section.

⁴ **Dr. Kitching**, formally Chair of the Technical Committee of the North American FMD Vaccine Bank; was previously Head of the OIE/FAO World Reference Laboratory for FMD; and is the senior author of the FMD Chapter for the OIE's Terrestrial Animal Health Code.

BACKGROUND

INDUSTRY PROFILE

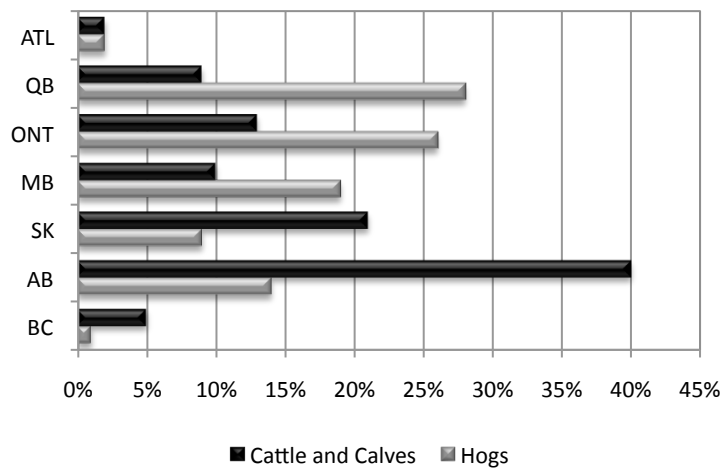
Canada's meat and livestock industry is profiled in this sub-section. The profile is not intended to be complete. Instead the intent is to identify those aspects that are most relevant to an assessment of the economic impacts of an FMD outbreak, and relevant mitigation and preparedness strategies.

The livestock industry is the second largest portion of agriculture, after crops, as defined by cash farm receipts. It represents a major element of the social economy in the rural portion of all provinces.

Canada's livestock industry has significant and well established beef, dairy and swine sectors. Sheep, goat, bison and cervid sectors also exist, although to a lesser degree.

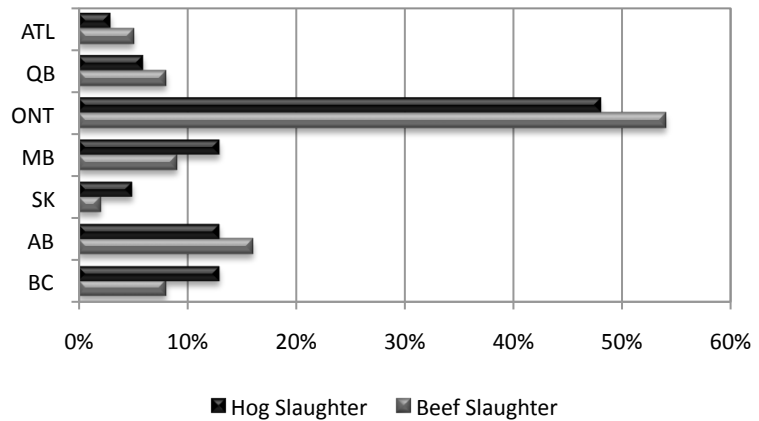
Canada's beef, dairy and swine populations are concentrated in certain provinces or regions, although significant populations exist in all provinces across Canada. Beef cattle populations are concentrated in western Canada, specifically Saskatchewan and Alberta (Figure 1). Swine populations are concentrated in central Canada, specifically Manitoba, Ontario and Quebec (Figure 2). Dairy cattle populations are concentrated in Ontario and Quebec.

Figure 1: Cattle and Hog Regional Inventories



Source: Statistics Canada, 2006 Agriculture Census.

Figure 2: Proportion Provincial Hog and Beef Slaughter by Province, 2008



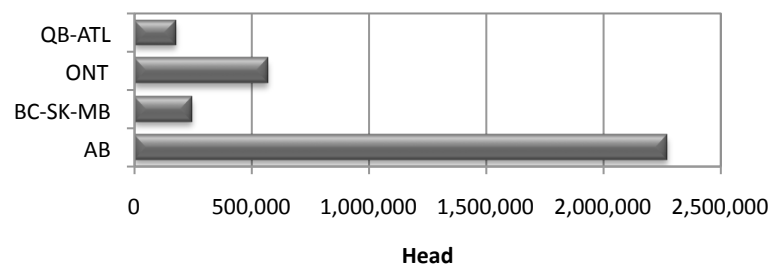
Source: CFIA and Provincial Governments

Canada has significant horse and poultry sectors in all provinces. Alternate species such as llamas, alpacas, etc., are present to a lesser extent as well.

Livestock densities are as high in certain areas of Canada as they are anywhere in the world. Areas having high density livestock populations are: Quebec (dairy and hogs); Southern Ontario (dairy and hogs); Southern Manitoba (hog weanlings); Southern Alberta (beef cattle feedlots); and BC's Lower Fraser Valley (dairy).

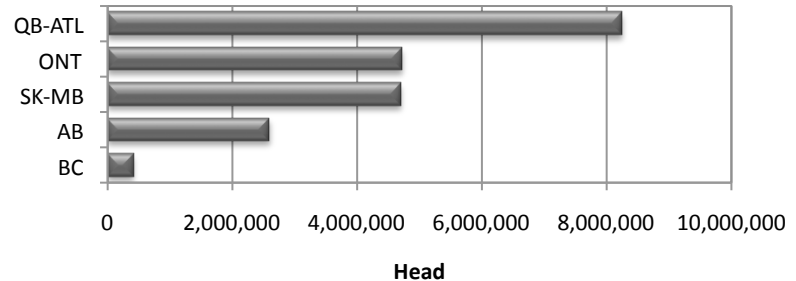
Livestock slaughter capacity is also concentrated in certain provinces across Canada. Beef slaughter capacity is overwhelmingly concentrated in Alberta, with 72% of capacity (Figure 3). Hog slaughter is less concentrated, with capacity located in Quebec (41%) and Ontario (24%) and Manitoba / Saskatchewan (24%) (Figure 4).

Figure 3: Federal Plant Beef Slaughter by Region, 2008



Source: CFIA

Figure 4: Federal Hog Slaughter by Region, 2008



Source: CFIA

The above slaughter figures relate to federally inspected plants, licensed for export to other provinces and countries. Provincially inspected plants also exist, limited by law to produce only for consumption within the province. Although they account for a much smaller portion of production, they are present in all provinces or regions.

Canada's beef and pork sectors are major exporters in the international market place. Canada has been the world's largest exporter of pork, and as high as the world's third largest exporter of beef, for certain periods over the past 10 years⁵.

When expressed as a percentage of total production in animals, this international market share is referred to as export dependency. Canada's export dependency is 58% for beef⁶ – lower post BSE, but now recovered to 49% and 71% for pork⁷.

BC's Lower Fraser Valley has a substantial and varied livestock industry. Much of the province's dairy cattle and swine population industry is concentrated here. The density for cattle – in this case dairy cattle – is relatively high. Beef cattle are present, but the population and density in the area is small and spread in small units throughout. There is a significant poultry sector and a relatively large horse population as well. Processing facilities are present for most species, although of limited capacity for swine and beef cattle.

British Columbia has a limited number of federally licensed beef and hog slaughter plants. In 2008, the plants were:

- ➔ Lawrence Meat Products – Dawson Creek – licensed for both beef and pork
- ➔ Pitt Meadows Meat – beef
- ➔ Britco Pork at Langley – pork
- ➔ Medallion Meats, Armstrong – beef, and other species.

⁵ Based on combined exports of live animals and meat products.

⁶ As reported by Canadian Cattlemen's Association.

⁷ As reported by Canadian Pork Council.

BC LIVESTOCK INDUSTRY PROFILE

The BC livestock industry is characterized by its intensity in specific regions. While the total number of livestock in BC relative to the rest of Canada may not be huge (with the exception of poultry and dairy), the production is concentrated in relatively small areas, in particular the Lower Fraser Valley.

Table 1 below provides a summary, based on the most recent Agriculture Census, of the 2006 livestock inventories in British Columbia.

Concentrating on the livestock species that are directly impacted by a FMD outbreak, the following observations are made:

- ➔ Beef cattle, totalling 655,343 are distributed across the province, with only 4% in the Lower Fraser Valley (LFV)
- ➔ Dairy production is much more concentrated. Of the 145,512 dairy cattle, 104,476, or 72% are in the LFV.
- ➔ Similarly with pigs, of the total number of 135,826 pigs, over 100,000 or 74% are located in the LFV.
- ➔ The population of horses, goats and sheep are relatively well distributed outside the LFV area.

Almost exclusively, the production and processing of hens, chickens, turkeys, is contained within the LFV area of BC.

The implication of this data is that production and processing of FMD susceptible livestock species is most concentrated in the LFV area of the province.

Table 1: Livestock Inventories, Fraser Valley and BC, 2005

	Lower Fraser Valley	BC
Total	15,476,4	18,341,9
hens/chick ens	10	07
Turkeys	767,068	822,036
Other poultry	504,176	538,524
Total cattle and calves	127,701	800,855
Beef cattle	22,991	655,343
Dairy cattle	104,710	145,512
Total pigs	100,476	135,826
Total sheep and lambs	9,074	61,033

	Lower Fraser Valley	BC
Horses and ponies	9,331	53,246
Goats	5,106	13,091
Mink	261,948	261,948
Llamas/alpacas	1,001	5,750
Bees for honey (hives)	10,149	30,249
Chicken meat production (kgs)	164,208,337	192,759,394

	Lower Fraser Valley	BC
Turkey production (kgs)	22,678,284	23,952,719
Hatcheries (chicks)	X	104,151,192

LIVESTOCK DENSITY

DISEASE CONTEXT

The Lower Fraser Valley is characterized as having one of the higher farmed animal densities within Canada⁸. Based on actual farm numbers and livestock inventories from the most recent Census of Agriculture, the density of a typical location within the LFV is indicated in Table 2. These densities are used in the economic impact analysis model.

High densities impact on prevention costs and disease control from the need to provide surveillance and control on greater number of farm premises, having to destroy and dispose and greater numbers of animals, and the increased likelihood of animal and product movement both within, and to destinations outside the infected and surveillance zones.

Table 2: Average Livestock Contained in an Infected and Surveillance Zone in the Lower Fraser Valley

	Infected Zone (3 km radius)		Surveillance Zone (10 km radius)	
	Number of Farms	Number of Animals	Number of Farms	Number of Animals
Dairy cattle	11	2,506	123	27,842
Beef cattle	25	550	279	6,113
Pork	4	2,404	40	26,716
Sheep	10	217	108	2,413
Poultry	33	1,012,920	369	4,067,193

Foot and Mouth Disease was specified as the disease on which to model economic impacts for this assessment. FMD was specified because of the widespread and severe consequences in countries reporting it, and the ‘general’ awareness that exists for the disease and its widespread potential impacts.⁹

FMD is a virus that affect cloven-hooved animals, e.g. cattle, swine, sheep, bison, cervids, etc. Llamas and alpacas are minimally affected. Human health is not impacted by the disease.

Mortality rates vary significantly from relatively low to quite high, depending on the outbreak, virus strain and host species. Painful vesicles / blisters are typically found in and around the animal’s mouth leading to salivation and drooling. They may also be found on the feet leading to

⁸ Hans Schreier, UBC, Policy Options, as reported in Vancouver Sun, Sept 24, 2009.

⁹ While awareness exists as to the name and impacts of the disease, in large part due to previous high impact outbreaks, this has not fully translated into mitigation and preparedness activities in Canada.



lameness. Recovered animals may be permanently affected, with reduced growth and milk production rates.

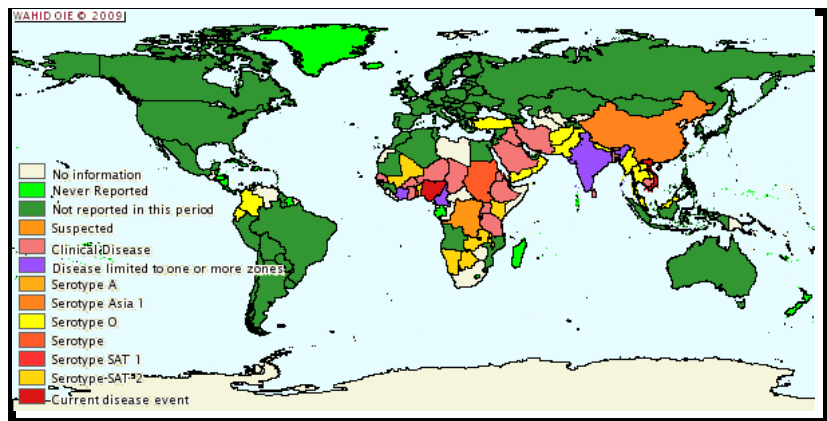
FMD Virus is transmitted relatively easily. Modes of transmission involved in past outbreaks include: movement of animals (clinically infected and recovered carriers), meat and animal products, aerosol (virus ‘floating’ in air), and fomites (inanimate objects, including vehicles, boots, etc.).

Recent analysis for the 10 years preceding 2003 identified 24 FMD outbreaks that occurred in previously free countries that were relatively well documented. Other outbreaks were not sufficiently documented or reported to be considered in the analysis. It suggests that outbreaks were grouped into three sizes:¹⁰

- Small: 1 – 5 cases (11 outbreaks, 46%);
- Medium: 5 – 150 cases (9 outbreaks, 38%); and
- Large: over 2000 cases (4 outbreaks, 17%).

FMD virus is endemic to many countries around the world. Outbreaks occur frequently in a number of countries around the world, as shown in Figure 5 below for the 6-month period ending July 2008. China, India, Paraguay and a number of other countries in Asia, South America and Africa where borders are often porous to the movement of livestock and livestock related items, are known to have frequent and sometimes unreported outbreaks.

Figure 5: Disease Distribution (January – July 2008)¹¹



¹⁰ Description of recent foot and mouth disease outbreaks in non-endemic areas: Exploring the relationship between early detection and epidemic size. Melissa McLaws, Carl Ribble. Can Vet J 2007;48:1051–1062.

¹¹ Disease Distribution Maps. WAHIS Disease Interface. www.oie.int

The conclusion here is that the risk of FMD exists on an ongoing basis. Over 50 countries reported FMD in this time period alone. Canada trades

or has movement of people or assets – either legal or illegal – with many of these countries.

Accordingly, a broad range of ongoing mitigation and preparedness measures are necessary in Canada to ensure that:

DISEASE MANAGEMENT

- ➔ FMD virus doesn't enter from a broad range of countries;
- ➔ if it enters Canada, that it does not come in contact with the broad range of susceptible animals that form a large part of our economy; and
- ➔ if it comes into contact and affects these animals, that they are diagnosed promptly and reared in an environment where spread and impact are limited.

Mitigation and preparedness measures used or required on an ongoing basis to address FMD and other diseases include surveillance, laboratory capacity and capability, legislative authority, border restrictions and inspections, among others. In Canada these measures are administered through provincial and national government organizations.

Additional mitigation and preparedness measures have been recognized globally as a necessity. These have been noted in formal statements by a range of global organizations of which Canada is a member, including the World Bank, the World Animal Health Organization, and the Food and Agriculture Organization.

The additional measures called for include identification, traceability, biosecurity, surveillance, laboratory capacity and capability, legislative authority, border restrictions and inspections. Generally speaking, Canada's actions in these areas involves both industry and government organizations, and is at a relatively early stage of development with additional time and effort required before these become truly effective.

Control measures used in the past by countries after outbreaks have occurred, and which are likely to play a role in future outbreaks, include: quarantine of premises, movement bans in affected and potentially affected areas, depopulation of infected animals and in some cases of exposed animals, and finally self-imposed bans on the export of susceptible livestock, semen and meats.

The response of international trading partners is typically immediate and severe, when FMD is reported. Importing countries invariably ban all imports of susceptible livestock, semen and meats. More importantly their ban applies to all parts of the affected country. Nowadays such bans may be triggered by media reports of suspect cases and quarantines, well before a country formally reports confirmation of the virus.

Recognizing the international community's sensitivity to the presence of FMD, the OIE has established guidelines for trade with countries that

DISEASE OUTBREAK IMPACTS

report FMD. The OIE recognizes three classes: FMD free without vaccination; FMD free with vaccination; and FMD present (with or without vaccination).

A country meeting OIE guidelines may declare FMD freedom in as little as 3 months after the last evidence of disease. Trade resumption usually is not achieved for a much longer time period of months or even years.

Vaccination may be used. Its use is complicated by the presence of multiple strains each requiring specific vaccines, and by difficulties in distinguishing between vaccinated and infected animals. While OIE¹² has established guidelines for the recognition of vaccination, these are not binding upon trade partners. In short, countries considering the use of vaccination are not always rewarded in the market by a more rapid return to trade. Vaccine use may increase in future however, as ethical and financial considerations create pressure for alternatives to depopulation.

Until recently these guidelines were applied on a country-wide basis. If for example Canada reported FMD in Newfoundland, then trade with all of Canada would likely follow the restrictive guidelines set out in the class 'FMD present' until even the most remote area re-qualified for the 'FMD free without vaccination' class.

Zoning is recognized by OIE for the purposes of international trade.¹³ While again only a guideline, and still subject to numerous detailed requirements for surveillance, control and biosecurity, the OIE concept enables a country to establish a single containment zone containing all cases. The balance of the country would retain its 'FMD free' status. Zoning has significant implications for countries like Canada that are geographically large and have substantial exports.

Authorities in FMD free countries are typically very risk averse in recognizing newly declared disease free status, and resuming trade with a country that has experienced an FMD outbreak. In part this is because lengthy public consultations and / or legislative / regulatory change processes are often required to lift import bans imposed on a country while it has an FMD outbreak. Market and political agendas may also be at play. These factors can add months and often years, before trade can resume with the country having the outbreak.

¹² OIE is the acronym of the original French name for the World Organization for Animal Health. For trade and other purposes, the OIE is recognized by the World Trade Organization (WTO) as the organization responsible for establishing standards or guidelines for animal health related issues. These guidelines are non-binding.

¹³ Zoning (def'n.) means a clearly defined part of a territory containing an animal subpopulation with a distinct health status with respect to a specific disease for which required surveillance, control and biosecurity measures have been applied for the purpose of international trade. OIE Terrestrial Animal Health Code 2009 (Glossary). (see also S 4.3)

Several of these mitigation, preparedness and control measures are incorporated into this analysis.

Outbreaks having the greatest impact are those occurring in countries that had previously been free of the disease. These are countries that derive market advantage from being recognized as being FMD free.

Previously disease free countries suffer an immediate and generally long-lasting ban on exports of live susceptible animals and their products (meat, semen, hides, etc). As well, there are immediate and quite lengthy local cease movements and quarantines which severely restrict the movement of all people, animals and equipment. The loss of animals may be very high, often with more animals destroyed for welfare reasons – farmers unable to continue operations – than for disease reasons.

The social and economic costs are extreme, when a previously disease free country reports FMD. This is demonstrated in the highlights of the following outbreaks.^{14, 15}

- ➔ Taiwan: Outbreak (FMD, 1997): over 6,000 cases, costing over \$7 B USD, varying reports suggest depopulation of over 3,800,000 head. Taiwan was previously one of the world's top three pork exporters, but has been essentially banned from most markets due to ongoing vaccination.
- ➔ UK: Outbreak (FMD, 2001): 2,030 cases, controlled in 8 months, costing over \$16 B USD, with varying reports suggesting depopulation of approximately 10,000,000 head – 60% of which were for welfare reasons. The UK was not a major exporter of meat and livestock at the time.
- ➔ US: Crimson Sky Model (FMD, 2002): spreading from 5 premises to cases reported in 35 states in 10 days. The US, while a major exporter, was and is only 10% reliant upon export markets.
- ➔ Canada: Canadian Animal Health Coalition Model (FMD, 2002): economic impacts of \$13B to \$46B. Canada is also a major exporter, whose beef and pork sectors were at the time each reported to be in excess of 55% and 70% reliant upon exports.

Similarly extreme impacts have been recorded in countries reporting several other diseases. Examples abound, from countries reporting Bovine Spongiform Encephalopathy (BSE) and Classical Swine Fever (CSF).

¹⁴ Foot and Mouth Disease. Wikipedia. http://en.wikipedia.org/wiki/Foot-and-mouth_disease

¹⁵ The role of Vaccination as a Response Strategy. D. Geale. CFIA. <http://www.centreforcoastalhealth.ca/images/fmd/dorothy%20geale%20fmd%20vaccination%20bcma1%20oct%202009.pdf>

IMPLICATIONS FOR BC

Implications of the forgoing information are summarized below. Several of these implications are incorporated into the following assessment.

The disease risk is present on an ongoing basis, from FMD and a range of other known diseases. Effective response to an outbreak that may occur at any time and any place in Canada, or one which has occurred in BC's Lower Fraser Valley, requires pre-existing capacities and capabilities. The appropriate mitigation, preparedness and response (for control) strategies cannot be utilized when needed, unless they are developed and implemented in advance and carried out on an ongoing basis.

Important distinctions must be understood, between the time taken to:

- ➔ Obtain the last evidence of the disease, which may be when the last case is depopulated, or when the last vaccinate is depopulated;
- ➔ Reach FMD-free status, when the country declares that it has met OIE guidelines for FMD freedom;
- ➔ Resume trade, when major trading partners allow the resumption of trade by lifting import bans; and
- ➔ Regain previous market share, when Canada regains the trade volumes that were experienced prior to the outbreak.

Several characteristics of Canada's livestock industry will tend to impact on the size and significance of an FMD outbreak:

- ➔ Comprised largely of sectors that are highly susceptible to FMD (large populations of host animals);
- ➔ A primary component of the social economic construct of rural Canada in all provinces / regions (the rural communities and supply chains will be directly disrupted in the event of a FAD outbreak);
- ➔ Highly export dependent – a FAD outbreak will immediately disrupt trade, that represents in between 40 and 70% of the economic output from the beef and hog industries respectively;
- ➔ Several high density areas of susceptible populations (local spread, such as in the LFV)
- ➔ Frequent movements of animals over long distances are common place, which increases the risk of disease transmission, (wide spread outbreak);
- ➔ Difficulties with livestock slaughter , if it becomes necessary to do so for a large number of animals – need to have effective and safe mean to dispose of depopulated animals, a particular problem in high density areas such as in the LFV, and the logistics of killing large numbers of animals;
- ➔ Incomplete procedures, and protocols for certain capabilities to be effective in an outbreak, e.g. biosecurity; and traceability or movement monitoring that would enable zoning (containment difficulties);

Eg. lack of familiarity with cease movement protocols – and protocols possibly inappropriate to a contagious disease – particularly in these susceptible large animal sectors (containment difficulties);

- ➔ Absence of a US Veterinary Equivalency Agreement between Canada and the US, enabling the US to recognize disease free zones claimed by Canadian authorities in a timely manner (significant delay to start of recovery)

Characteristics tending to increase the size and impact of an FMD outbreak originating in BC's Lower Fraser Valley, in addition to those noted above, include:

- ➔ High density of dairy animals in the Lower Fraser Valley, coupled with a number of hog farms ;
- ➔ Close proximity – and large number of animal movements – to the high density beef cattle population and slaughter plants in Southern Alberta (resulting regional spread and loss of slaughter capacity, as they are closed, or restrict slaughter);
- ➔ Proximity or access to several major, high traffic ports of entry – Vancouver air and sea ports (difficult to monitor and control against disease introduction);
- ➔ Disposal of large numbers of animals made difficult by flood plain (spread); and
- ➔ All difficulties compounded by occurrence in an area having a large human population (visibility).

OUTBREAK SCENARIOS

OVERVIEW

The severity and eventual impact of any FMD outbreak in BC is dependent on a wide variety of factors. Some of the major factors that have been considered in the design of the economic impact scenarios are the following:

- ➔ The time it takes to detect the initial outbreak, and the effectiveness of the subsequent control strategy.
- ➔ The relative concentration of livestock and type of livestock within the infected and control zone.
- ➔ The relative co-operation within the agricultural sector, particularly the production sector, in responding to control measures, and in disclosing potentially infected animals.
- ➔ The specific procedures and protocols employed by government and industry in effectively controlling the outbreak.
- ➔ The capability of Canada to implement a stamping out policy as per OIE guidelines.
- ➔ The relative effectiveness of bio-security, livestock tracking and premise identification systems in place, prior to the outbreak, and the impact of a defined Cease Movement, Bio-security program to limit disease spread during the outbreak.
- ➔ Disposal and depopulation alternatives that may be utilized or available in the Lower Fraser Valley (LFV) region in BC, and the relative capacity to destroy large numbers of animals in a short period of time.
- ➔ The potential regional zoning options that could be applied e.g. LFV, Western Canadian Zoning, or none.
- ➔ The willingness of Canada's trading partners to recognize internal zoning policies, or other policies such as a US/Canada Veterinary Equivalency Agreement.
- ➔ The impact that the disease will have on domestic consumption, on meat prices and imports.

In consultations with the Steering Committee, three scenarios were designed and have been modelled in this economic impact analysis. These are each described below. The following sections detail the economic modelling approach and the economic impact analysis and results.

SMALL SCALE SCENARIO

This is the Best Case Scenario, in other words: “where we want to be.”

The outbreak is assumed to originate in the Lower Fraser Valley. It is limited to five herds in the Valley, and it is contained within 2 months.

This implies the last herd was depopulated and disposed of within that time.

The means by which FMD was introduced to livestock in the LFV, while of interest to policy makers and stakeholders, is not relevant to the model. However, it is not unrealistic to assume that it was introduced to the country via infected product entering – intentionally or unintentionally – through the Vancouver seaport or international airport and on to a farm. Transition to the farm, could occur:

- ➔ Unintentionally in connection with an increasingly ethnic farm labour force, or the illegal swill feeding thought to occur on some hog farms in the LFV, or
- ➔ Intentionally through an act of bioterrorism.

Industry and government are fully prepared, with highly effective policies and programs in place and implemented for the following.

MEDIUM SCALE OUTBREAK

- ➔ Biosecurity: on-farm protocols are in place on an ongoing basis to control the introduction / spread / amplification of highly contagious diseases like FMD. On suspicion of the outbreak, all BC and AB producers adopt a ‘high risk’ protocol.
- ➔ Cease Movement: an interim capability implemented immediately upon suspicion, is enabled by a pre-existing municipal / provincial / industry cooperative agreement. This is followed by a formal Ministerial declaration when the virus is confirmed by CFIA, generally a few days after suspicion (or more depending upon the instance).
- ➔ Zoning: an LFV zone is created encompassing the area West of Hope, North of the border, and South of Squamish, achieved with pre-existing monitoring of movements through Hope.
- ➔ Identification and Traceability: Traceouts are facilitated by an effective system operating on an ongoing basis.
- ➔ Livestock depopulation and disposal: all infected animals are immediately slaughtered on-farm. These animals’ biomass is disposed of through a pre-arranged process, as yet undefined.
- ➔ Other policies as required, e.g. surveillance, laboratory capacity and capability, etc., all of which are already generally accepted as being present and well developed in Canada.

A US / Canada Veterinary Equivalency Agreement (VEA) had been negotiated prior to the outbreak. This gave the US administration the legislative authority for immediate recognition of Canada’s declarations of disease free status and zones. It eliminated the requirement for consultation and rule changing activities which took some other countries several years to complete. The effectiveness of the VEA was not absolute, and subsequent recognition of the disease free status for the LFV zone where the outbreak occurred, was delayed for two years. This meant that the US could not begin to import susceptible species or product from the LFV for two years after the zone was declared free.

This scenario provides an intermediate risk case. The outbreak originates again in the LFV, to spread elsewhere into Alberta. Through the effective zoning capability at West Hawk Lake (WHL), the outbreak is contained to Western Canada, the trade impacts are reduced, with only minimal trade sanctions imposed on the eastern Canada region.

The major assumptions of this scenario include:

- ➔ Biosecurity and cease movement policies and actions are moderately effective.
- ➔ Zoning at WHL is effective and outbreak is contained to Western Canada.
- ➔ The time to control the disease is six months, resulting in 100 cases reported.
- ➔ Stamping out is inclusive of the slaughter of all animals on the infected premises, and all suspect and contiguous livestock herds in

the infected zones are pre-emptively slaughtered, both in the LFV, and in Alberta assumed at an livestock auction mart, and feedlot.

- ➔ The time for OIE recognition, after the last case has been controlled, is three months in the western Canada infected area, and one month in the Rest of Canada (RoC) area (eastern Canada).

- ➔ A US Veterinary Equivalency Agreement

LARGE SCALE OUTBREAK

is in place; however we assume that while the US allows immediate trade resumption in the disease free area after OIE recognition, they restrict imports for 24 months from the affected area.

- ➔ With the additional 24 months which passes before US and other markets are opened to Canadian livestock and meat products from the affected area, the total time out of the export markets is 33 months for the affected zone.
- ➔ In the disease free area, trade resumes 7 months from the start of the outbreak.
- ➔ There are impacts on domestic beef and pork consumption, of 10% on price and 10% on consumption. There is an anticipated increase in poultry consumption and prices.
- ➔ Surveillance, lab capacity/capabilities and communication/coordination are moderately effective.

This represents the worst case scenario.

Due to minimally effective control, biosecurity, and cease movement actions and programs, the outbreak eventually spreads across the country.

The major assumptions applied to this scenario are:

- ➔ Biosecurity and cease movement policies and actions are ineffective and the outbreak spreads across the country.

PREPARED NESS ASSUMPTIO NS

- Zoning is not applied at either LFV or West Hawk Lake, and the disease cannot be contained to either the LFV or Western Canada.
- ➔ Zoning is not applied, and as such trade embargos apply to all of Canada.
 - ➔ The time to control the disease is 12 months, resulting in 1,000 cases reported.
 - ➔ Stamping out is inclusive of the slaughter of all animals on the infected premises, and all suspect and contiguous livestock herds in the infected zones are pre-emptively slaughtered.
 - ➔ The time for OIE recognition, after the last case has been controlled, is three months.
 - ➔ An additional 24 months passes before US and other markets are opened to Canadian livestock and meat products. The total time out of the export markets is 39 months (12 months disease control, three months for OIE recognition, plus 24 months for US market recognition).
 - ➔ There are impacts on domestic beef and pork consumption – 25% reduction in price and 10% reduction in consumption. There is an anticipated increase in poultry consumption and prices.
 - ➔ Surveillance, lab capacity/capabilities and communication/coordination are not effective.
 - ➔ A US Veterinary Equivalency Agreement is not in place.

Critical to measuring the economic impacts for each of the three outbreak scenarios described above are the assumptions made as to the degree of preparedness with respect to each of the programs and activities with are or can be done to be prepared. Table 3 summarizes the assumptions used in this impact assessment.

Table 3: FAD Preparedness Assumptions

	Small	Medium	Large
Biosecurity	In place Effective	Partly in place Moderately effective	Partly in place Limited effectiveness
Premise & Animal ID	In place Effective	In place Moderately effective	Limited effectiveness
Traceability	In place	Partly in	Ineffective

	Small	Medium	Large
(animal movement)	Effective	Partly effective	Partly effective
Laboratory capacity &	In place	Partly in place	Partly in place

	Small	Medium	Large
capability	Effective	Partly effective	Partly effective
Surveillance	In place	Partly in place	Partly in place

ECONOMIC IMPACT ANALYSIS

OVERVIEW OF MODEL AND ANALYSIS

A dynamic BC FMD Economic Impact Model has been developed to allow for the analysis of multiple scenarios and outbreak assumptions. The model is built from the basis of the current production and economic structure of the Canadian livestock industry, with respect to livestock inventories, production, processing, and trade on a regional and national basis. The economic model is structured to generate results on a regional basis – the BC Lower Fraser Valley region, the rest of British Columbia, Western Canada, Eastern Canada, and consolidated on a national basis.

The regional structure of the model allows for the specific impacts relative to BC and the Lower Fraser Valley to be modeled and identified. The most current livestock industry inventory, production, consumption, trade and processing data has been utilized in the analysis.

The following is a list of impacts that were modelled and costs drivers that are used in calculating the impacts during an outbreak of FMD. A more detailed set of tables can be found in the Appendix of this report, which outlines the specific cost assumptions that have been used in the analysis.

Prevention Costs: Estimated from the actual livestock inventories in each region, and estimated costs for livestock ID and traceability, biosecurity, and CFIA surveillance and testing. Under the most effective conditions, all animal movements are tracked, all farms have biosecurity programs implemented, and there are significant resources spent on surveillance and testing. Under a moderate prevention regime, only animal identification and some tracking programs are in place, while still spending significant resources on surveillance and testing, and biosecurity level of moderately effective. The lowest investment in prevention includes only animal identification, and limited expenditures on surveillance and testing, and limited implementation of on-farm biosecurity systems. Prevention costs are the total required to meet the assumed scenario prevention level. Prevention costs ignore the livestock producers, related industries, and government existing investments of in-kind labour and funds toward prevention costs.

Zoning Costs: Estimated from the anticipated costs for operating the West Hawk Lake Zone Control between Manitoba and Ontario. The costs for operating largely includes staffing a site 24/7 with data entry staff.

Control Costs: Estimated based on a minimum staff compliment required to monitor infected and restricted zones during the course of an outbreak.

Slaughter, Disposal, and C& D Costs: Estimated as the cost of slaughter, cleaning and disposal at infected and suspect farms (on a per animal basis),

and the number of farms predicted to be affected based on actual densities of farms by location, and the size of a zone.

Other Costs for Disposed

Herd: Estimated costs to dispose of feed and time to bring new animal up to production.

CFIA Compensation:

Estimated replacement/ market value for animals, and the predicted number of animals that have been disposed. No assumption is made for any changes in market value of livestock that may occur over the course of an outbreak.

Domestic Price and Demand

Impacts: Based on the

ANALYSIS RESULTS

calculated domestic market values, the chosen level of impact (0, 10%, and 25%), and length to return to normal market values.

Trade Impacts: Based on the calculated size of export markets (live animal and meat), length of trade ban, existence of disease free zone, acceptance of US equivalency agreement, and the length of time required to return to normalized export values.

Processing Impacts: Based on the calculated value added contribution of the meat processing and dairy processing industries, the impact of trade and domestic market changes to the amount of processing, and the time to return to normalized processing.

Tourism Impacts: Based on the calculated size of the tourism industry by region, the length, size and location of disease outbreaks, and estimates of how tourism spending would change in these circumstances.

The analysis is built upon three possible FMD outbreaks, all of which are assumed to have originated in the Lower Fraser Valley region of BC. Each scenario is substantively different based on the degree to which the outbreak may have eventually spread, due to a range of preventive control measures applied, the degree to which bio-security measures may have been in place, the presence or absence of zoning, and the impact of Canada’s trading partners.

Table 4 provides a summary of the major assumptions used in each of the three outbreak scenarios.

Table 4: Detailed Scenario Economic Analysis Assumptions

	Small Outbreak	Medium Outbreak	Large Outbreak
Number of Affected Farms	5	100	1000
Length of Outbreak (months)	2	6	12
Number of Feedlots	0	1	3
Number of Control Zones	3	61	602
Number of Animals Disposed	4,967	77,164	543,686



	Small Outbreak	Medium Outbreak	Large Outbreak
Volume of Animal Disposal (m ³)	5,876	52,013	245,988
Geographic Spread	Lower Fraser Valley	Western Canada	All of Canada
Zoning In Place	Lower Frazer Valley & West Hawk Lake	West Hawk Lake	No Zoning
US Equivalency Agreement	Yes	Yes	No
OIE Recognition in Affected Zone (months after Outbreak Controlled)	3	3	3
US Trade Embargo Period in Affected Zone (months in addition to OIE recognition)	24	24	24
Total Time to Trade Resumption in Affected Zone (months)	29	33	39
Trade Recovery Time, Affected Zone (months)	12	12	24
OIE Recognition in Affected Zone (months after Outbreak Controlled)	1	1	N/A
US Trade Embargo Period in Affected Zone (in addition to OIE recognition)	Immediate	Immediate	N/A
Total Time to Trade Resumption in Disease Free Zone (months)	3	7	N/A
Trade Recovery Time, Disease Free Zone (months)	12	12	N/A
Domestic Price Impact (negative means decline)	0.0%	-10.0%	-25.0%
Domestic Demand (negative means decline)	0.0%	-10.0%	-10.0%

Small Scale Outbreak

The economic results of the three scenarios are discussed and evaluated in turn below.

The small scale outbreak is assumed to be restricted to the LFV region of BC. A total of five infected herds are detected and disposed of. Zoning in effect in the LFV contains the spread within the Valley. Trade embargos impact mostly on BC, where the total time out of the market is 29 months. Trade in other parts of Canada resumes within three months. Biosecurity and other disease control measures are assumed to be effective.

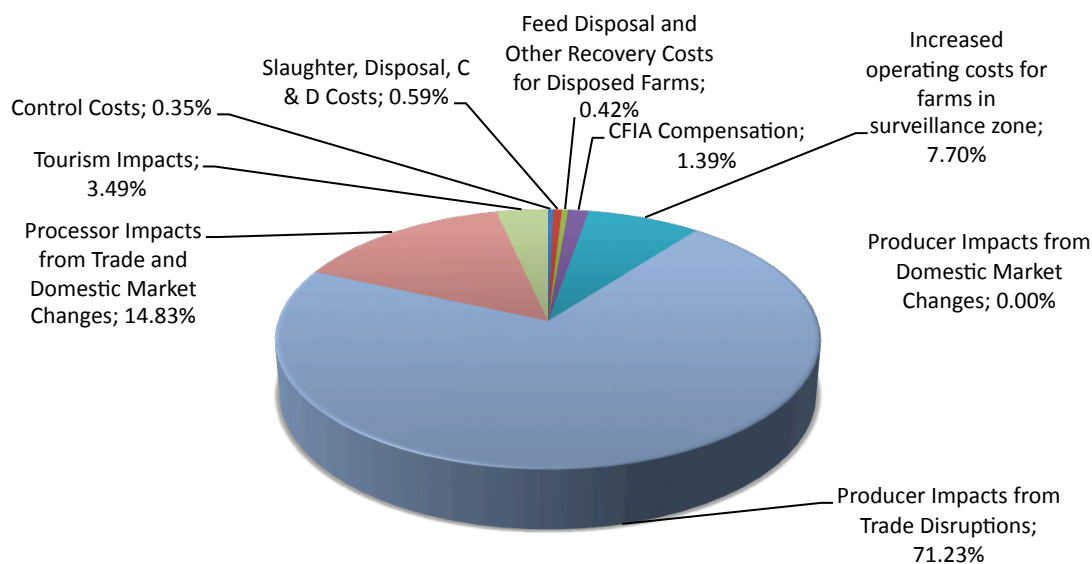
Table 5 provides an overall summary of the small scale outbreak on BC, and Canada. The overall impacts of this outbreak are expected to be \$6.5 billion. Figure 5 provides a summary of relative percent of the impacts. Particularly for a small scale outbreak, the proportion of the costs and impacts that are trade related, swamp the other impacts. As noted on Figure 5, 71% of the impacts are related to trade losses.

Table 5: Economic Impact Results: Small Scale Outbreak

	Total BC	Western Canada	Eastern Canada	Total
Investment (Million Per Year)				
Prevention Measures	\$42.4	\$609.0	\$250.4	\$901.8
Zoning Costs	\$0.3	\$2.5	\$2.1	\$5.0
Total Investment	\$42.8	\$611.5	\$252.6	\$906.8

Costs and Impacts (Million Per Outbreak)				
Control Costs	\$1.3	-	-	\$1.3
Slaughter, Disposal, C & D Costs	\$2.1	-	-	\$2.1
Feed Disposal and Other Recovery Costs for Disposed Farms	\$1.5	-	-	\$1.5
CFIA Compensation	\$5.0	-	-	\$5.0
Increased Operating costs for Farms in Surveillance Zone	\$27.8	-	-	\$27.8
Producer Impacts from Domestic Market Changes	-	-	-	-
Producer Impacts from Trade Disruptions	\$257.0	\$3,168.9	\$1,935.6	\$5,361.5
Processor Impacts from Trade and Domestic Market Changes	\$53.5	\$663.7	\$439.2	\$1,156.3
Tourism Impacts	\$12.6	-	-	\$12.6
Total Costs and Impacts	\$360.8	\$3,832.6	\$2,374.8	\$6,568.1

Figure 6: BC Relative Proportion of Economic Impacts by Type, Small Scale Outbreak



Medium Scale Outbreak

The medium scale outbreak results in a spread of the disease into Alberta. Zoning in effect at West Hawk Lake contains the outbreak to western Canada. A total of 100 infected herds are detected and disposed of. The disease control period is three months. Trade embargos impact mostly on western Canada and BC, where the total time out of the market is 33 months. Trade in eastern Canada resumes within seven months.

Biosecurity and other disease control measures are assumed to be moderately effective.

Table 6 provides an overall summary of the medium scale outbreak on BC, and Canada. The overall impacts of this outbreak are expected to be \$23 billion. Of this, the greater proportion of cost is with respect to the trade losses, estimated to be in the range of \$641 million, or 53% of all impacts.

Table 6: Economic Impact Results: Medium Scale Outbreak

	Total BC	Western Canada	Eastern Canada	Total
Investment (Million Per Year)				
Prevention Measures	\$25.7	\$372.3	\$159.6	\$557.5
Zoning Costs	\$0.2	\$1.3	\$1.1	\$2.5
Total Investment	\$25.8	\$373.5	\$160.7	\$560.0
Costs and Impacts (Million Per Outbreak)				
Control Costs	\$15.3	\$10.6	-	\$25.9
Slaughter, Disposal, C & D Costs	\$15.0	\$25.1	-	\$40.2
Feed Disposal and Other Recovery Costs for Disposed Farms	\$9.9	\$7.7	-	\$17.6
CFIA Compensation	\$33.2	\$25.6	-	\$58.8
Increased Operating Costs for Farms in Surveillance Zone	\$37.6	\$5.4	-	\$43.0
Producer Impacts from Domestic Market Changes	\$55.3	\$379.9	\$509.1	\$944.2
Producer Impacts from Trade Disruptions	\$641.6	\$13,732.1	\$2,795.9	\$17,169.6
Processor Impacts from Trade and Domestic Market Changes	\$137.7	\$2,954.6	\$700.2	\$3,792.5
Tourism Impacts	\$278.5	\$520.9	\$387.2	\$1,186.6
Total Costs and Impacts	\$1,224	\$17,662	\$4,392	\$23,278

Large Scale Outbreak

The large scale outbreak is assumed to not be able to be restricted to the LFV region of BC, or even BC. A total of 1000 infected herds are detected and disposed of in Canada. The disease control period is 12 months, and the total time out of the trade market is 39 months. Zoning is not effective or assumed not to be in place. Biosecurity and other preventive control systems are not assumed to be effective.

Table 7 provides an overall summary of the large scale outbreak on BC, and Canada. The overall impacts of this outbreak are expected to be \$48 billion.

Table 7: Economic Impact Results: Large Scale Outbreak

	Total BC	Western Canada	Eastern Canada	Total Impacts
Investment (Million Per Year)				
Prevention Measures	\$21.3	\$307.7	\$129.5	\$458.4
Zoning Costs	-	-	-	-
Total Investment	\$21.3	\$307.7	\$129.5	\$458.4
Costs and Impacts (Million Per Outbreak)				
Control Costs	\$51.0	\$128.4	\$76.5	\$255.9
Slaughter, Disposal, C & D Costs	\$36.3	\$117.1	\$35.6	\$188.9

Feed Disposal and Other Recovery Costs for Disposed Farms	\$23.3	\$35.6	\$16.5	\$75.3
CFIA Compensation	\$77.6	\$118.5	\$55.0	\$251.1
Increased Operating Costs for Farms in Surveillance Zone	\$45.9	\$65.3	\$301.4	\$412.6
Producer Impacts from Domestic Market Changes	\$189.0	\$1,299.6	\$1,741.7	\$3,230.3
Producer Impacts from Trade Disruptions	\$839.0	\$17,957.4	\$10,968.4	\$29,764.8
Processor Impacts from Trade and Domestic Market Changes	\$186.0	\$3,918.2	\$2,620.3	\$6,724.6
Tourism Impacts	\$962.8	\$1,800.9	\$4,202.2	\$6,966.0
Total Costs and Impacts	\$2,411.0	\$25,440.9	\$20,017.5	\$47,869.4

BC IMPACTS OVERALL IMPACTS

The important focus of this analysis was to evaluate the impacts of a FMD outbreak on BC. This section provides the detailed assessment of these costs and impacts for the three FMD scenarios.

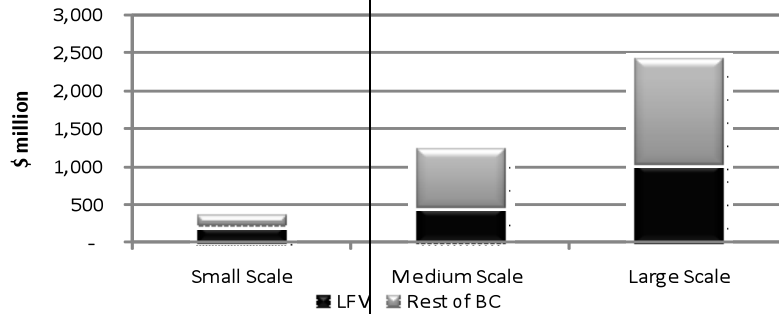
Canada and each province would suffer an impact regardless of where FMD is found in the country. However, the impacts will vary depending on the outbreak location and the size of the outbreak. This study only looks at impacts if the disease originates in BC.

The total impacts of an FMD outbreak are summarized for each of the three scenarios, and by sub-region within BC. The results are illustrated in Table 8 and Figure 7. The impacts increase from \$389 million for the small outbreak, to \$2.5 billion for the large outbreak. Of note, for the small scale outbreak, most of the impacts are in the Lower mainland, as the outbreak is controlled to this region. As the scale of the outbreak increases, the proportion of the economic costs relative to the total costs for the province decline. Much of this change is due to the growing impact of lost trade value and its impact on producers.

Table 8: FMD Economic Impacts on British Columbia

	LFV	Rest of BC	Total BC
Small Scale (m)	\$229	\$132	\$361
Medium Scale (m)	\$465	\$759	\$1,224
Large Scale (m)	\$1,030	\$1,381	\$2,411

**Figure 7: FMD
Economic Impacts on
BC**



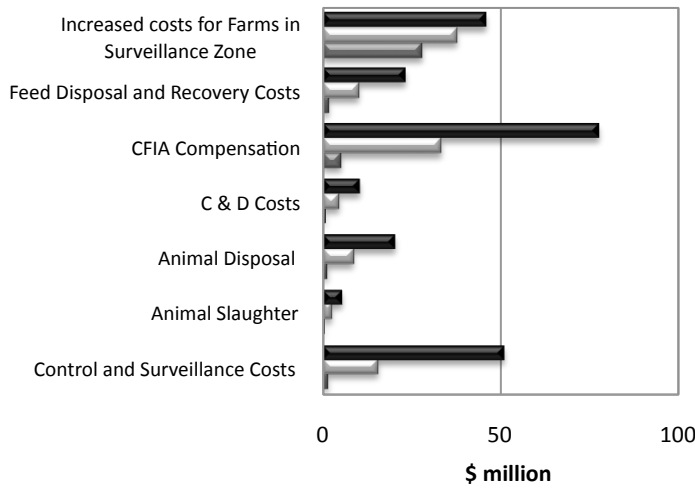
IMPACTS BY COMPONENTS

There is a benefit in being prepared for a possible outbreak in terms of biosecurity, zoning, surveillance, lab and scientific capacity, ID and tracking, and policies for cease movement and animal disposal. The costs of being prepared can be viewed as an investment that will reduce and mitigate the impact of a future disease outbreak. These costs will/are borne by producers, processors, auction marts and other members of the livestock value chain, and all levels of government. A significant proportion will be in-kind costs, but a substantial proportion will be in cash.

There is little information on what is the industry and governments current investment in prevention. The economic analysis has tried to provide a first estimate of these costs for BC both in aggregate and per producer.

The total investment could reach over \$40 million annually with strong preventative systems in place (small outbreak), to about half of this for a large outbreak preparedness scenario. Figure 8 summarizes the estimated preventative investment costs for the three scenarios.

**Figure 8: Total BC Estimated Preparedness
Investment**



... understanding the magnitude and environmental risk and disposal options

ected in BC could range from 200 to 1000 for a large outbreak (Figure 11). The number of farms exposed of in a large FMD outbreak could range from 200 to 1000. The volume of animals that may need to be disposed could exceed 42,000 cubic meters in the

Farms, Zones and Welfare Slaughter in BC

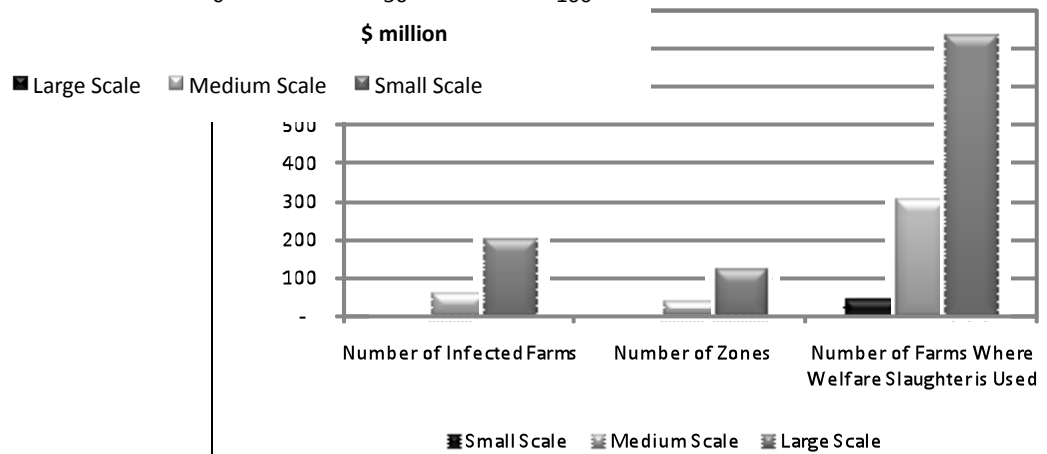
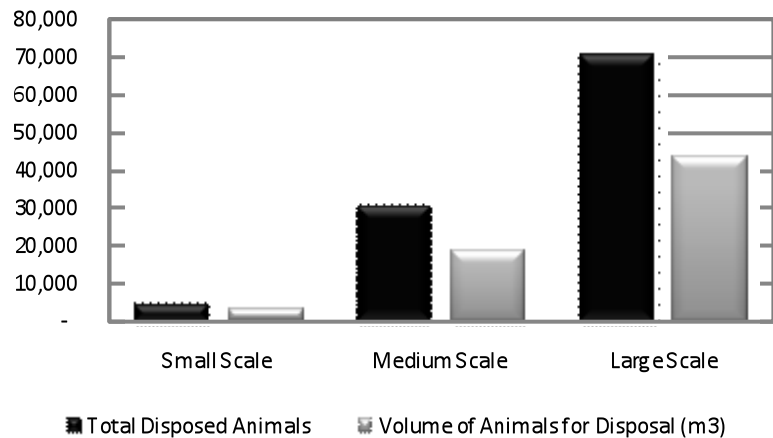


Figure 12: BC Lower Fraser Valley Animal Disposal



SUMMARY OF BC COSTS AND IMPACTS

The economic analysis, in addition to calculating the economic impacts of an outbreak, has estimated the costs of being prepared (prevention and preparedness) and the control costs of an outbreak – the costs of animal disposal, compensation, cleaning, disruption of farm income and costs of business recovery. These costs for BC, and the economic impacts are summarized in Table 9 and Figure 13.

Table 9: Summary Economic Impacts, Preventative, and Control Costs

BC FMD Outbreak

	Small	Medium	Large
Prevention Costs (m)	\$43	\$26	\$21
Control Costs (m)	\$38	\$111	\$234
Economic Impacts (m)	\$323	\$1,113	\$2,177

Figure 13 shows the dollar costs and proportion of prevention, control and economic impacts for the medium scale outbreak. Prevention costs while estimated to be a significant investment in this analysis at almost \$26 million, is a relatively small proportion of the costs of control, and of the subsequent economic impact, should an outbreak occur. Prevention costs are the total required to meet the assumed scenario prevention level. Prevention costs ignore the livestock producers, related industries and governments existing investments of in kind labour and funds toward prevention costs.

**Figure 13: Costs and Proportion of BC Preparedness, Control, and Economic Impacts
FMD Medium Scale Outbreak**

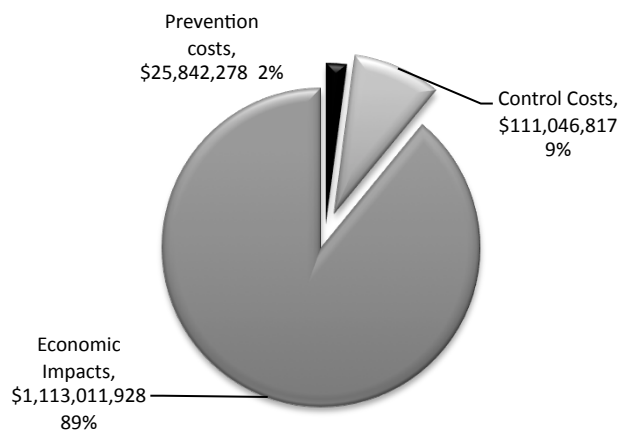
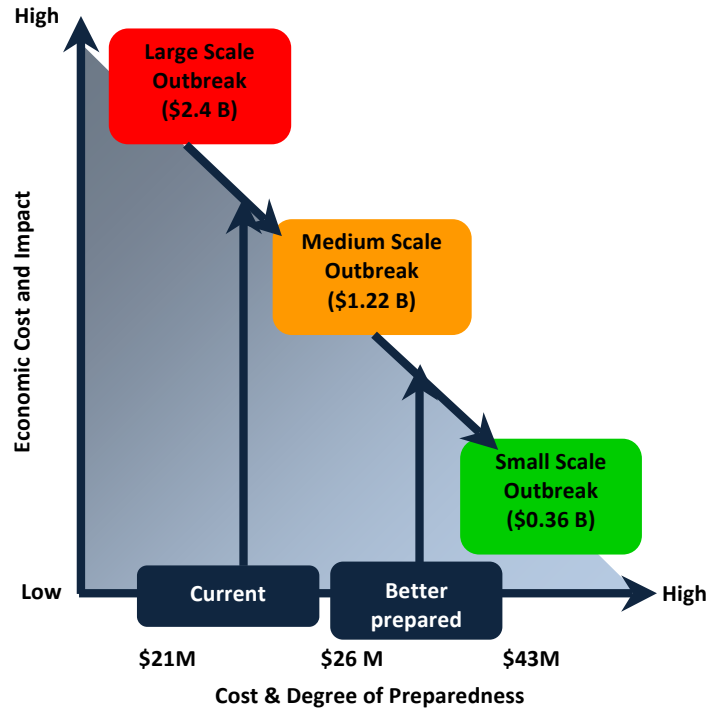


Figure 14 provides a conceptual summary of the estimated costs of the three outbreaks, the investment preparedness costs of each, and a

representation of both where the industry may now be in this continuum, and the direction the industry and government may wish to advance to. Where “we want to be” is a decision the industry and government needs to collectively decide upon.

Figure 14: The BC Foreign Animal Disease Risk and Preparedness Position



INVESTMENT IN PREVENTION ANALYSIS

A critical question for industry and government is the impact or payback there is to investing in preventive measures to prevent or to at least mitigate the severity of a FMD or any animal disease outbreak. Table 10 provides an analysis of how this can be evaluated. An outbreak will likely occur at any point in time – it could be immediately, not for 10 years, or much longer. Prevention costs, to be effective, must be incurred annually.

To better compare annual costs to the one time expected FAD economic impact costs, the annual prevention costs have been converted to a one time value, reflecting the present value of an annuity, which if now set up, would generate cash flow equivalent to the estimated annual disease prevention costs under each of the three outbreak scenarios. An example is used reflecting an expected outbreak frequency of 50 years. This is one reasonable outbreak frequency, given the previous Canadian FMD outbreak in 1952.

Table 10 summarizes the estimated prevention costs, economic impacts, and investment annuity requirements based on a 50 year outbreak

frequency. The impact to investment ratio, measures the economic impact costs, relative to the total investment that would be required.

A marginal saving ratio has also been determined, which measures the reduction of economic impact cost, for an additional dollar in prevention expenditure, moving from the large scale outbreak, and on to the small medium and scale outbreak respectively.

For BC, referring to Table 10, increasing preparedness expenditure from large scale to a medium scale would potentially return \$9.45 in reduced economic cost of the outbreak, for each dollar of annual expenditure.

Increasing the annual expenditure further from a medium outbreak to a small scale outbreak, is estimated to generate a benefit of \$3.82 for each annual dollar of expenditure. This shows there is significant return on moving toward a stage of preparedness reflective of the small scale situation, however, the marginal return, as one approaches the small scale situation reduces.

Based on the opinion of a number of BC industry and government officials, BC's state of preparedness is likely 60% from the large to medium scenario position. Based on the 50 year expected outbreak frequency outcome, this would imply for BC, that an annuity of \$438 million, reflecting an annually prevention expenditure of \$24 million is reflective of the current situation. If a target were chosen to reach a midpoint of preparedness between the medium and small scale outbreak scenarios, this would require an annuity be established of \$639 million, generating an annual prevention expenditure of approximately \$35 million.

Based on this analysis, an increase in preparedness expenditures in the order of 46% would allow for an acceptable level of preparedness within the BC livestock industry for the prevention of FAD's such as FMD and other diseases.

Table 10: Prevention Investment Evaluation

	Small Scale	Medium Scale	Large Scale
All of Canada			
Prevention Costs (Millions)	\$907	\$560	\$458
Economic Impacts (millions)	\$6,569	\$23,279	\$47,870
PV Annuity (50 yrs, 5%) (m)	\$16,562	\$10,226	\$8,363
Impact /investment Ratio	0.4	2.3	5.7
Marginal Saving ratio	2.64	13.20	
British Columbia			
Prevention Costs (millions)	\$43	\$26	\$21
Economic Impacts (millions)	\$2,411	\$1,224	\$361
PV Annuity(50 yrs, 5%) (m)	\$ 785	\$ 475	\$ 383
Impact/investment Ratio	3.1	2.6	0.9
Marginal Saving ratio	3.82	9.45	

PV= present value,



SENSITIVITY ANALYSIS

Sensitivity analysis has been completed on a few variables to identify how the economic impacts change when the assumptions and inputs are changed in the model. For the most part, the medium scale outbreak is used as a benchmark from which to compare the changes in impacts.

One of the most significant variables in the model is that of trade disruption. In the model, we have used an assumption that given a US VEA, trade would resume immediately following OIE recognition in the disease free area, but trade would not resume from the affected area until 24 month after OIE recognition. (In principle trade could resume in both the disease free area and the affected area after OIE recognition). However a political decision in the US could also prolong trade resumption for a period beyond OIE recognition, in conflict with the VEA. We have assumed a middle ground, where the VEA is followed in the disease free area, but it takes an additional 2 years before trade resumes from the affected area.) If we modified this assumption by assuming trade would also begin immediately following OIE recognition in the affected area, it would result in significantly lower impacts, as shown in Table 11 and 12 below. For BC, Table 9 shows a 39% reduction in overall impacts from our baseline impacts in a medium scale outbreak, or a decrease of approximately \$470 million in impacts. The impacts for Canada are even more pronounced in the medium scale, with a decrease of 46% or \$10.7 billion. In both cases these impacts are trade impacts, which are felt throughout the value chain from producers to processors, and the indirect and induced effects of lower industry spending to firms and households.

Table 11: Immediate Trade Resumption in Affected Area (BC Impacts) (Medium Scale)

Sensitivity Analysis	BC		
	Small	Medium	Large
Baseline Impacts (million)	\$360.9	\$1,224	\$2,411
With Immediate Resumption of Trade in Both Affected and Disease Free Zones after OIE Recognition if VEA is in Place (million)	\$238.4	\$749.6	\$1,937
Variance From Baseline	-34%	-39%	-20%

Table 12: Immediate Trade Resumption in Affected Area (Canada Impacts) (Medium Scale)

Sensitivity Analysis	Canada		
	Small	Medium	Large
Baseline Impacts (million)	\$6,568	\$23,278	\$47,869
With Immediate Resumption of Trade in Both Affected and Disease Free Zones after OIE Recognition if VEA is in Place (million)	\$6,446	\$12,584	\$30,842
Variance From Baseline	-2%	-46%	-36%

In a similar fashion, if we change the conditions to having no VEA agreement in place (or if the VEA is over-ruled by a political decision), Table 13 shows the resulting effect on the medium scale outbreak, and it indicates that the impacts may increase by over \$6 billion in Canada, or 27%.

Table 13: No VEA Agreement, 24 Months to US Market in All Areas (Medium Scale)

Sensitivity Analysis	BC	Canada
Baseline Impacts (million)	\$1,224	\$23,278
No VEA in Medium (million)	\$1,224	\$29,611
Variance From Baseline	0%	27%

Table 14 shows the effects, if the months out of trade are reduced by 10%. This indicates that if the months out of trade were changed by 10% (2.4 months in the affected area), it may result in about a 4-5% change in economic impacts.

Table 14: 10% Change in Months Out of Trade (Medium Scale)

Sensitivity Analysis	BC	Canada
Baseline Impacts (million)	\$1,224	\$23,278
Decrease Month out of trade by 10% (million)	\$1,177	\$22,209
Variance From Baseline	-4%	-5%

Beside trade implications, the length and size of the control period have been analyzed for their sensitivity to the economic impacts. We first consider a scenario with a reduction in the disease control months by 10%. As shown in Table 15, a 10% (.6 month) change in the control months results in a 2%-3% change in total impacts. In effect this is very similar to the changes in trade resumption, as the absolute months that have been changed are lower. The impacts to BC in this case are also greater, but it is the focal point of disease control, or more dollars are spent on disease control in BC relative to Canada in the small and medium scale outbreak.

Table 15: 10% Change in Control Months (Medium Scale)

Sensitivity Analysis	BC	Canada
Baseline Impacts (million)	\$1,224	\$23,278
Decrease Disease Control Months by 10% (million)	\$1,184	\$22,734

Variance From Baseline

Table 16 shows the impacts when reducing the affected farms by 10%. Just as with the control months, these changes are very significant for BC. While the financial impacts show a change of 1% in this scenario, there are significant changes to the number of animals that have to be pre-emptively slaughtered, and volume of animals for disposal. Both of these issues are very important to the livestock industry, particularly in the LFV.

Table 16: 10% Change in Affected Farms (Medium Scale)

	BC Baseline	BC 10% Fewer Farms
Impact (million)	\$1,224	\$1,216
Variance From Baseline		-1%
Number of animals (hd)	34,518	30,142
Variance From Baseline		-13%
Volume of Animals (cubic meters)	21,767	19,291
Variance From Baseline		-11%

One last scenario was a reduction in the density of dairy farms in the LFV (Table 17). In the following scenario, 250 farms and 30,000 animals are moved outside of the LFV to other regions in BC. This has the greatest impact on the number and volume of animals slaughtered in the LFV.

Table 17: Reduced Density of Dairy Farms in LFV (Medium Scale)

	BC Baseline	Reduce Density of Dairy to .18 from .39
Impact (million)	\$1,224	\$1,199
Variance From Baseline		-2%
Number of animals (hd)	34,518	30,795
Variance From Baseline		-11%
Volume of Animals (cubic meters)	21,767	16,873
Variance From Baseline		-22%

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SUMMARY CONCLUSIONS AND RECOMMENDATIONS

SUMMARY CONCLUSIONS

Costs and impacts are tremendous for an outbreak originating in BC's Lower Fraser Valley. The costs and impacts are summarized below.

Table 18: Summary of FMD Impacts and Costs

Scenario	Costs and Impacts	BC	Canada
Small Scale	Prevention Costs (million)	\$43	\$907
	Control Costs (million)	\$38	\$38
	Economic Impacts (million)	\$323	\$6,531
	Animals Depopulated (hd)	4,967	4,967
	Biomass Volume (cubic meters)	3,147	5,876
Medium Scale	Prevention Costs (million)	\$26	\$560
	Control Costs (million)	\$111	\$186
	Economic Impacts (million)	\$1,113	\$23,093
	Animals Depopulated (hd)	34,518	77,164
	Biomass Volume (cubic meters)	21,767	52,013
Large Scale	Prevention Costs (million)	\$21	\$458
	Control Costs (million)	\$234	\$1,184
	Economic Impacts (million)	\$2,177	\$46,686
	Animals Depopulated (hd)	82,014	543,686
	Biomass Volume (cubic meters)	51,976	245,988

The degree of preparedness of the BC industry with respect to the mitigation or prevention of the economic impacts and costs of a FAD outbreak is estimated to be about 60% in from the preventative costs of a large outbreak and a medium outbreak. This reflects an annual cost to industry and government in the range of \$24 million, or an equivalent one time annuity value of \$300 million. If it would be desired to improve the level of preparedness to the mid point between the small and medium scale outbreak, the annual expenditures on preparedness would need to be increased to 46%, or to \$35 million. This would be equivalent to an annuity of \$430 million.

Sensitivity analysis was completed on variables in the medium scale outbreak to measure the relative change in the impact that results from changing the model assumptions/drivers. The following table summarizes the sensitivity analysis results.

Table 19: Sensitivity Analysis of FMD Economic Impacts and Costs

Sensitivity Analysis		
Baseline Impacts of Medium Scale Outbreak in BC		
Impact (million)	\$1,224	
Number of Animals (head)	34,518	
Volume of Animals (cubic meters)	21,767	
10% Change in Months out of Trade		
		% Decrease
Impact (million)	\$1,177	4%
10% Change in Disease Control Months		
Impact (million)	\$1,184	3%
10% Change in # of Affected Farms		
Impact (million)	\$1,216	1%
Number of Animals Slaughtered (head)	30,142	13%
Volume of Animals (cubic meters)	19,291	11%

From a purely economic perspective, decreasing the length of the event, either by accessing trade markets faster, or by controlling the length of time the disease is active, has the most significant impact on the financial magnitude of the outbreak. A 10% change in months out of trade and a 10% change in the disease control period, results in a 4% and 3% change in the economic impact respectively.

A change in the number of affected farms does not have as significant an impact financially on the industry. A 10% change in the number of affected farms resulted in a 1% change in the impact. More significantly however, it substantially lowered the number of animals that would potentially be pre-emptively slaughtered and the volume of animals that would need to be disposed of. These issues pose very important concerns to the BC livestock industry.

Additional scenarios have been run on the ability to gain trade access in all regions of Canada (affected and disease free zones) immediately following an outbreak. On the medium and large scale outbreaks modeled in this analysis, where trade restrictions of up to 24 months were assumed, there is potential to lower the economic impacts by perhaps as much as 46% through activities and policies that allow for immediate trade resumption. The presence of a Veterinary Equivalency Agreement (VEA) with the US may facilitate trade resumption.

A number of points are of critical importance when considering the results of this assessment:



- ➔ The outbreak sizes modeled – the 5 herds, 100 herds and 1,000 herds – are based upon those which occurred with most frequency in actual outbreaks occurring globally in the past 15 years.

- ➔ The estimated impacts identified in this study are comparable to those identified previously in other studies, and to those that actually incurred in previous outbreaks;
- ➔ Impacts are national, for any outbreak of a contagious disease which Canada was previously free of;
- ➔ Solutions are complex, requiring long term investment and ongoing capabilities, not simplistic, short term fixes that can be applied after an outbreak; and
- ➔ Responsibility for investment, implementation and leadership in these solutions, rests with both industry and government.

Impacts are likely to be reduced by improvements in mitigation / preparedness / response (control) capabilities. This is demonstrated by the reduced impacts achieved in transitioning from the large to medium to small scale outbreaks, and which were accompanied by increased effectiveness of: biosecurity, cease movement, zoning, identification and traceability, depopulation and disposal, and veterinary equivalency agreement.

Present capabilities for Canada and BC, the ‘where we might be’ now, appear to be somewhere between those modeled in the large and medium scale outbreaks. The capabilities modeled in the

medium scale outbreak might be achieved with continued investment, in 3 to 5 years.

The extent to which future capabilities might be developed, the ‘where we might get to,’ is beyond the scope of this study. However it is not unreasonable to think that capabilities would continue to be improved – particularly biosecurity, traceability and zoning – though not perhaps to the extent of the small scale scenario.

Improvements are significant, in terms of reduced impacts to Canada and BC, as a result of transitioning from ‘where we might be’ to ‘where we might get to.’ The study has indicated there is a return of nearly \$14 in reduced economic impact for each dollar of prevention expenditure, as the BC industry would move from a state of preparedness reflecting a large scale outbreak, to a medium level of preparedness as suggested by the medium scale outbreak. Moving in preparedness to that of a small scale outbreak will pay off about \$6 in reduced economic cost for every dollar of preparedness investment. Likely the BC industries levels of preparedness is between that of the medium and large scale outbreak situation..

Continued investment is required and justified in capabilities for which Canada is already recognized. These areas include surveillance and biosecurity.

The continued and new investment required to achieve the gains suggested above could be directed to the following mitigation / preparedness / response (control) initiatives:

- ➔ Biosecurity: Programming based upon standards only just now being defined, are fully integrated into ongoing business practices on-farm, including both ‘day to day’ and ‘high risk’ protocols;
- ➔ Cease Movement: An interim capability rapidly implemented – yet to be defined;
- ➔ Zoning: Programming achieved through traceability or movement monitoring only beginning to be developed or implemented, at particular sites anticipated as being logical zone borders (Hope, BC; Ste. Anne-de-la-Pocatiere, Quebec; West Hawk Lake, MB; other);
- ➔ Identification & Traceability: Traceouts

RECOMMEN DATIONS

effectively facilitated with an ongoing system, presently in the process of being defined and developed;

- ➔ Livestock depopulation and disposal: Rapid and effective capabilities for large numbers of infected and possibly healthy animal disposal, involving investment in disposal infrastructure and pre-approved disposal protocols to avoid the need to suspend environmental and other existing legislation in times of an outbreak;
- ➔ US / Canada Veterinary Equivalency Agreement: Successful negotiation of agreement presently under negotiation by CFIA and USDA; plus a strong awareness initiative to ensure acceptance amongst US industry.

While not the focus of this study, two other conclusions became apparent during the course of completing this work.

Firstly, Canada lacks an overall and strategic approach to safeguarding the health status of its livestock industry. This jeopardizes the economic status of the country as a whole as is plainly evident from the impacts of the possible outbreaks.

Secondly, there is no coordinated investment plan to improve the capabilities needed to safeguard Canada’s livestock population from serious disease outbreaks. For these capabilities to be effective in time of need, required is an investment plan beyond the capacity of the present ‘one off’ approach to individual projects.

The following recommendations are made based on the analysis conducted within the framework of this report.

Firstly, undertake a coordinated and national approach to planning and investing in the mitigation, preparedness and response (control) policies and programs that are required for Canada’s livestock industry. While a national strategy is evolving, there is no national approach to investment.

More specifically the following are recommended:

- ➔ Implement a **biosecurity** program in all species, incorporating cost effective practices aligned to a national standard into existing programs. While this is a national initiative, careful analysis is

required to ensure that impacts are not disproportional in different regions and to allow regional approaches to the same ends.

- Identify a range of **cease movement** models for use in different circumstances, considering existing and previously defined alternatives, plus new alternatives enabled through provincial and municipal authorities. The Lower Fraser Valley is an excellent location to undertake some of this work on behalf of the country as a whole, in light of the experience gained from Avian Influenza.
- Identify logically anticipated **Zoning** locations and implement the necessary **movement monitoring** and other capabilities required at each. Already in process at West Hawk Lake, although long-term funding remains an issue, additional zones established at several other points – notably the Lower Fraser Valley – offer substantial benefit to key production areas such as Alberta and Central Canada.
- Enhance **Traceability** capabilities and ensure Identification capabilities, through continued support of the national initiatives. A recognized priority of the ‘Growing Forward’ provincial / federal government accord, this is a model for similar work in the field of Animal Health Emergency Management.
- Fund additional projects to expand **depopulation and disposal** capabilities and capacities
- Initiate an ‘industry to industry’ awareness campaign in support of the emerging **US / Canada Veterinary Equivalency Agreement**. While the VEA gives the USDA the authority to recognize zones and disease-free status declared by Canada, it may be challenged by the US industry. The potential for such challenges can be reduced with enhanced awareness amongst Canadian industry leaders, transferred ‘peer to peer’ to US leaders.

APPENDIX

ANALYSIS AND DATA TABLES