



GEORGE MORRIS CENTRE

**Economic Analysis of the Hog Production Industry in Manitoba  
in Relation to the Clean Environment Commission Review  
of Environmental Sustainability**

**Final Report**

Prepared for: Manitoba Clean Environment Commission

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## **Executive Summary**

The purpose of this project is to provide an economic background against which the environmental sustainability of the Manitoba hog production industry can be measured. The Manitoba Clean Environment Commission (CEC) intends to use this report to evaluate the industry's prospects in order to assess environmental impacts and needs into the future.

### **Manitoba Hog Industry Profile**

- In Manitoba, hog farming is the largest agricultural endeavour by far. Depending on the year, hog farming can be as much as two times larger than the second largest farming endeavour.
- In the ten years from 1997 through 2006, the Manitoba sow herd has nearly doubled, growing by 92%. Over that same time frame, the Western herd has grown by 53% and the Canadian herd has grown by 38%.
- Manitoba hog farm numbers are declining but are increasing as a share of total Western hog farm units.
- In 2002, Manitoba's average unit size was about 1,600 hogs, compared to the Western total of 622 hogs/unit. In 2007 the average unit size in Manitoba had grown to 2,258 hogs while the non-Manitoba Western size had grown to 840, increases of 40% and 35% respectively.
- Manitoba slaughter has stabilized in recent years after more than doubling from 1997 to 2001.
- Exports, either live or in pork form, account for about 80% of Manitoba hog marketings.

### **Catalysts To Growth**

A number of factors converged in the mid-1990's to generate and sustain the Manitoba industry's growth. The following are key points:

- The 1995 repeal of the Western Grain Transportation Act (WGTA), in particular, created an incentive to produce livestock in the Western provinces, a region historically dedicated to grain production.
- The move from single desk selling to open marketing accelerated change in Manitoba. Essentially, the fact that producers were responsible for their own marketing decisions resulted in a more efficient and competitive industry, based a more knowledgeable producer base.
- The Government of Manitoba also played a role through its overt support for the hog industry. The government of the day provided the vision, the direction and the reassurance that doubling the hog industry was the right thing to do. This was very significant because it provided the simple message to the public of Manitoba that the hog industry is competitive and sustainable.
- Related to the above concepts was the fact that there was regional acceptance of livestock growth. This acceptance was due to the lack of alternatives or, conversely, the positive spin-offs of hog production.
- During the period of depreciation of the Canadian dollar in the late 1990's and early 2000's, a lower dollar meant higher hog prices. Not only that, but other costs such as labour could be

much higher in Canadian dollars while still remaining competitive in US dollars. A cheap dollar was especially good for weaner pig shippers to the US. Given that feed grains were not a large part of their business, compared to finishers, the depreciating dollar simply translated into higher prices and higher profits. The net result was that the cheaper dollar resulted in higher profits or lower losses than would have otherwise been the case. This encouraged expansion, especially of the weaner trade.

- Canada signed trade agreements with the US in 1989 through CUSTA, with Mexico in 1993 through NAFTA, and with the WTO in 1994 which had the effect of increasing market access for Canadian products. In addition, the countervailing duty that had been levied by the US on Canadian hog exports expired fully in 1997. The effect was greater access to export markets for meat and livestock, along with other products. This was significant for Western Canada because the local population of consumers is quite small compared to its productive capacity for livestock and meat; the presence of a more readily accessible export market provided a demand-based rationale for livestock development.
- The Canadian prairies and Manitoba also had an advantage over the US in terms of swine diseases, available land and a supportive climate for production. This is partially manifested in the fact that Canada has much higher sow productivity than the US.

### **Industry Economic Contribution**

Based on Statistics Canada's economic Input-Output model, the hog and pork packing industry in Manitoba can be credited with the following impacts:

- Total jobs generated in Manitoba: 7,500
- Total Wages, Contracts, Benefits and Other Income in Manitoba: \$610 million
- Total Economic Activity: \$2 billion

### **Production and Packing Issues and Challenges**

Manitoba hog producers face a number of competitive challenges relative to their counterparts in the US Midwest. The most important challenge relates to feed grain costs, but labour is also a significant variable. Based on George Morris Centre analysis, as of late 2006 or early 2007, an efficient operation in Manitoba may be at a cost disadvantage, compared to the US Midwest, by approximately \$5-8/head.

For perspective on that differential, it is noted that during the last three years prior to 2007, average prairie hog producers likely made about \$8 per head profit. This differential between Canada and the US helps to explain why, over the past three years, US producers have enjoyed an extended period of profitability while prairie producers have seen variable returns at best, or losses at worst.

The Canadian and Manitoban pork packing industries appear to be at a competitive disadvantage across a range of critical success "drivers." The most important of these drivers is economies of scale and its impact on plant efficiency. There is little doubt that there are real, measurable

weaknesses facing Canadian packers for each of these competitive drivers. For the industry as a whole, a conservative estimate of the disadvantage would also be \$5-8/hog in Manitoba plants.

Lastly, the pending 2008 US legislation regarding Country of Origin Labeling has the potential to exert a very damaging impact on the Canadian livestock industry. It will result in lower prices in Canada and will accelerate producer attrition and the decline in herd sizes for both cattle and hogs.

### **North American Hog and Pork Industry Market Demand Prospects**

In terms of volume, the international market has become larger than the Canadian domestic market. Furthermore, while Canada is currently experiencing some export market slowdowns, the cause is related more to domestic production reductions. In fact, the Food and Agricultural Policy Research Institute (FAPRI) asserts that the international market will continue to grow and the major importers and major exporters will remain important participants. That is, Canada will continue to be a significant player in international markets and Canadian exports will continue to grow.

Alternatively, Canada's domestic market appears to be suffering from stagnant or declining demand. While this situation is arguably not permanent, history does not suggest that the industry can rely on the domestic market for growth. That is due to the fact that for the past twenty years, Canadian per capita consumption has generally been stable with little or no growth.

### **Prospects For Livestock Feeding in Manitoba**

There is a moderately positive outlook for Manitoba livestock competitiveness in the future, compared with recent history. The policy factors working against feed grain production and pricing are now widely known and producers are working to deal with them. The major factor that could act against this would be major ethanol developments in Western Canada that cause Manitoba barley and feed wheat prices to increase proportionally or more against US corn. The driver for this would be a policy decision by the government to subsidize ethanol production on the prairies, given that it is not economical without subsidies. This currently appears unlikely, but the understanding must exist that ethanol development in Western Canada is a negative for the livestock industry, especially in an environment of rising feed grain prices.

### **Prospects For Pork Packing in Manitoba**

The prospects for the packing industry range from optimistic to pessimistic, from a producer perspective. Regardless of the overall prairie situation in packing, however, there are two important points to be made with regard to Manitoba:

1. Manitoba will soon be home to the largest packing plant in Canada and this plant is likely going to be competitive with those in the US. Moreover, the Springhill plant will stay in production. As such, Manitoba is the only province to gain capacity based on known plans.

2. Manitoba has the easiest and least costly access to the most important US hog slaughter plants in the Mid-west.

As such, while prairie scenarios can be debated, there is little overall concern regarding Manitoba's hog packing prospects. Furthermore, the fact that Hytek wishes to proceed with another plant in Manitoba further supports the province's positive, packing related position, relative to other jurisdictions.

### **Land Availability**

Hog density per square kilometer of arable farmland has been cited as a measure of industry potential when compared to the swine industry in other regions and countries. In Canada, Saskatchewan is at 7 hogs produced per square kilometer, Alberta at 17, Manitoba at 76, Ontario at 126, and Quebec at 208.

Compared to the United States and other major pork producing countries, hog production densities are not remotely an overriding issue for the prairie industry. Internationally, by comparison, densities in Canada are low compared to Iowa at 212, North Carolina at 484 and the Netherlands at 1,350 pigs per square kilometer of arable farmland.

In addition, Canada has the second highest quantity of arable land per person in the world, after Australia. Canada's arable land per person is nearly double that of competing nations such as Argentina, Brazil and the United States. In general, according to the Canadian Agri-Food Marketing Council, Canada has greater availability of fertile arable land relative to human and animal requirements than most, if not all, major pork producing countries.

### **Environmental Overview**

Agricultural activities can have an impact on various elements of the environment, specifically water, air, soil and biodiversity. There are several potential risks to the environment from hog production. Some of these include:

- Degraded water quality impacting animal and human health
- Toxicity of the soil at high nutrient levels
- Increased greenhouse gas and air pollutant emissions
- Odour and noise pollution
- Impacts on aquatic biodiversity

Given the multitude of environmental concerns related to hog operations, it is not surprising that the hog industry and various levels of government have responded with initiatives to reduce the risk.

Some of the voluntary approaches taken in the province of Manitoba to address environmental risk have been the completion of environmental farm plans and the adoption of beneficial management practices. In Manitoba, 740 livestock operations and 2,183 mixed operations have completed an environmental farm plan.

Significant environmental initiatives reported in the 2006 Census of Agriculture include: 53% of predominant hog operations in Manitoba are using a crop rotation; 51% have established windbreaks or shelterbelts on their farms; and 19% are using buffers to protect water ways. All of these practices help to protect the environment.

In addition the adoption of Beneficial Management Practices (BMPs) by hog producers has been an important part of addressing the environmental risk in Manitoba, and hog producers are active participants in these programs. It should be noted, however, that the effectiveness of BMPs at addressing environmental risk in the province of Manitoba has yet to be determined.

Despite the voluntary initiatives, governments often decide to use legislation and regulation to fully address perceived environmental risk. From the comparison of regulatory regimes in competing jurisdictions, it is clear that regardless of the jurisdiction, with the exception of Saskatchewan, the major pig producing provinces and Iowa are all moving toward more stringent environmental regulations to address environmental risk. That being said, modifications and additions to Manitoba's regulatory environment will most certainly have an economic impact as producers adjust to new and more stringent regulations. A recap of some of the changes includes:

- Inclusion of phosphorus as part of the regulatory process.
- Restrictions on nutrient applications in certain zones.
- Restrictions on the construction and expansion of livestock operations in certain zones.

Unfortunately, at this time the regulations and zones have not been finalized. Therefore, it is difficult to determine the number of hog operations in Manitoba that would be impacted by the increased restrictiveness of the regulations in general, and more specifically within the environmentally sensitive zones. This will be an important factor in determining the overall impact of Manitoba's environmental regulations on the hog industry and its ability to grow, prosper and compete in the future.

## **Summary and Conclusions**

The Manitoba hog and pork industry is an agricultural success from any economic perspective including growth, jobs, incomes and trade. The Manitoba and, in fact, the entire industry in Canada has undergone a period of three years in which it has suffered disproportionate losses relative to US competitors. As a result, the industry now finds itself in a period of rationalization of packing plants and more rapid attrition in producer numbers. The summer 2007 announcement by Olymel that it would reduce its pricing structure in Red Deer will accelerate the attrition in producer numbers on the prairies. Furthermore, the prospects for packing plant closures on the prairies and in Ontario are factors that, again, will involve massive challenges for producers. Lastly, the pending US legislation regarding Country of Origin Labeling has the potential to further reduce pricing in Canada relative to the US. There will be a period of two to three years of industry pressure and reduced production in much of the prairies and the hog regions of Eastern Canada.

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At the same time, however, Manitoba is in a strong position on two key fronts. First, and most importantly, the province has enormous production capability in feed grains and land available for hog production. Fundamental factors that made the province the number one growth area in North America are still in place and are at the forefront for the future. The key problems that Manitoba faces in feed grain competitiveness are policy related, not natural disadvantages. These policy issues can, and likely will, be addressed. Key among the non-feed grain policy issues relates to environmental legislation. Manitoba must ensure that its regulations address real environmental issues in a way that does not unfairly burden the industry relative to competing jurisdictions. In addition, the packing sector has determined that Manitoba is a place of growth for the future. The packing sector is expanding in Manitoba and new entrants are hoping for the opportunity to participate in the market. Just as importantly, producers have ready access to packers in the United States.

Manitoba producers will not escape the coming difficulties but they are in a good position to endure it, compared to other areas of Canada. Furthermore, when the difficulties pass, Manitoba's model has proven it to be the best place to grow and move forward.



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## **1.0 Purpose, Objectives and Methodology**

### **1.1 Purpose**

The purpose of this project is to provide an economic background against which environmental sustainability of the Manitoba hog production industry can be measured. The Manitoba Clean Environment Commission (CEC) intends to use this report to evaluate the industry's prospects in order to assess the environmental impacts and needs into the future.

### **1.2 Objectives**

The CEC has requested that the following objectives be met in order for the project to achieve its purpose.

1. Overview of the economics and contribution of the Manitoba hog industry to Manitoba's economy from 1990 to 2007, with particular emphasis since 2000.
2. Outlook for the future considering:
  - a) future markets (growth potential), small and large operations
  - b) value of spin-off goods and services
  - c) potential increase in feeder capacity in Manitoba
  - d) impact of environmental regulations
  - e) feed market situation
  - f) effect of the moratorium

### **1.3 Methodology**

The project was conducted primarily utilizing George Morris Centre databases, previous George Morris Centre research projects regarding the Canadian hog industry, and interviews with industry leaders and government personnel in Manitoba. Research reports and economic data compiled by the Manitoba Ministry of Agriculture, Food and Rural Initiatives (MAFRI) were also utilized. The project employed the Statistics Canada Input-Output model on economic activity and economic impacts.

The information and research was conducted in order to address the CEC's objectives. The research areas and work required to address those objectives were as follows:

1. Industry Overview and Economic Contribution
2. Current Industry Issues and Challenges
3. North American Hog and Pork Industry Future Prospects
4. Manitoba Future Strengths and Weaknesses in the North American Context
5. Environmental Overview

The final report and project outline are consistent with the research areas outlined above. In addition to the five sections, the final report also provides conclusions and arguments regarding the prospects for the Manitoba industry within Canada and the world.

## 2.0 Industry Overview and Economic Contribution

This section provides a high level overview of the important economic variables in the Manitoba hog and pork industry. Its purpose is to provide a perspective of the industry's contribution, size, development and scope.<sup>1</sup>

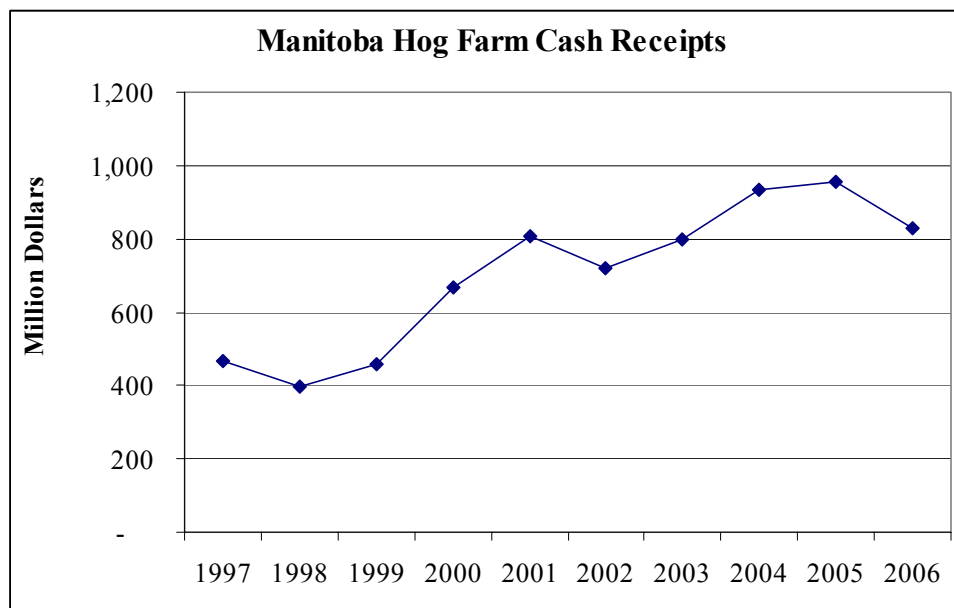
### 2.1 Statistical Overview

#### 2.1.1 Production and Trade Trends

The first part of the overview is simply to present a statistical description of the size, trends and make-up of the industry. This section provides data and graphics from farm through to packing and trade. The purpose is to offer perspective on the Manitoba industry, relative to the rest of Canada and relative to its recent past.

#### Farm Cash Receipts

Manitoba's hog farms have generated an average of \$905 million in farm cash receipts over the three-year period from 2004-2006. The following graph shows the trend in farm cash receipts over the ten years from 1997-2006.



**Figure 1** Source: Statistics Canada CANSIM Table 002-0001: Farm cash receipts

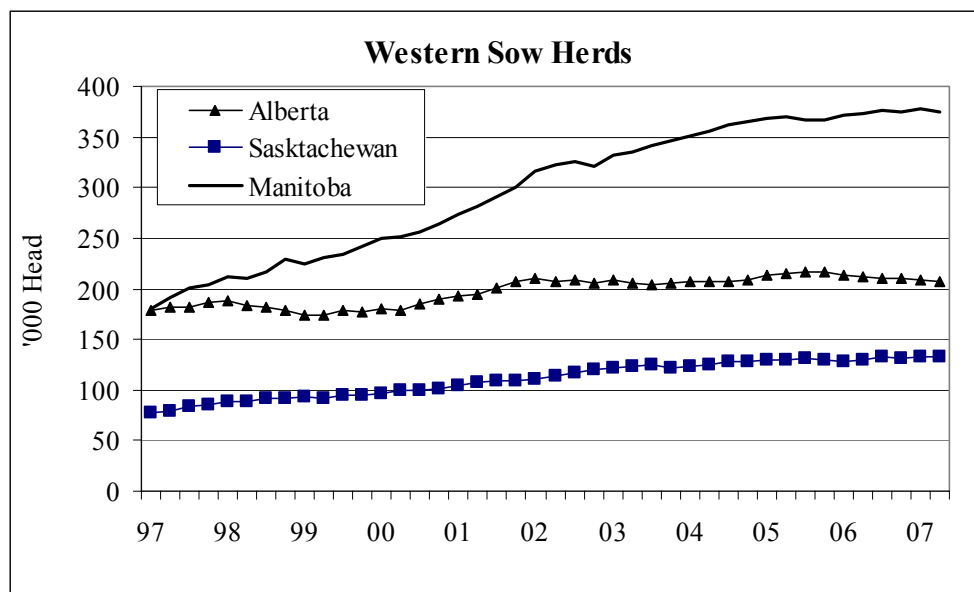
Over that ten-year time frame, Manitoba's share of total Canadian hog farm cash receipts has increased from 16% to 24%. In addition to that perspective, it is important to note that Manitoba's hog farm cash receipts represent over 51% of total livestock farm cash receipts and

<sup>1</sup> This section is not intended to provide analysis of trends or developments. The analysis follows in subsequent sections. A detailed assessment of industry performance including profitability is in section 3.

over 26% of total farm cash receipts from crops and livestock. In Manitoba, hog farming is the largest agricultural endeavour by far. Depending on the year, hog farming can be as much as two times larger than the second largest farming endeavour, which is usually canola (Statistics Canada, 2006).

Inventories

In the hog industry, sow numbers are typically used as a gauge of the size and trends in the industry. In that regard, the following graph shows the trends in the size of the sow herd for the three Prairie Provinces.



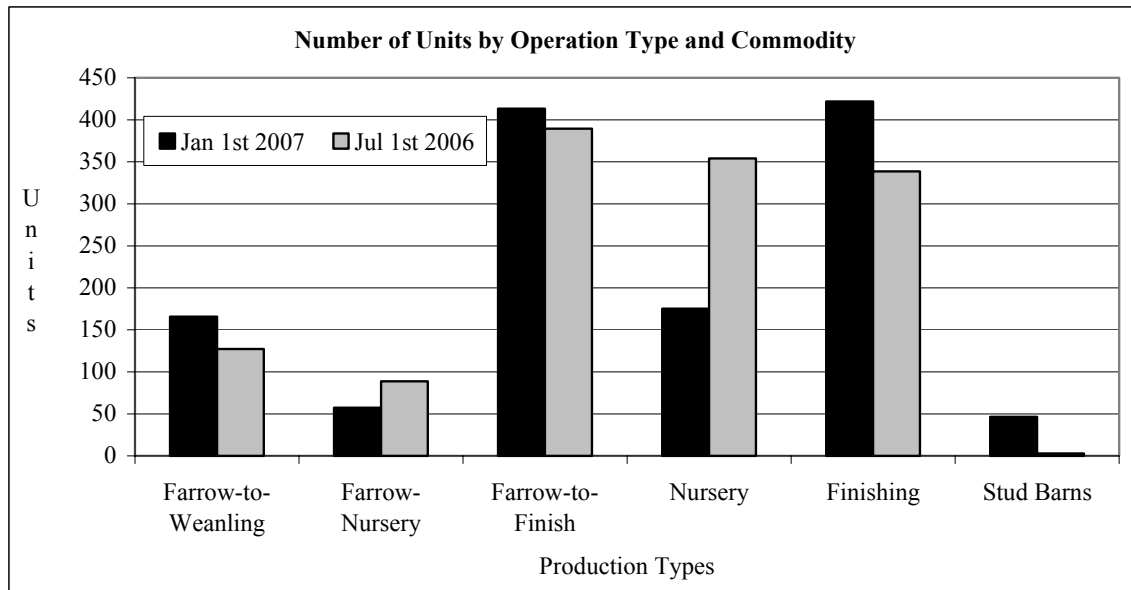
**Figure 2** Source: Statistics Canada, Livestock and Animal Products Section

In the ten years from 1997 through 2006, the Manitoba sow herd has nearly doubled, growing by 92%. Over that same time frame, the Western herd has grown by 53% and the Canadian herd has grown by 38%. The Manitoba sow herd has grown the fastest of any province in Canada over the past ten years. In 1997, the Manitoba herd comprised 17% of the Canadian total, compared to 23% of the Canadian total in 2006.

Producer Numbers

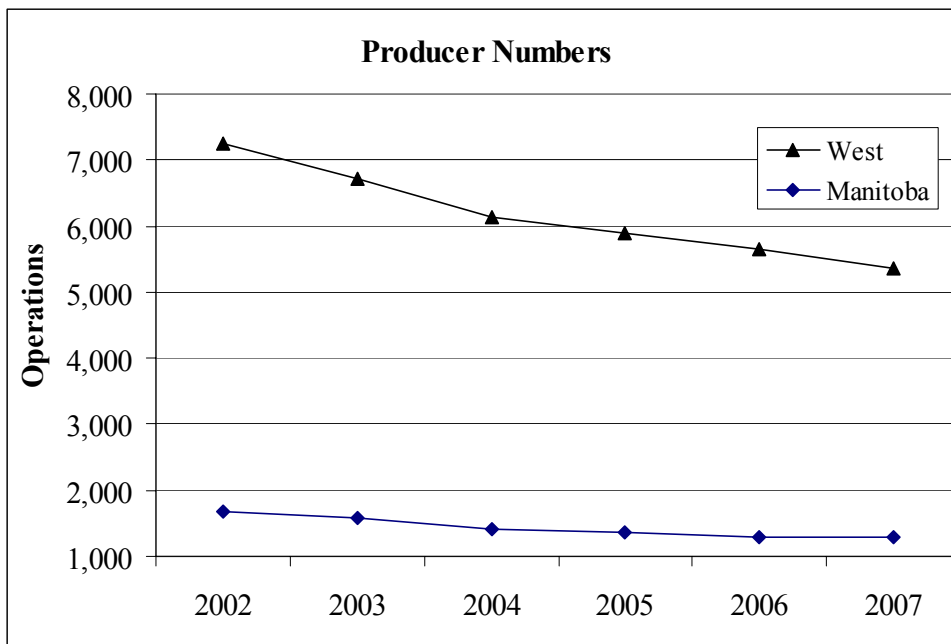
According to Statistics Canada data, Manitoba had about 1,280 hog farm units as of the beginning of 2007. That was down by at least 20 units compared to the middle of the previous year. The following graph, figure 3, shows the breakdown of the types of business enterprises operated in those farm units.

As can be seen on the graph, the majority of the units are either farrow to finish or finishing units. Farrow to finish units amount to about 400, while finishing units are around 422 in 2007, compared to 339 in 2006.



**Figure 3** Source: Statistics Canada/MAFRI Manitoba's February 15th 2007, Hog Statistics, Factoring Published Inventory Numbers

For comparison, it is noted that in Western Canada there were approximately 5,355 hog farms operating as of January 2007. Manitoba hog farms comprised 24% of that Western total. In 2002, there were 7,250 hog farms in the West, with Manitoba having 1,670 or 23% of the total. The following graph, figure 4, shows the number of hog farms in the West and in Manitoba from 2002 through the beginning of 2007.

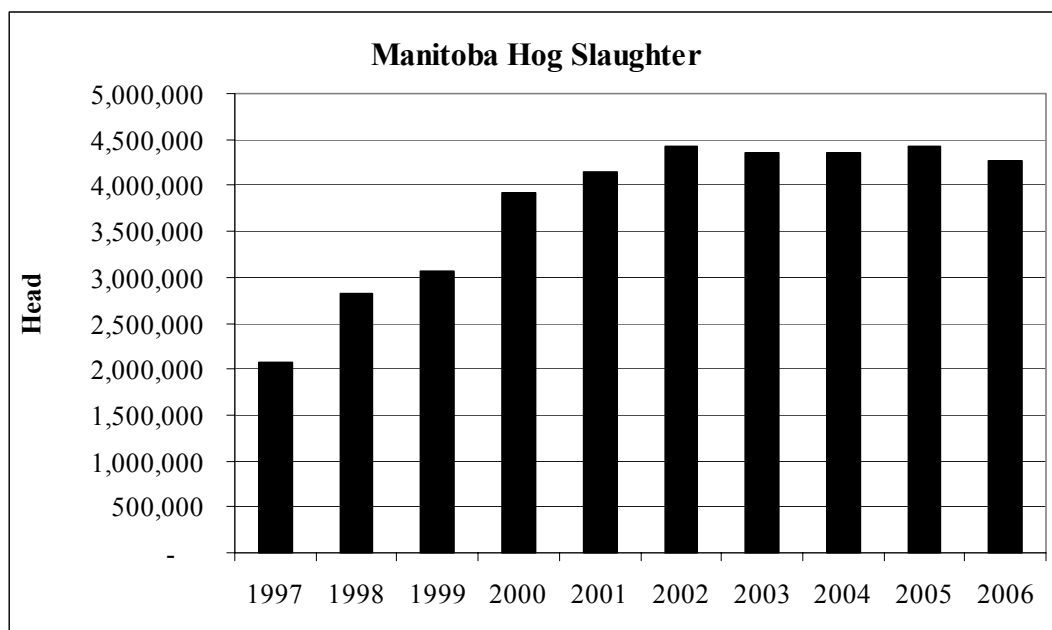


**Figure 4** Source: Statistics Canada

Over the period of time shown on the graph above, from 2002 to 2007 Manitoba numbers declined by 23% while Saskatchewan numbers dropped by 27% and Alberta by 34%. Total Canadian units declined by 21%. Using just the simple farm numbers and total inventories, in 2002 Manitoba’s average unit size was about 1,600 hogs compared to the Western total of 622 hogs/unit. In 2007 the average unit size in Manitoba had grown to 2,258 hogs while the non-Manitoba Western size had grown to 840, increases of 40% and 35% respectively. From a strictly arithmetic perspective, the reason for the larger unit size growth in Manitoba was due to the fact that the total herd grew by 7% in Manitoba while it declined by 2% in the West, not including Manitoba.

Slaughter

Manitoba’s hog slaughter has averaged over 4.3 million head per year over the last five years through 2006. The following graph, figure 5, shows total slaughter for the last ten years from 1997 through 2006.



**Figure 5** Source: AAFC Red Meats Section

As can be seen on the graph, slaughter has reached a plateau in recent years after more than doubling from 1997 to 2001. The doubling occurred with the construction and operation of the Maple Leaf Pork Brandon operation.

Only about 3% of provincial slaughter takes place in very small provincially inspected plants. The remaining slaughter occurs in three federally inspected operations. Of the three, two plants are owned by Maple Leaf. That company’s Winnipeg slaughter operation handles about 15-20,000 head per week while the Brandon operation slaughters over 45,000 head per week. The other plant, Springhill Farms, operates in Neepawa.

## Trade

Manitoba's trade in this industry can be measured in both the live and processed markets. With regard to the live trade, the following graph shows shipments from Canada into the United States through North Dakota.

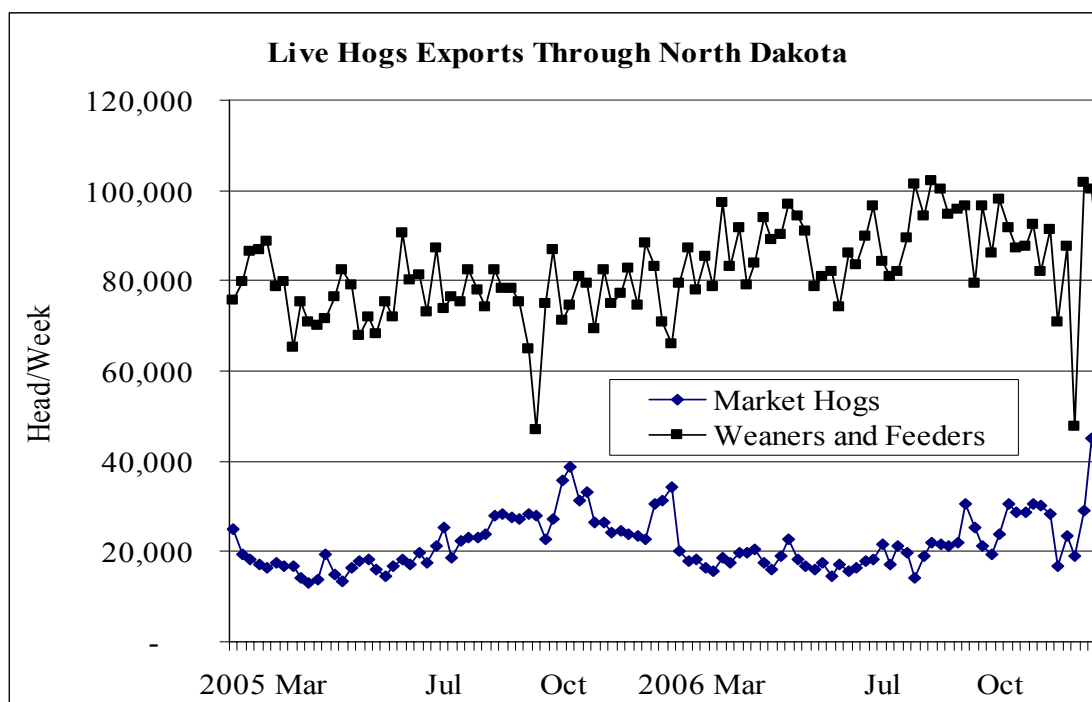


Figure 6 Source: [http://www.ams.usda.gov/mnreports/WA\\_LS637.TXT](http://www.ams.usda.gov/mnreports/WA_LS637.TXT);  
[http://www.ams.usda.gov/mnreports/WA\\_LS635.TXT](http://www.ams.usda.gov/mnreports/WA_LS635.TXT)

These hogs moving through North Dakota could have originated from any province on the prairies. There is no definitive estimate or definitive publicly available tabulation of the actual source of these shipments. For purposes of market analysis, Agriculture and Agri-Food Canada (AAFC) estimates that 90% are from Manitoba (Agriculture and Agri-Food Canada, 2007b).

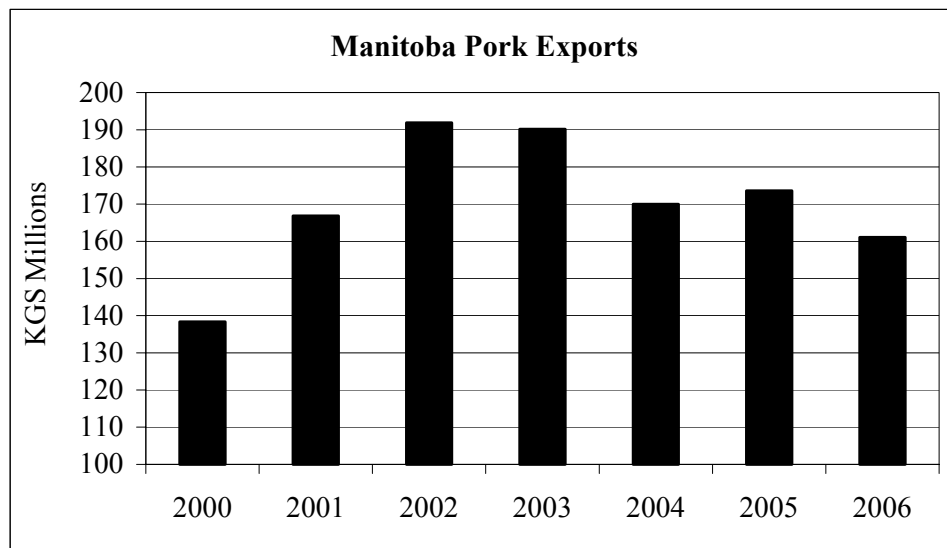
Over the past two years, 2005 and 2006, on average Manitoba producers shipped approximately 90-95,000 hogs per week to the United States. The annual total amounts to nearly 4.8 million hogs per year over the two years (based on the US data and the AAFC 90% estimate). Of the weekly shipments, about 75-80%, or 70-75,000 head, are weaner and feeder hogs, destined to be finished in the United States (likely Iowa). The remaining 20-25%, or up to 20,000 head, are market hogs that will be slaughtered directly in US packing plants.<sup>2</sup>

It is also important to note that during the first half of 2007, those shipments of weaner/feeder and market hogs have been increasing dramatically. Both categories of hogs have seen shipments increase by up to 17% each week in 2007 compared to the previous two-year average.

<sup>2</sup> Using USDA data coupled with Agriculture Canada's estimate of 90% originating in Manitoba. Note that these totals are averages for 2005 and 2006. The estimates for sections 2.2.1 below are for 2007 and are materially higher than for 2005 and 2006 average.

The breakdown of market hog versus weaner/feeder is roughly the same although the weaner/feeder tally appears to be increasing.

With regard to the pork trade, Manitoba's pork exports were valued at approximately \$409 million in 2006, a decline of 13% from 2005. Pork volume in 2006 was 161 million kilograms, a decline of 7% from 2005. In 2007 as of the end of April, it appears that Manitoba's pork exports are rebounding as value and volume are up by 15% and 10% respectively. The following graph, figure 7, shows the trend in Manitoba pork exports for the six years from 2000 through 2006.



**Figure 7** Source: Statistics Canada

The United States is the most important market for Manitoba pork, taking an average of 34% of the exported volume during 2004-2006. Japan is the second largest market in terms of tonnage, taking about 28%, followed by Mexico at 17%.

The most important point to note with regard to exports is how crucial they are to the industry in the province. Total production in Manitoba in any given year will amount to about 350 million kilograms (slaughter x carcass weight). Of that pork production total, about 60% is shipped out of Canada (Manitoba exports/total production). Those pork exports are the equivalent of about 2.4 million head. Those 2.4 million can be added to the near 5 million that are exported on a live basis to show that exports, either live or pork, accounted for nearly 6.4 million head in marketings in Manitoba. Total marketings in Manitoba amount to 8.7 million head. That means that exports, either live or in pork form, account for at least 80% of Manitoba hog marketings.

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### 2.1.2 Summary Points

- In Manitoba, hog farming is the largest agricultural endeavour by far. Depending on the year, hog farming can be as much as two times larger than the second largest farming endeavour.
- In the ten years from 1997 through 2006, the Manitoba sow herd has nearly doubled, growing by 92%. Over that same time frame, the Western herd has grown by 53% and the Canadian herd has grown by 38%.
- Manitoba hog farm numbers are declining, but are increasing as a share of total Western hog farm units.
- In 2002, Manitoba's average unit size was about 1,600 hogs compared to the Western total of 622 hogs/unit. In 2007 the average unit size in Manitoba had grown to 2,258 hogs while the non-Manitoba Western size had grown to 840, increases of 40% and 35% respectively.
- Manitoba slaughter has stabilized in recent years after more than doubling from 1997 to 2001.
- Exports, either live or in pork form, account for at least 80% of Manitoba hog marketings.



## 2.2 Growth and Structural Evolution

This section of the report provides a description of the marketing and production systems in Manitoba. The section also provides an explanation for the structural evolution of the industry and its growth. Its purpose is to give perspective and context to the statistical overview provided in the previous section.

### 2.2.1 Marketing Flows

There are approximately 370,000 sows in Manitoba as of July 2007. Those sows will generate weaner or market hog marketings of over 9.0 million head per year. Those marketings amount to up to 75-80,000 head per week in domestic, Manitoba-based slaughter; 85,000 head per week of Manitoba-based weaner/feeder exports; and about 20,000 head per week in market hog slaughter exports (see diagram below – figure 8).

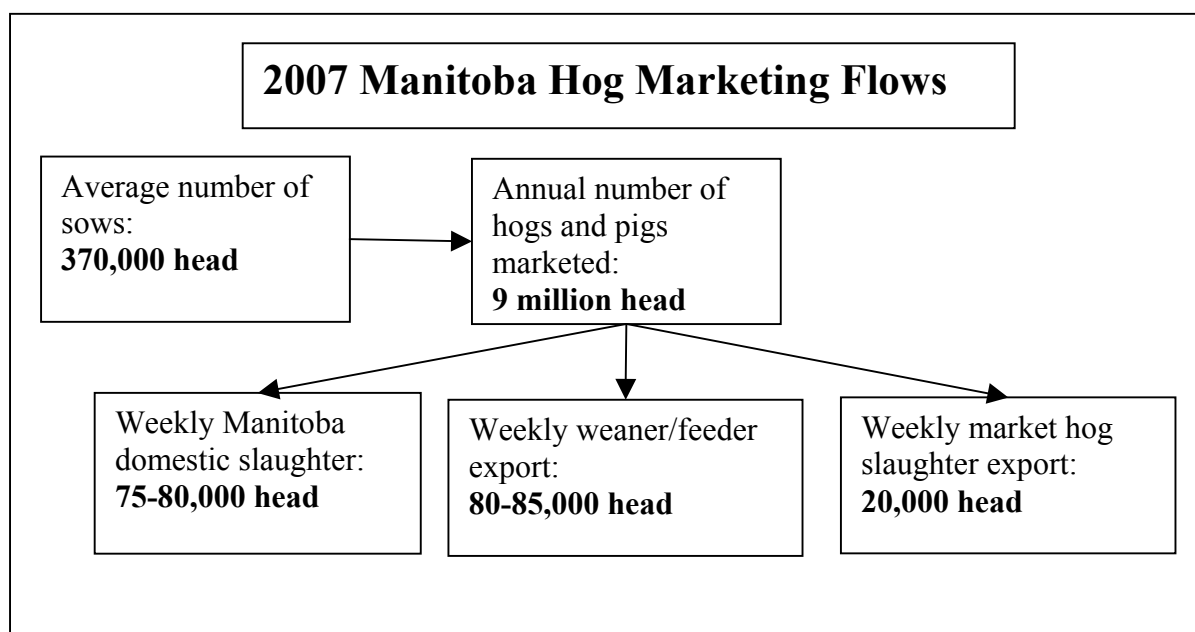


Figure 8 Source: GMC Graphic

Hog producers in Manitoba sell their hogs in an open market in which producers decide where their hogs are sold. The mandatory or compulsory regulated marketing system for hogs ended in Manitoba in the mid-1990's. Producers make decisions to market hogs as slaughter hogs or weaner feeder hogs or as part of a production system. Producers decide to market hogs domestically on the prairies, or as export shipments to US packers or hog finishers. Producers can market hogs on their own, or with the assistance of a third party marketer such as Manitoba Pork Marketing Cooperative.

Within Manitoba, it is likely that at least 90% of all hogs are marketed to domestic packers under some form of contract or marketing agreement. This estimate includes private producer-packer contracts as well as those that are marketed by Manitoba Pork Marketing Cooperative and other private marketing agencies. The rest of Manitoba's domestically slaughtered hogs are marketed

on the spot or cash market. Weaner and feeder hogs are marketed into the US through a variety of channels including retained ownership, contracts, auctions and third party brokers. Most market hog exports sold in the US are on contract, but more are sold on the cash or spot market than in the weaner/feeder trade.

### **2.2.2 Production Systems**

Manitoba production systems have seen significant evolution over the last 10 to 15 years. In fact, one of the most remarkable developments in Canadian agriculture has been the birth and growth of the isowean trade between Manitoba and the US Midwest. (see Appendix A) In addition, as noted earlier the Manitoba sow herd has grown the fastest in Canada over the last ten years. Over the ten years to 2005, the province's herd has grown by more than two times its 160,000 head size in 1995. No other province has seen growth approaching that of Manitoba. Much of that growth is due to the unique opportunities provided by the weaner trade with the US Mid-west.

When discussing Manitoba hog production systems and, indeed, most of prairie hog production systems, a starting point is the Hutterite colonies. Hutterites are a religious group that lives communally in rural North America. Each community unit is called a colony and each colony is engaged in a variety of livestock production, particularly pork. As a colony grows in population, or as the need arises, one colony can split into two. The Hutterite colonies are estimated to represent about 35% of the sow base in Manitoba. From the early 1990's through the present, the typical Hutterite colony production system was, and is, farrow to finish. While the Hutterite production model has remained the same, the size of the units has increased by roughly 50%. That is, in the early 1990's the typical Hutterite colony may have had a farrow to finish system with 600 to 800 sows while today, that representative unit may have 1,000 to 1,200 sows.

Beyond the Hutterite and isowean trade aspects of the industry, the representative Manitoba production system has grown due to its comparative advantages and adoptive production systems. In the early 1990's two-site models and the traditional farrow to finish operations characterized Manitoba's production systems. In other words, if a representative system is defined as one in which most of the production would occur, then a two-site and a farrow to finish operation would be considered representative of the bulk of production. In the two-site system, the farrowing operation produced pigs and sold or transferred them to a second site at about 50 pounds where they were then finished to market weight. Most production in the province would have taken place in farrowing units that were likely in the range of 600-800 sows.

In recent years, a more common production system, from which most of Manitoba's production would take place, would be based on a three-site, all-in, all-out model. In addition to a farrowing and finishing unit, a nursery barn would also be included. The farrow to wean stage produces a five kilogram weaner pig that is then moved to the nursery stage until it reaches about 23 kilograms. After that point the pig is moved to a finishing barn to be fed to slaughter weight. The base number of sows in the farrowing unit is more often in the 2,400 head range. The farrowing unit would produce about 1,000 pigs per week. The nursery unit would be capable of holding about 2,000 head, which would be filled over a two-week period. The finishing unit, in turn, would be about 2,000 head capacity. These sizes can, of course, vary. For example, two of

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the larger production systems in the province use a 3,000 head sow barn model with a nursery of 2,500 places.

As a point of reference, not counting the Hutterite systems, the traditional farrow to finish operation is relatively rare in Manitoba. In fact, the independent farrow to finish systems may simply represent about 10% of the sow base in the province.

The growth in Manitoba has been particularly focused in the Southeast corner of the province. Intensive hog, dairy and poultry production have characterized this region for the past twenty years. Adding to its attractiveness for livestock production is the fact that the region has seen diminishing opportunities for growth in grain production. Relative to other areas of the province, however, the Southeast also has higher human population density.

Within that Southeast framework, over the past ten years, feed companies recognized, created and managed hog production systems that were best suited for the circumstances of the region. The preferred mode for the feed companies was the three-site production systems described above. Feed companies actually build many sow barns in the region in order to encourage growth. Of course, the primary impetus for the feed companies was to generate feed sales volume. The motivation was to develop growing markets for feed within trucking distance of the mill, while grain would be sourced from a wide distance. With that motivation noted, the feed companies developed systems that could accommodate large numbers of pigs and coordinated the systems in an all-in, all-out approach that was both efficient and complementary to the region's land-based constraints. Feed companies' main contributions were not so much in the area of production expertise, but in the areas of organization, management, structure and, perhaps more importantly, seed capital.

In addition to the feed companies, other major production companies are integral to the growth and character of hog production in the province. Larger production companies in the province include Maple Leaf's Elite Swine (ESI), Hytek Group, and Puratone. In fact, most feed and production companies are essentially or practically intertwined in the province, such that it is difficult to discern whether a company is feed or production based. These feed and production companies will work with individual farmers in a variety of ways, including building barns, equity, services and labour.

If, as noted above, the traditional independent farrow to finish operator represents about 10% of the sows, the remaining 90% (including the Hutterite colonies) is mostly comprised of very large hog production systems. In fact, the top three systems, Elite, Hytek, and Puratone control about 40% of the sows in Manitoba. Prior to Maple Leaf's corporate restructuring, Elite was estimated to have about 80,000 head in the province, followed by 40,000 for Hytek and 27,000 for Puratone. Adding the Hutterite colonies to the top three will account for more than 70% of the sows. In Saskatchewan, the larger companies of note are Big Sky and Stomp Farms. These two firms have control of well over half the 130,000 sows in Saskatchewan.

Manitoba fundamentals (see below) encouraged the likes of Hytek, ESI, and Puratone to develop as described above, along with being able to access the management to take it to that level. In contrast, the Alberta industry has been more weighted to the colonies that often maximized production at much smaller levels, because management was the bigger constraint. In addition,

Alberta's overall environment was not as friendly as Manitoba's. It had a tougher permitting environment, higher feed cost and higher construction costs which all contributed to slower pace and scale of development.

Manitoba has developed a business model that is, very often, more cost effective than Alberta or Ontario for several reasons. Manitoba's fundamentals were based on a least cost model. This means lowest cost of production. Features include the following:

- a) Integrate as many of the "profit centers" i.e. feed, management, barn contracts, construction, transportation, into "cost centers", therefore producing a pig at the lowest cost and one profit centre – that's the pig.
- b) It is influenced by the type of business model operated. If a company owns all barns and makes its own feed and produces its own genetics, then the cost of production will be lower than another firm that buys isowean pigs, contracts feeder and market hogs and buys all feed and genetics at retail cost.

### **2.2.3 Catalysts to Growth**

#### **Crow Removal**

As a starting point in explaining the development and growth of the hog sector in Manitoba, it is necessary to site the removal of the Crow Rate grain transportation subsidy. The 1995 repeal of the Western Grain Transportation Act (WGTA), in particular, created an incentive to produce livestock in the Western Provinces, a region historically dedicated to grain production. The WGTA had subsidized rail transport of grain produced in the Western provinces to Atlantic and Pacific export points. Absent these subsidies, feeding wheat and barley to livestock—particularly hogs—became more profitable than shipping the grain for export (Haley, 2005).

The question of how important the removal of the Crow was can be answered by looking at the cost to get grains into an export position. From Manitoba, a good estimate is that it would have taken about \$1/bu freight to get grains into export position, which in turn is equal to \$40/tonne or acre equivalent. Taking into account feed conversion and the grain based component of feed factor that \$1 freight ended up costing Manitoba producers over \$10/hog. Conversely, the removal of the Crow reduced hog production costs by over \$10/hog, which is a massive differential.

#### **Single Desk Selling**

The removal of the single desk selling system in Manitoba, and on the prairies in general, had an impact on the evolution of the industry in Manitoba. The move from single desk selling to open marketing accelerated change in Manitoba. Essentially, the fact that producers were responsible for their own marketing decisions resulted in a more efficient and competitive industry, with a more knowledgeable producer base. Producers structured production into the most cost efficient systems in order to gain efficiencies and maximum revenues per pig. The inevitable result was larger and more specialized vertical supply chains or loops.

With open marketing the innovative producers developed experience and expertise in marketing hogs. That knowledge served as a growth catalyst for the larger production system as they sought new marketing opportunities and they were rewarded for it. The balance of the industry acquired the marketing knowledge via processors and government agencies that provided this information

as a value added service to the producers. This was a signal that the need for marketing knowledge had become main stream. Today, competitive producers are very sophisticated in their marketing programs in comparison to a decade ago.

#### Government and Regional Support

The Government of Manitoba also played a role through its overt support for the hog industry. The government of the day provided the vision, the direction and the reassurance that doubling the hog industry was the right thing to do. This was very significant because it provided the simple message to the public of Manitoba that the hog industry is competitive and sustainable. The government's confidence in the hog industry acted as a promoter and provided the momentum that was needed to achieve the planned growth. This signaled to the hog industry players to get it done. That confidence was paramount to sustaining the growth achieved in Manitoba during the 90's and early 2000's. This is best understood when comparing it to today's environment of temporary pauses and environmental concerns being caused by the hog industry.

Perhaps related to the above concepts was the fact that there was regional acceptance of livestock growth. The growth experienced in Manitoba first happened in areas that were traditional livestock growing areas – in Southeastern Manitoba. The growth further positioned Southeastern Manitoba as the most diversified region in Manitoba and the region that does best economically during tougher agricultural times.

The growth then expanded westward to Western Manitoba with the primary catalyst being farmers needing to deal with the removal of the Crow which created a \$40/acre increase in their cost of production, and communities needing to deal with rural depopulation because of a struggling grain industry. The solution was as follows:

- a) Individual grain farmers diversifying into hog production by way of owning barns and inventory or by becoming contract growers with the objective of accessing hog manure to substitute inorganic commercial fertilizer and drive their grain cost of production down.
- b) Communities, by way of community investors, investing in 3,000 sow farrow to finish operations providing employment opportunities for their youth with the objective of sustaining their rural communities.

In other words, there was regional acceptance due to the lack of alternatives or conversely the positive spin-offs of hog production.

#### Canadian Dollar Depreciation

Hog prices in Canada are directly tied to prices in the United States. Canadian prices are equal to the US price, converted to Canadian dollars and adjusted lower for the cost of transport south to US packers. The Canadian dollar influences Canadian prices directly. As the exchange rate depreciates, Canadian hog prices increase and vice versa. As such, during the period of depreciation in the late 1990's and early 2000's, a lower dollar meant higher hog prices. It also meant higher grain costs for producers but the impact was less than the hog price. Not only that, but other costs such as labour could be much higher in Canadian dollars while still remaining competitive in US dollars.

A cheap dollar was especially good for weaner shippers to the US. Given that feed grains were not a large part of their business (compared to finishers), the depreciating dollar simply translated into higher prices and higher profits.

In addition, the cheaper dollar translated into higher pork pricing for packers and lower US dollar equivalent operating costs.

The net result was that the cheaper dollar resulted in higher profits or lower losses than would have otherwise been the case. As a result it encouraged expansion, especially of the weaner trade.

### Market Access

Canada signed trade agreements with the US in 1989 through CUSTA, with Mexico in 1993 through NAFTA, and with the WTO in 1994, which had the effect of increasing market access for Canadian products. In addition, the countervailing duty that had been levied by the US on Canadian hog exports expired fully in 1997. The effect was to provide greater access to export markets for meat and livestock, along with other products. This was significant for Western Canada because the local population of consumers is quite small compared to its productive capacity for livestock and meat; the presence of a more readily accessible export market provided a demand-based rationale for livestock development.

### Disease Control

The Canadian prairies and Manitoba also had an advantage over the US in terms of swine diseases. For example over the last ten years, Porcine Reproductive and Respiratory Syndrome (PRRS), was the primary issue in the US along with summer heat that resulted in lower productivity and lower quality pigs (which is still the case today). Manitoba also had PRRS but the Canadian industry responded more quickly and effectively to manage the disease.

As noted above, a large measure of the growth in Manitoba has been focused on, and as a result of, the development of the weaner trade into the United States. This weaner sector growth occurred for the following reasons:

- Private family farms in the U.S. Mid-west were facing a challenge of continuing farrowing operations, particularly due to ongoing labour problems.
- US farms have also experienced great difficulty in procuring prolific, healthy isoweans.
- US farms, particularly in Iowa and Southern Minnesota have a competitive advantage in finishing hogs due to lower grain costs.
- George Morris Centre research from 2002 showed the prairies had a competitive advantage in farrowing.
- Prairie operations developed an advantage in live births and pigs weaned as a result of management and natural advantages. (see section 5.3 below)
- Logistical and marketing infrastructure developed in support of the Manitoba-Iowa farrowing and finishing linkages.

Manitoba has a competitive advantage in the production of isoweans and feeder pigs primarily because of the higher productivity level. That, combined with larger sow units, provides access to larger volumes of quality pigs which is competitive with the “multiple source lower quality hogs” accessible in the US.

## 2.3 Economic Contribution

This section gages the impact of the Manitoba hog and pork industry on the whole Canadian economy, and in Manitoba, by utilizing the Statistics Canada Industry Input-Output Model<sup>3</sup>. The model evaluates the impact of hog production at the producer level and pork packing at the processor level on Canadian economic activity including taxes, jobs, payroll and overall GDP. The results reflect all producer and processor input activity including grain farms, feed mills and other industry suppliers. The model provides a description of the overall contribution of the particular economic activity; in this case, hog production or pork production.

As a starting point, recall that Manitoba's hog farms have generated an average of \$905 million in farm cash receipts over the three year period from 2004-2006. The question that the Statistics Canada Input-Output Model addresses is: What is the overall economic impact of the hog farming sector. The model tabulates activity from the input sectors through to and including the sector itself. It tabulates the economic activities that go into the production of hogs from input through the finished animal, but not beyond the farm gate. The following table, figure 9, shows the key economic impacts in Manitoba, and in Canada as a whole:

<b>Economic Activity Generated by Manitoba Hog Farms</b>		
<b>(\$'000) 2007</b>	<b>Manitoba</b>	<b>Canada</b>
<b>Indirect Taxes on Production</b>	27,157	36,823
<b>Wages, Contracts, Benefits and Other Income</b>	504,035	723,317
<b>Direct Employment in the Industry</b>	1,382	1,382
<b>Indirect Employment Supplying the Industry</b>	3,394	5,777
<b>Total Employment</b>	4,775	7,159
<b>Total Economic Activity</b>	1,716,479	2,241,298

Figure 9

For the purposes of the model, “economic activity” is defined as total revenue generated by the particular industry as well the revenue generated by its supplier sectors as a result of the industry. As can be seen, the hog industry in Manitoba generates about \$1.7 billion in economic activity in Manitoba and a total of \$2.2 billion in Canada as a whole (including Manitoba). The industry produces nearly 5,000 jobs in Manitoba, either directly on farm or in feeder industries. Total Canadian employment provided by the sector amounts to well over 7,000 jobs.

It is of interest to note that, according to the Statistics Canada model, there are about 1,000 Manitoba jobs, almost evenly divided between manufacturing and the professional scientific/technical support sectors, both dependent on the Manitoba hog industry. In addition the hog industry supports over 500 jobs in construction and transportation/warehousing in Manitoba.

The Manitoba hog industry is also the most important market for the province's \$1 billion total grain and oilseeds industry. In fact according to the Statistics Canada model, the industry is a

<sup>3</sup> System of National Accounts, Industry Accounts Division, Canadian Open Input-Output Model, 2002. The model was administered by Industry Accounts Division personnel.

market for about \$500 million in grains and feedstuffs. Of that total, the model indicates that only about \$33 million would be imported feedstuff or gains. The model indicates therefore that the hog sector is a market for over half the value of the total grains and oilseeds sector in the province.

The hog or pork packing industry is further along the supply chain and of course it generates jobs, and economic activity from feed mills through to the actual pork production. As a starting point, it is estimated that the Manitoba pork packing sector generates approximately \$640-650 million in total sales per year. This is based on slaughter of about 4.3 million head per year at an average carcass value of \$150/head. This is likely a conservative estimate of the sales value generated by the pork. The following table, figure 10, shows the economic activity associated with the pork packing industry in Manitoba. This activity is measured from the hog sector inputs through to the final pork product at the plant level.

<b>Economic Activity Generated by Manitoba Pork Packers</b>		
<b>(\$'000) 2007</b>	<b>Manitoba</b>	<b>Canada</b>
<b>Indirect Taxes on Production</b>	12,656	20,045
<b>Wages, Contracts, Benefits and Other Income</b>	360,137	524,205
<b>Direct Employment in the Industry*</b>	x	x
<b>Indirect Employment Supplying the Industry</b>	x	x
<b>Total Employment</b>	3,713	5,607
<b>Total Economic Activity</b>	1,216,970	1,676,649

**Figure 10**

The Manitoba pork packing industry generates about \$1.2 billion in economic activity in Manitoba and nearly \$1.7 billion in the rest of Canada. It is to be noted that the overall activity generated by the pork packing sector is less than for hog farming. This may appear inconsistent given that hog farming is an input into pork packing and, therefore, on the surface, pork packing should be greater since it includes hog farming and hog farming inputs in addition to pork packing. It needs to be recalled, however, that only about half of Manitoba hogs go to Manitoba processors. As such, a great deal of the value added activity of processing is lost to the United States.

\*The Statistics Canada model does not explicitly state direct and indirect employment in the sector. That is due to confidentiality concerns, given the limited number of processors in the industry in Manitoba. Nevertheless, it is reasonable to assert that it takes about 1,000 workers plus administrative support to process 40,000 hogs per week. That suggests that there are likely about 2,500 people directly employed in the Manitoba hog packing industry.

With those points noted regarding the hog and pork industry economic contributions, it is possible to make overall assertions regarding jobs and economic activities of the combined sectors. For example, the following can be deduced from the model results pertaining to the hog and pork sectors:



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<p>Total jobs generated in Manitoba: 7,500 (hog farming plus direct estimate for packing) Total Wages, Contracts, Benefits and Other Income in Manitoba: \$610 million (all the packer income from wages, contracts, salaries, benefits and other income plus half the hog farming wages, contracts, salaries, benefits and other income) Total Economic Activity: \$2 billion (all the packer economic activity plus half the hog farming economic activity)</p>
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As a final point regarding economic impact, it is to be noted that the above analysis brings forward relatively moderate results compared to other research into the industry's impact. For example, the Manitoba Bureau of Statistics published a report entitled Manitoba Hog Industry 2005 Economic Impact Assessment in which the number of jobs tied to the industry was much greater than that indicated by the Statistics Canada model. For example, that analysis found that there were 2,620 jobs directly tied to hog production, compared to 1,382 for the Statistics Canada model. Furthermore, the Bureau's analysis found that total employment impact in Manitoba could amount to 10,620 person-years.

It is not unusual that different models yield differing results, likely due to differing input assumptions. In any event, the key point is that the Manitoba hog industry is responsible for at least 7,500 jobs in Manitoba and perhaps over 10,000 jobs.

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## 3.0 Current Industry Issues and Challenges

The purpose of this section of the report is to assess the rationale and depth of current industry problems in Manitoba. The section discusses and identifies the current issues and challenges facing the industry including:

- Feed costs relative to the US
- Packer competitiveness
- Environmental regulations
- Labour availability

This section is essentially a direct excerpt from a report conducted by the George Morris Centre for the Canadian Pork Council in March 2007 (Grier and Mussell, 2007).

### 3.1 Hog Production

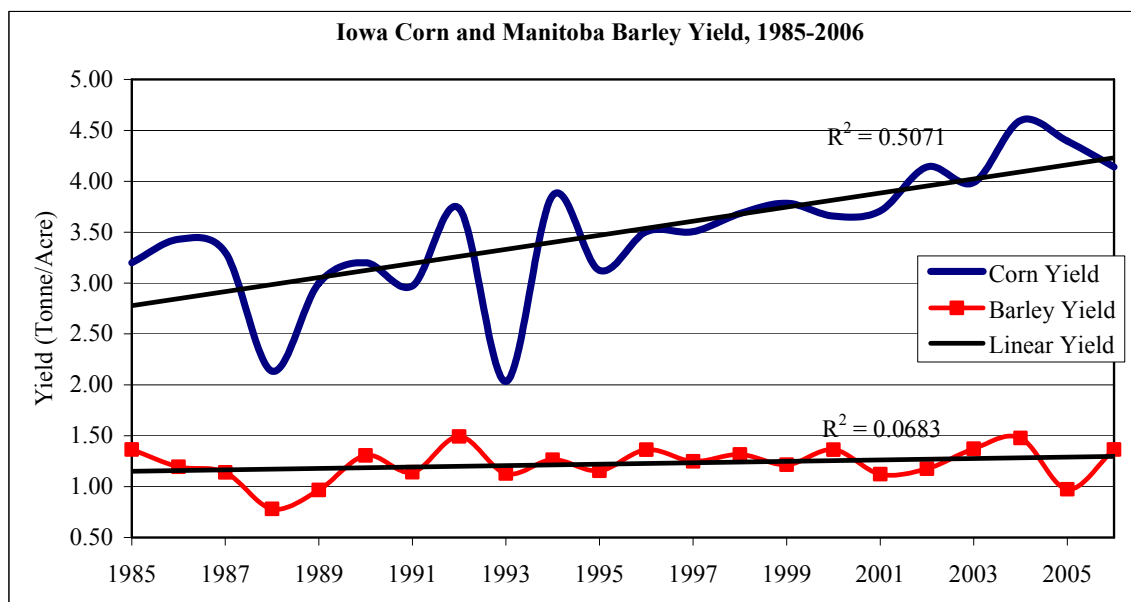
The Manitoban as well as the entire Canadian hog and pork industry is struggling with competitive tests throughout the supply chain. The following are some of the key factors at the producer level:

1. Lagging feed grain productivity relative to the United States
2. Declining feed grain acreage
3. Higher cost feed grains relative to the United States.
4. Higher cost of feeding hogs relative to the United States.
5. Farm labour cost and availability.

#### **3.1.1 Feed Costs**

##### Feed Grain Productivity

With regard to the first point, the following graph, figure 11, presents trends in Manitoba barley yields relative to Iowa corn. The figure shows that Iowa corn yields greatly exceed Manitoba barley yields and, more significantly, that yield growth in Iowa corn has proceeded at a much faster rate than Manitoba barley. For example, when the 2004-06 average yields are compared with the 1986-88 average yields for Manitoba barley and Iowa corn, the data show that Iowa corn yields increased by over 45%, while Manitoba barley yields increased by over 20%. It is acknowledged that corn yields more than barley, but the issue is the divergent trends.



**Figure 11** Source: USDA and AAFC

Acreage

Broadly speaking, the above information shows that Canadian feed grain productivity has lagged that of the Midwest US. In addition to the lagging productivity of the sector, the harvested acreage has also declined, materially. Figure 12, below, shows Manitoba barley acreage from 1985 through 2006. The graph shows the material decline in acreage in Manitoba, which is mirrored across the prairies as well. From the mid-1990’s to the last few years, acreage in Manitoba has declined by nearly 40%. Meanwhile in Iowa, corn acreage over the past 10 years has increased modestly.

The causes of declining acreage are varied but ultimately decisions on acreage are tied to profitability and opportunities. Of course barley is also grown on the prairies for rotational reasons and disease control. US Farm Bill subsidies help to lower grain prices across North American but subsidized production stays steady in the US while it declines in Canada. Alternative crops, particularly canola on the prairies offer better prospects due to yields and stronger markets.

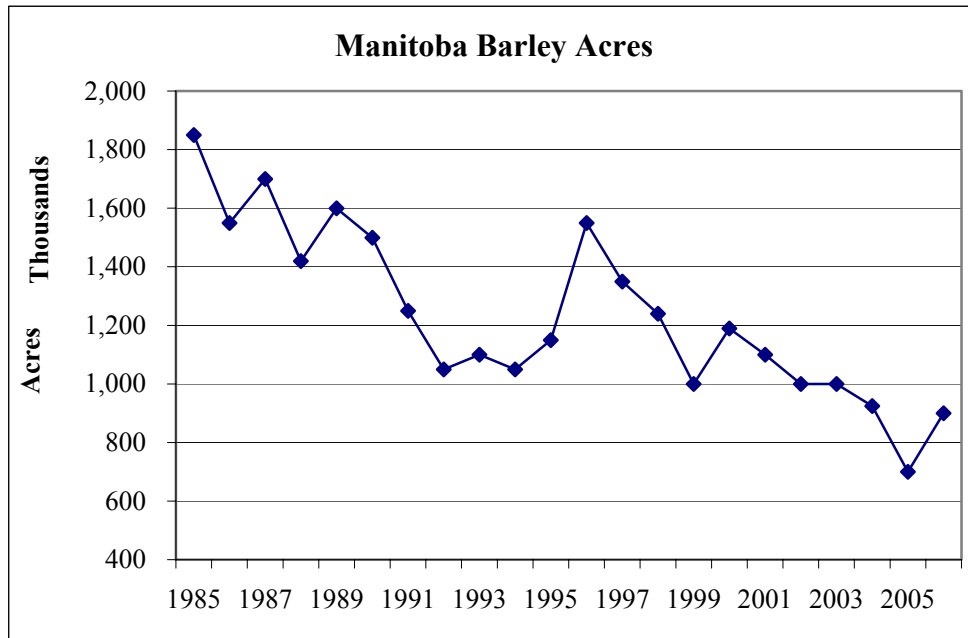


Figure 12 Source: Statistics Canada

Grain Pricing

Consistent with mostly lagging productivity and acreage in Canadian feed grains compared to the US, Canadian feed grain prices have increased on a relative basis. The next graph, figure 13, plots relationships between barley at Calgary, barley at Winnipeg, and Minneapolis corn. The figure shows that, historically, Winnipeg barley has been at a discount to Calgary barley and to Minneapolis corn. In particular, the discount relationship between Winnipeg barley and Minneapolis corn is some reflection of the fact that barley has about 85% of the feeding value of corn in a livestock ration. During the 2002-03 droughts in Western Canada, barley prices increased above Minneapolis corn prices. This drought situation was aggravated by crop diseases such as vomatoxin/Fusarium. Western barley prices have retreated since 2002-03 but remained priced at a premium to Minneapolis corn.

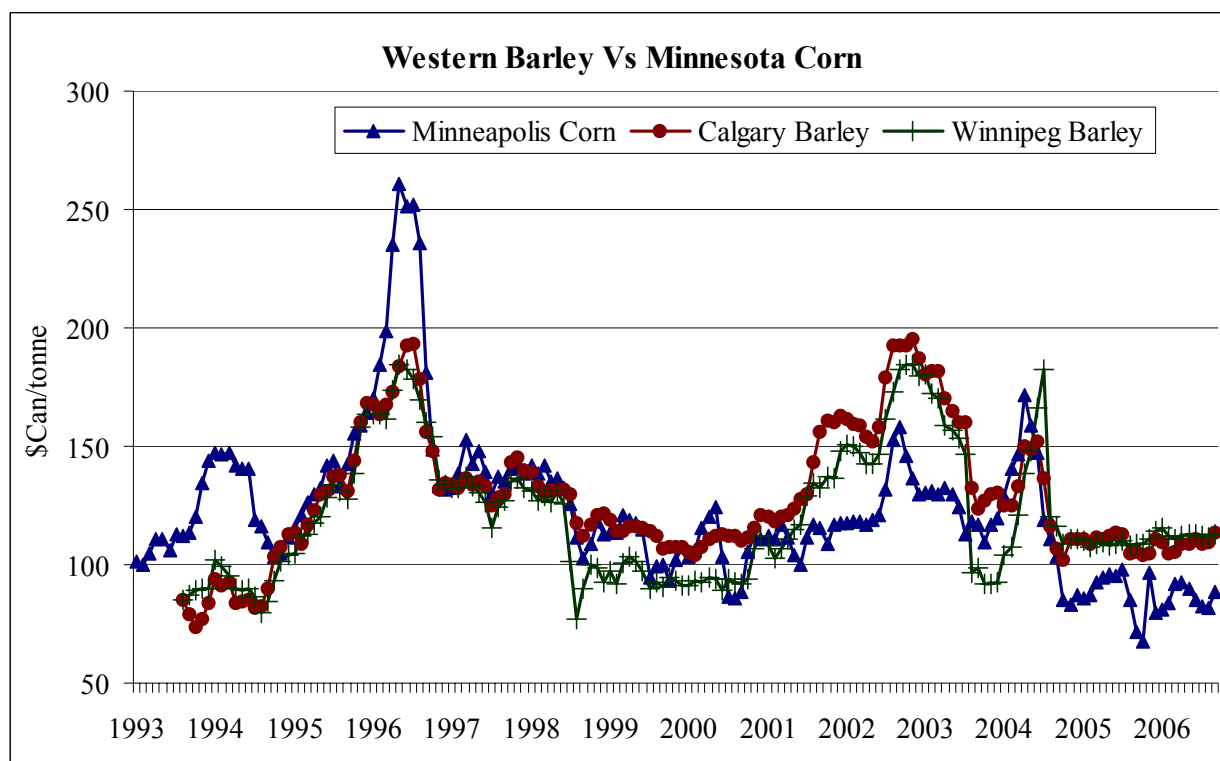


Figure 13 Source: AAFC, USDA ERS

For its part, soy meal pricing in Minneapolis and points in Eastern and Western Canada illustrate a classic freight cost relationship, in which Minneapolis is the low price point, followed by Winnipeg, Hamilton, and finally Calgary.

### 3.1.2 Impact on Hog Feeding

Needless to say, this disadvantage has significant ramifications for hog production competitiveness. Feed comprises approximately half of total production costs on a farrow to finish operation. The George Morris Centre has developed a cost of production model for a 1,200 head farrow to finish operation in Manitoba and Minnesota. According to the George Morris Centre cost of production model, Manitoba feed costs on this 1,200 head model operation amounted to over \$50/head during the first ten months of 2006. At the same time, Minnesota feed costs amounted to approximately C\$45/head. The total cost differential on feed amounted to up to \$8/head in favor of Minnesota.

Figure 14 shows the monthly trend in feed cost for a model hog production unit for Minnesota and Manitoba from 2005 through the first ten months of 2006. As can be seen the differential is material and can vary on a month-to-month basis depending on relative grain prices between the two regions.

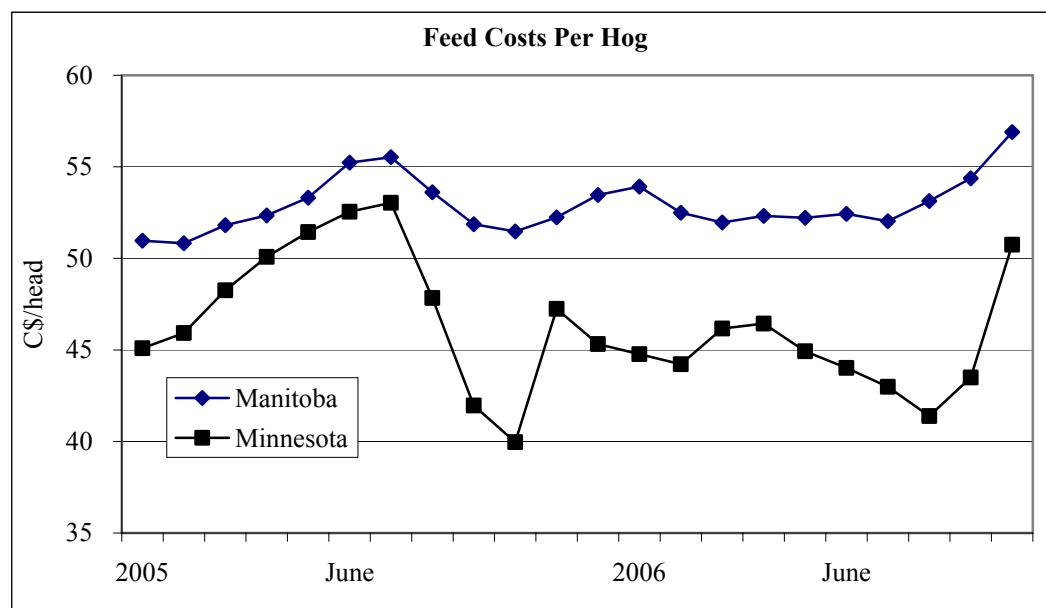


Figure 14 George Morris Centre Cost of Production Model

#### Impact of Ethanol on Relative Pricing

The increased demand for corn for use in ethanol production in the United States has become the largest single driver of the rapid rise in corn pricing in North America. According to the Renewable Fuels Association, as of the fall of 2006 there were 105 ethanol plants in the United States with 42 new ethanol plants under construction and 7 plant expansions underway. In addition, there are currently more than 300 business proposals for additional ethanol plants.

Given the crude oil price outlook for the next several years, ethanol's expansion is apt to continue for some time. According to grain market analysts in the United States, even under higher corn prices, ethanol returns still look promising. In the 2005/2006 crop year, corn usage for fuel amounted to 1.6 million bushels. That is about double the usage in 2002. Estimates suggest that by the 2007/2008-crop year, corn for fuel will double again.

A key driver of the ethanol based demand for corn is US government subsidies. Due to US subsidies, it is estimated that ethanol users can bid an extra US\$1.38/bushel.<sup>4</sup> That subsidy is about two-thirds of the 1998-2005 average price of corn in the United States. Further perspective on the magnitude of the subsidy is that after three years, the subsidy essentially can cover the cost of an ethanol plant.

The dramatic increase in demand for corn, due to ethanol subsidies in turn is having a dramatic impact on corn pricing. Ethanol plants can pay \$5.50/bushel given late 2006 prices for ethanol. This of course is having a material impact on hog producers and their profitability in both Canada and the United States.

<sup>4</sup> Ethanol info source: Purdue, Missouri + ISU Econ Depts.

When the US corn price increases, Canadian corn and barley prices also increase. The key point for Canadian producers relates to relative pricing between Canada and the United States. As noted earlier, US feed grain pricing has been relatively lower than Canadian pricing. This relative relationship is due to local supply and demand conditions, primarily declining acreage in Canada. The massive US subsidies may work to change that relative relationship. Acreage will increase in both Canada and the US, which in the case of Canada is a reversal of a trend. In addition, due to the subsidies in the US, relative supply and demand could result in stronger pricing relationships in the US compared to Canada.

At this point it is too early to state whether the relative supply-demand changes will be enough to eliminate or narrow the Canadian feed disadvantage. Furthermore, if the Canadian government increases subsidies for Canadian ethanol, this in turn could erase the US demand-supply price increase relative to Canada.

### **3.1.2 Labour**

Another determinant of regional competitiveness is the availability of a farm workforce. This has a couple of dimensions. The most tangible component is labour cost. However, some measure of labour productivity and interest in working with livestock in addition to cost is relevant.

Data on labour costs and wage rates is generally difficult to obtain, however data on wage rates for livestock workers is collected by Human Resources and Skills Development Canada according to National Occupation Classification (NOC) codes, including livestock workers (NOC 8253). The data is obtained from Employment Insurance claim data, and is fragmented by region, exclusive of benefits. In the US, data on wage rates is collected by the USDA National Agricultural Statistics Survey in the Farm Labour Survey for livestock workers. The wage rates collected are exclusive of benefits.

The table below, figure 15, presents a comparison of Canadian regional and US Midwest wages rates, in \$Can/hour. The table shows that livestock worker wage rates are clearly the highest in Alberta. This is not surprising, given the competitive influence of the oil industry on Alberta labour markets. Manitoba and Ontario livestock worker wage rates are significantly lower than Alberta. Wage rates for livestock workers in the Midwest US are generally the lowest. Compared with the Midwest US livestock worker wage rates, Manitoba wage rates appear to range around \$2/hour higher, and Ontario wage rates range about \$3/hour higher. Alberta wage rates appear to range \$7/hour over the Midwest US.

### Livestock Worker Wage Rates

Jurisdiction	Region	Reference	Time Period	Wage Rate (\$Can/hour)
Alberta	Red Deer/ Camrose/Olds	NOC 8253	Sep. 2003-Sep 2005	\$17.54
Manitoba	Winnipeg	NOC 8253	May 2005	\$12.00
Ontario	Kitchener/Stratford	NOC 8253	2005 Average	\$13.10
Iowa/Missouri	Cornbelt II	Livestock Worker	July 2005	\$10.15*
			July 2006	\$11.28*

**Figure 15** \*Converted to Canadian dollars assuming \$Can 1=\$US .90

The key point in this regard is that while labour may only comprise about 10% of total production costs, it comprises about 20% of non-feed costs. In fact it is the largest non-feed cost (MAFRI, 2007a). A two dollar per hour differential between Manitoba and the US Midwest could amount to up to a dollar a hog in cost difference.

### 3.1.3 Canadian Dollar Appreciation

In Canadian farm product markets, the most important driver of pricing is the overall North American market conditions, particularly reflected in US commodity pricing. Commodity prices are usually cited from some particular US market such as Iowa, or the Chicago-based Board of Trade or Mercantile futures exchanges. The second key driver of pricing in Canada is the value of the Canadian dollar while the third driver is cost of transportation.

Regarding transportation, the premise is that the price in Canada will be the US price less the transport cost of bringing the product to the US, if Canada is on an export basis. If Canada is on an import basis (rare), the price is the US price plus the cost of bringing the product from the US to Canada.

With regard to the value of the Canadian dollar, there is a simple arithmetic rule: if the exchange rate appreciates, the value of the Canadian commodity declines in Canadian dollars and if the exchange rate depreciates, the value of the Canadian commodity increases in Canadian dollars. For example if hogs are priced at US\$50/cwt in Iowa, the equivalent value in Canada (before transport) will be C\$66.67 at a 0.75 cent dollar (50/.75). That same US\$50 hog will be worth just C\$52.63 at a 0.95 cent dollar (50/.95).

As such the Canadian dollar appreciation of the past three years has resulted in lower hog pricing for Canadian hog producers. For example, at the beginning of 2004, the exchange rate was about 0.77 cents US. At summer 2007 hog prices of about US\$74/cwt, that would translate to C\$96/cwt. At summer 2007 exchange rates that US\$74/cwt hog is worth just C\$78/cwt, a difference of 23%.

While it is true that inputs such as grain would have also declined, the arithmetic shows that revenue declines faster than costs on with shifts in the exchange rate. The appreciation of the exchange rate has meant that producers are dealing with much lower hog prices than they could have anticipated, given past exchange rate structures.



### 3.1.4 Prairie Hog Producer Profitability

Over the past three and a half years, the profitability or margins per hog have varied significantly for prairie hog producers. According to estimates using George Morris Centre cost of production models for prairie hog farms, prairie hog producers would have enjoyed material profitability in both 2004 and 2005. George Morris Centre estimates indicate that prairie farrow to finish operations would have had positive margins of about \$15/head in both 2004 and 2005. By 2006, however, those margins would have been erased to the point where average returns were just barely break even or negative. Moving into 2007, producers appear to be suffering severe losses amounting to about \$10/head. The following graph shows George Morris Centre estimates of weekly prairie margins for 2005 to mid-2007

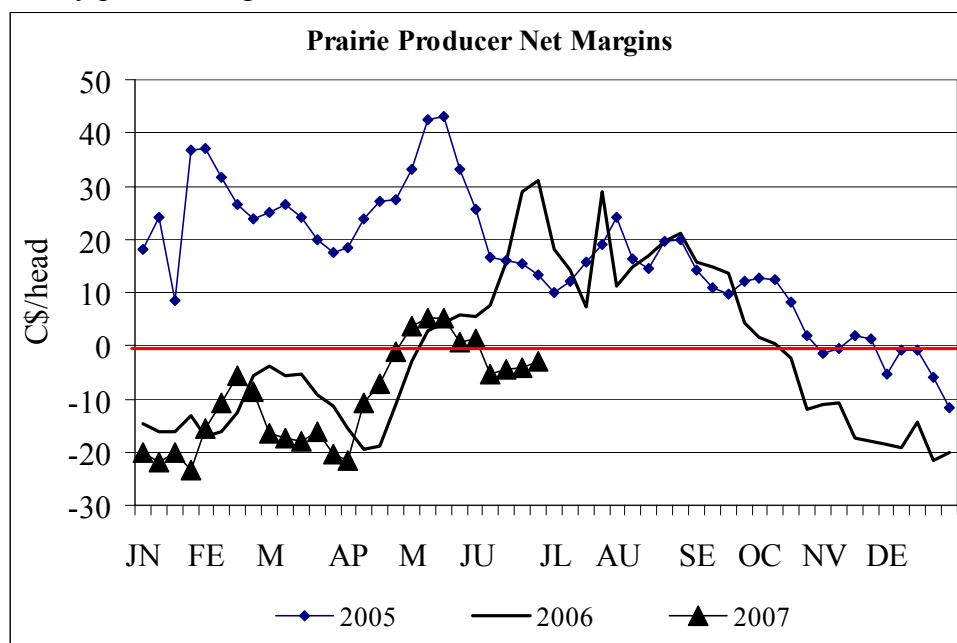


Figure 16 Source: George Morris Centre Estimates

According to experts in hog industry production costs, it is also estimated, based on costs across the prairies, that top Manitoba producers would typically have costs that are about \$5/head lower than prairie averages. That means that top Manitoba producer margins would be about \$5 greater than the prairie average.

### 3.1.5 Production Summary Points

Manitoba hog producers face a number of competitive challenges relative to their counterparts in the US Midwest. The most important challenge relates to feed grain costs but labour is also a significant variable. Based on George Morris Centre analysis, an efficient operation in Manitoba may be at a cost disadvantage compared to the US Midwest by approximately \$5-8/head.

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For perspective on that differential, it is noted that during the last three years prior to 2007, average producers likely just made about \$1-2 per head profit. This differential helps to explain why over the past three years, US producers have enjoyed an extended period of profitability while prairie producers have seen variable returns at best or losses at worst. The producer income challenge was exacerbated by the appreciation of the exchange rate over the past three years.

## **3.2 Pork Packer Issues and Challenges**

The Canadian pork packing industry is now the focal point of industry competitiveness. The sector is in the midst of large scale restructuring and rationalization. In order to understand why this is occurring and where the industry is likely heading, it is necessary to understand some of the main drivers in the industry. The following points are key pork packing plant characteristics that determine success or failure of plant operations.

- Scale economies
- Plant location/utilization
- Labour costs
- Hog Weights
- Credits

### **3.2.1 Scale Economies**

The following provides a good outline of relative plant sizes between Canada and the United States:

#### Canada

- average daily capacity: 3,200 head
- 5 largest Cdn plants: 8,400 per day.
- 3 of top 29 are >40,000 per week

#### United States

- average daily capacity: 13,000 head.
  - nearly 4 times greater than in Canada.
- 5 largest US plants: 21,000 head
  - 2.5 times greater than the top five in Canada.
- 20 of top 29 are > 40,000 per week

The main message of the data shown above is that Canadian plants or line speeds are much smaller or slower than in the United States. The following table, figure 17, provides another perspective on the same factor:

<b>Relative Packing Plant Sizes</b>			
	<b>US</b>	<b>Canada</b>	<b>Quebec</b>
<b>Avg Daily Capacity</b>	13,000	3,200	2,700
<b>Five Largest</b>	21,000	8,400	5,500
<b># Plants &gt;40,000/head per week</b>	20	3	0

Figure 17

Plant size is an important consideration because economic research as well as statistical analysis and basic cost accounting have consistently showed that larger plants have lower costs per head than smaller plants (Hayenga, 1997; MacDonald and Ollinger, 2000; Xia and Buccola, 2002; Ward, 1988). In larger plants, direct and even indirect costs are spread over larger numbers. For example fixed costs such as management, marketing, depreciation, rent and property taxes will not change materially or at all if line speeds are increased or if plant sizes vary from 500 head per hour to 1,000 head per hour. While these costs do not materially increase, the cost per head can be materially reduced in the larger plant. In addition labour is more productive and physical assets are more fully utilized. Plant managers concur that there is a significant increase in labour productivity as line speeds increase. Of course there are limits but the practice consistently results in lower labour costs in larger plants. According to George Morris Centre, USDA and other academic research, costs can be C\$2-8/head lower costs for large (1,000/hour) versus small (300-400)/hour.

Double shifting is important for similar reasons. Indirect costs such as administration and depreciation are spread over a larger number of hogs and assets are generally more fully utilized. All major US plants are double shifted whereas in Canada only two very small plants in Quebec are double shifted. According to George Morris Centre data research, Canadian plant costs are at least C\$3 higher than US plants due to a lack of double shifting.

Essentially, Canadian plant costs are likely at least C\$5/hog higher than in the US due to the fact that they are smaller and not double shifted. In fact, anecdotal information from Canadian packers suggests that the US advantage is likely closer to C\$8/head due to smaller sizes and a lack of double shifting.

### **3.2.2 Other Factors**

#### **Capacity Utilization**

Capacity utilization is an important component of cost competitiveness. The principle is similar to the concepts discussed above regarding scale economies. The costs of the plant, particularly fixed costs, but also labour costs, are going to be borne by the business regardless if the plant is fully utilized or not. As such, the more that the plant is utilized in terms of hog throughput, the lower the cost per head.

The key point with regard to capacity utilization is that the lower the utilization rate, the greater the costs per hog. In that regard, the trend in Canada has been for lower utilization rates in recent years. This trend has contributed to declining rates of cost competitiveness relative to the United States.

#### Labour Costs

Labour costs can comprise about half of total operating costs, not counting the cost of the hog. As noted above, labour is one of the most crucial factors facing packers from an availability perspective. Given its importance in terms of operating costs, labour is also a focal point of competitive difference between plants.

Based on independently collected data, the best it could be said that Canadian wage rates generally appear to be competitive with those in the United States. On a plant by plant basis some plants are more or less competitive than other plants in Canada and the United States. In Manitoba, the data suggests that wage rates were generally competitive through 2006.

#### Carcass Weights and Byproducts

With regard to carcass weights, in the United States, carcasses typically generate up to 200 pounds or 91 kilograms of edible meat. In Canada, the average carcass in 2006 might have generated about 190 pounds or less or about 87 kilograms of edible meat. Based on carcass values in 2006, the larger carcass would have resulted in extra revenue of at least \$9 per hog.

While the hog weight issue is being addressed by new grids, the fact is that there remains a strong revenue advantage on average in the United States compared to Canada.

Another factor that is of importance is the inedible byproducts or credits resulting from kill and cut operations. A prominent school of thought in the packing sector suggests that the revenues derived from the credit items, whether edible or inedible, can often make the difference between profit and loss.

With regard to the inedible items, the value of items such as bone meal, tallow, lard and blood are established on the open market. This market is worldwide and in theory packers in Canada and the US would be receiving the same pricing for these items, with only local supply and demand spreads between markets. In reality, however, US packers can typically receive more for rendered items due to economies of scale discussed earlier. That is, larger plants or larger networks of affiliated plants can generate a critical mass of credit items for rendering or further processing. Based on third party data collected on behalf of the George Morris Centre, it appears that with regard to credit items, US packers have been earning at least C\$5/head more than Canadian packers.

### **3.2.3 Appreciation of the Canadian Dollar**

The appreciation of the Canadian dollar has had an impact on Canadian packers in two ways. The first is that it has modestly resulted in reduced gross margins. That is due to the fact that appreciation has reduced pork cutout revenues at a slightly faster rate than it has reduced hog costs. Figure 18 helps to explain the arithmetic of the gross margin erosion.

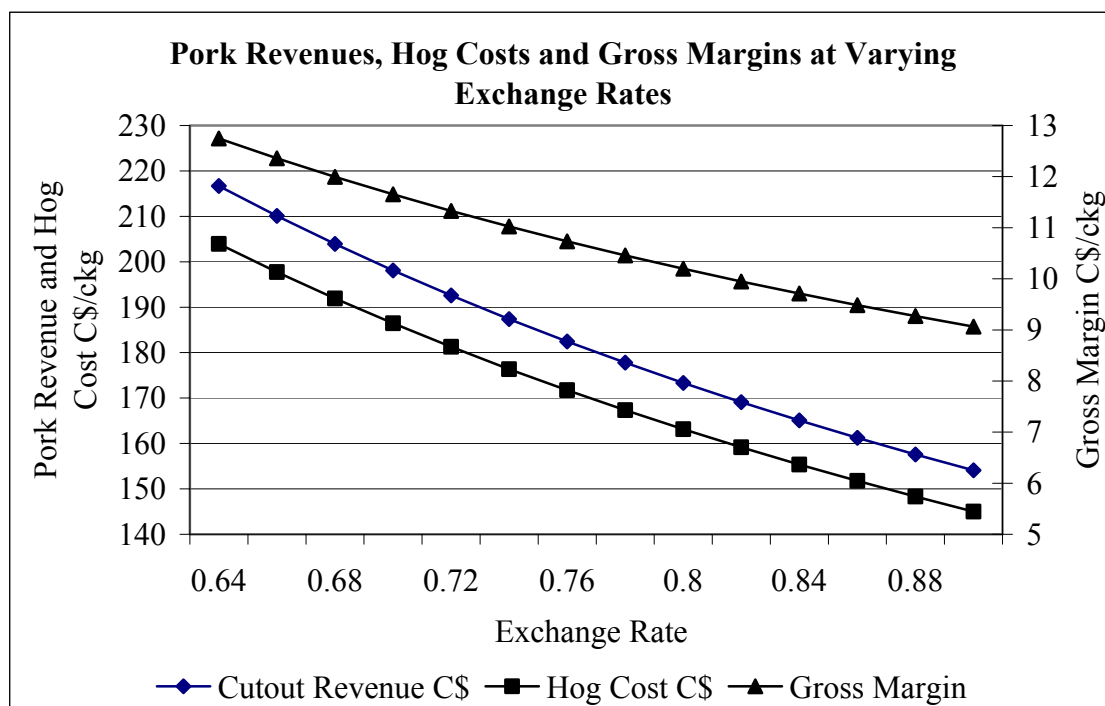


Figure 18 Source: George Morris Centre

The graph above is based on a US cutout value of US\$68/cwt and a hog carcass cost of US\$64/cwt. These values are roughly the average values for those two variables over the four years from 2003 to 2006. All hog and pork pricing in Canada is based on US prices whether by formula or by the fact that North America is one, open market. As such, Canadian pork cutout values and Canadian hog values are simply US prices, adjusted by the exchange rate, less transport/basis costs.

Based on those fixed US values, the graph shows the C\$ values of the cutout and hog cost at varying exchange rates. The US values are adjusted by the exchange rate and converted to Canadian carcass values in kilograms using the typical Canada and US carcass yields. The exchange rate ranges from US\$0.64 to 0.90, as it did from 2003 to 2006. As can be seen from the graph, using the left vertical axis as a guide, the cutout and hog cost both declined as the exchange rate appreciated. That is, when the exchange rate was at .64, that same US cutout value was at near C\$220/ckg while the hog cost was near C\$204. As the exchange rate appreciates, the revenue and costs both decline, but at different rates. The revenues decline faster than the costs as the C\$ appreciates. The right vertical axis shows the decline in the gross margin. Essentially as the exchange rate appreciated from 0.64 to 0.90, the gross margin deteriorated from about C\$13/ckg to about C\$9/ckg.

As such, gross margins have been trimmed during the period from 2003 through 2006 as the appreciation occurred.

In addition to the impact on gross margins, operating cost competitiveness relative to the US competition has also been impacted. For example, assume that labour costs per hog in Canada amount to C\$20/hog. When the exchange rate is at 0.65, the US equivalent was just US\$13/hog.

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At a ninety-cent dollar, that same US equivalent becomes US\$18/hog. As such, the appreciation results in a relatively higher labour cost structure. The same principles can be applied to all aspects of packer operations. The appreciation of the C\$ resulted in a dramatic escalation in operating costs in US dollars. This in turn meant that strictly due to appreciation, common plant costs that may have been competitive at a .65-cent dollar became uncompetitive at a .90-cent dollar.

It may be of some interest to speculate or estimate what exchange rate Canadian packers could be competitive relative to US packers. That exercise would be fraught with varying assumptions about plant sizes, throughput rates, wage rates and capacity utilization. At this point therefore, it is best to not assert that the challenge rests with the exchange rate. Instead it is best to assert that the exchange rate appreciation simply exposed the challenge.

### **3.2.4 Summary**

The Canadian and Manitoban pork packing industry appears to be at a competitive disadvantage across a range of critical success “drivers.” There is little doubt that there are real, measurable weaknesses facing Canadian packers for each of the competitive drivers. For the industry as a whole, a conservative estimate of the disadvantage would be at least \$5-8/hog in Manitoba plants.

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### 3.3 Country of Origin Labeling

Country of Origin Labeling (COOL) is to be put into practice in the United States by October 1, 2008. This is likely to have major negative ramifications for the Canadian cattle and hog industries.

Essentially, COOL requires that all fresh pork and beef sold at retail in the US be labeled as to the country of its origin. For a product to be labeled as product of the United States, it would need to be produced from an animal that was born, raised and processed in the United States. If it is not product of the US, it must be labeled as such. Fresh meat products from Canada sold in the US would simply need to be labeled as product of Canada.

In 2003 and 2004, when COOL first raised its head, the George Morris Centre did a great deal of research on behalf of hog industry organizations like Manitoba Pork, regarding the impacts of the legislation. The bottom line of the research was that US packers would need to segregate, sort, control and account for Canadian livestock that they purchase. They would also need to segregate and label the meat from these animals separately from other meats.

Needless to say, handling Canadian livestock would increase risks of mislabeling by US packers. More importantly, handling Canadian livestock would be more costly than running a plant without Canadian livestock. For example, the 2004 George Morris Centre research estimates indicated that handling Canadian hogs would cost packers an extra \$5/head. The actual amount of course is not actually known given that there are no systems in place to run a segregated slaughter. There may in fact be no extra costs, but this is unlikely.

These extra costs and risks mean one of two things: US packers won't bother buying Canadian livestock, or US packers will discount bids on Canadian livestock by the amount of the added costs and risks. Some packers simply said they could not take the risk or the added costs of buying Canadian hogs. Other packers said they would need to pay less for Canadian hogs due to higher costs. More than 160,000 hogs and 20,000 cattle cross the border each week. Livestock prices are tied to the US through their ability to purchase Canadian livestock through open trade. Anything that impedes or distorts that will impair pricing. That means that livestock prices in Canada are likely to decline as soon as the legislation is enforced.

The George Morris Centre research concluded that COOL is nothing less than a non-tariff barrier to trade. That, of course, is exactly what its proponents, mostly US cattle producers, intended when they pushed for the legislation.

This legislation has the potential to exert a very damaging impact on the Canadian livestock industry. It will result in lower prices in Canada and will accelerate producer attrition and the decline in herd sizes for both cattle and hogs. Those who see the glass as half full will point to the fact that more livestock will be processed in Canada, which is true, but will only be due to problems in the livestock sector directly resulting from the implementation of COOL. The benefits to processors will be short run as the livestock sector declines.

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## **4.0 North American Hog and Pork Industry Market Demand Prospects**

The purpose of this section is to provide perspective on the direction and prospects for the entire pork industry. The primary focus of the section is an analysis of the market or demand prospects for pork and whether Canada has a place in the domestic and international markets. While competitiveness is crucial to market success, the bulk of the other sections of this report focus on that aspect of the industry. As such, this section tends to focus on demand.

### **4.1 International Trade and Export Market Demand**

#### **4.1.1 Importance of Pork Trade to Canada**

Previous research by the George Morris Centre conducted for the Canadian Pork Council (CPC) in October 2006 illustrated the material benefits to the Canadian hog industry as a result of pork exports (Grier, 2006). The following are some of the major points derived from that research:

- Pork exports have been the driver of the exceptional growth of pork production in Canada
- Canada is a world leader in pork exports (see figure 19).
- Canada has diversified its export markets to over 100 countries and is increasingly less dependent upon the US market.
- Pork export demand has been rapidly growing while domestic demand has been stable.
- Pork exports of \$2.8 billion in 2005 are responsible for economic activity amounting to \$7.7 billion and 42,000 jobs.
- Pork exports support the incomes of about 6,000 farmers and about \$2 billion in farm cash receipts.
- Premiums derived from the export market due to value differences in those markets could result in enhanced producer income of up to \$9/hog.



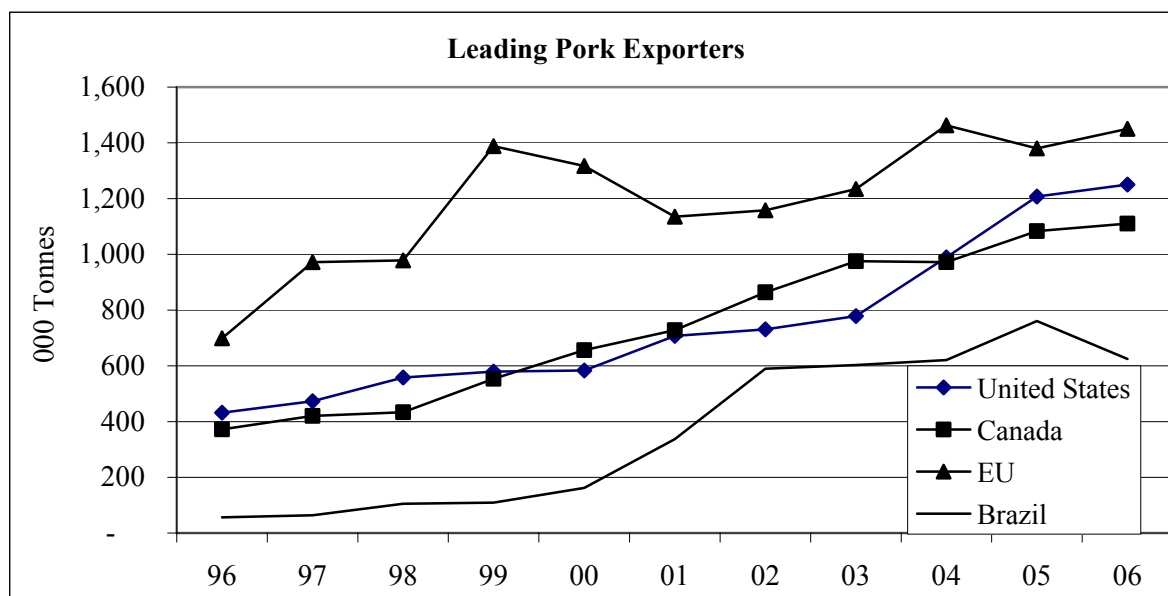


Figure 19 Source: USDA (Foreign Agricultural Service)

The key message of the October 2006 report to the CPC was the importance of exports to the Canadian hog production sector and to the Canadian economy in general. Further to that point it needs to be re-enforced here that pork exports are likely more important to Canada’s pork industry than to other industries around the world. The following comparisons make that point clear:

- World exports = 5% of total pork production
- US exports = 10-13% of total production
- Brazil exports = over 25% of total production
- EU’s exports = 7% of total production
- Canada exports > 50% of total production

The importance of Canada’s pork exports is further well illustrated in figure 20 below. The graph clearly shows that pork exports have been the sole source of growth for the Canadian pork industry.

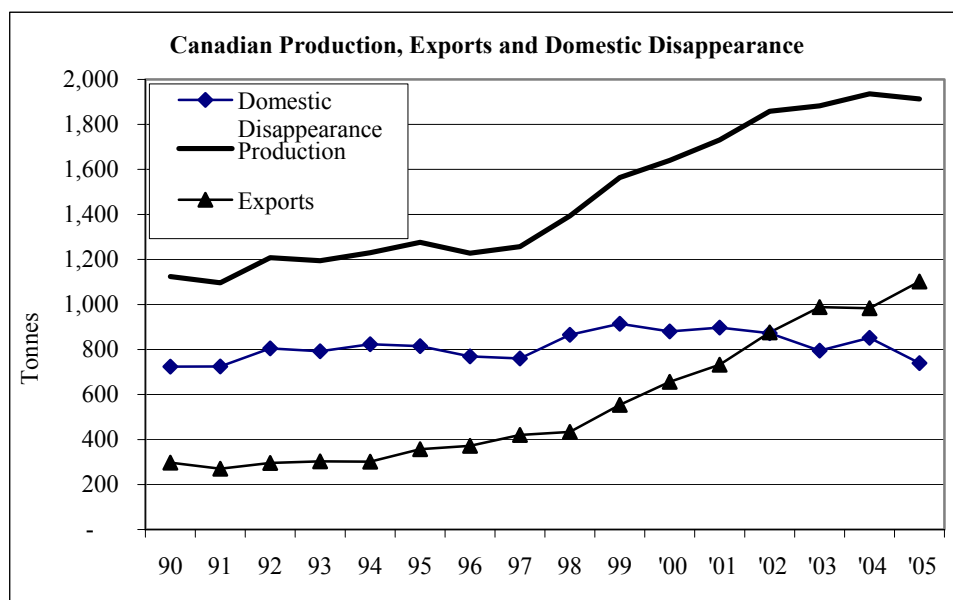


Figure 20 Source: Statistics Canada

#### 4.1.2 International Trade Prospects

Obviously, relative to other countries, Canada has a greater stake in exports and, therefore, in export market competitiveness. It is therefore important to assess longer-term issues and challenges in the export market. The Food and Agricultural Policy Research Institute (FAPRI) (FAPRI, 2006; FAPRI, 2007)<sup>5</sup> specializes in longer term macro economic forecasting. They see pork trade increasing by 2.4% annually by 2015. Over that period of time, the market share of the enlarged EU drops by 3.3 points by 2015. Canada, the U.S., and Brazil gain 1.9, 2.7, and 4.2 points of market share, respectively.

FAPRI’s analysis acknowledges Canada challenges but considers the situation to be relatively short-lived. FAPRI states that hog inventory in Canada has been declining since 2003 but forecasts that the decline turns around beginning in 2011. As a result, pork production declines 1.5% in the next two years. Over the rest of the decade, production grows 2.9%. Canada’s export of live hogs to the U.S. continues to grow at 1.5%, reaching 9.9 million head in 2016. Canada’s pork exports decline in the short run but grow by 4.8% over the rest of the decade (through 2016)

FAPRI asserts that Brazil’s long-term prospects are good; new investments are expected to improve infrastructure and raise productivity. Strong domestic and export demand fuels a 3.1% annual expansion in Brazil’s pork sector. Net pork exports grow by 6.0%, to 1.2 mmt in 2015. Improvement in productivity (breeding and feeding programs), favorable domestic policies (credit, infrastructure, fiscal), and a weakening currency improve Brazil’s competitiveness in the world pork market.

<sup>5</sup> FAPRI is a dual-university research program. With research centers at the Center for Agricultural and Rural Development (CARD) at Iowa State University and the Center for National Food and Agricultural Policy (CNFAP) at the University of Missouri-Columbia.

The EU's new member states are currently among the leading pork exporters in the world when grouped together. According to FAPRI, these countries will remain important exporters but their share of world markets will remain relatively stable or even decline by 2015.

In the EU, the decline in market share is driven by strict environmental regulations and animal welfare requirements. These factors limit the EU's (especially the EU-15's) long-term capacity, and production grows by only 0.7% annually.

China is often viewed as a potentially formidable competitor. FAPRI notes that pork is produced cheaply by backyard producers in China, but commercial producers' costs are comparable to those of other countries. The fact is, however that FAPRI sees China more as a market opportunity than as a major exporter. WTO accession for China will result in more open market opportunities in coastal population centers as tariffs are reduced from 20% to 12% and as foreign firms are allowed to engage in distribution. FAPRI sees net imports expanding significantly by 2015.

Other major importers are expected to remain as major importers. In Russia, FAPRI is forecasting that net imports decline by 1.4% as production grows faster than consumption. Russia however, is expected to remain as one of the major pork importers in the world. With WTO accession, Taiwan's pork production increases only slightly, by 1.0%, and imports expand by 8.5% to meet the 1.3% annual increases in consumption. South Korea's consumption growth, at 2.7%, is faster than its production growth, at 2.6%, and is thus met by more net imports. Improved consumer purchasing power and population growth caused pork consumption in Mexico to increase by 3.0%. Despite some industry integration, a limited supply of cheap feeds and credit problems keep growth in domestic production lagging behind.

Another aspect of FAPRI's work that needs to be considered relates to the prospects for economic growth in the world. FAPRI is forecasting that China and the important Pacific Rim countries will enjoy steady and relatively strong economic growth from now through 2015. In addition, FAPRI sees the lesser developed countries also benefiting from comparatively strong and steady economic growth. This is important because higher income, urbanization, other demographic shifts, improved transportation, and consumer perceptions regarding quality and safety are changing global food consumption patterns. Shifts in food consumption have led to increased trade and changes in the composition of world agricultural trade. In developing countries, higher income results in increased demand for meat products (Regmi, 2001).

#### **4.1.3 International Demand Conclusions**

The October 2006 George Morris Centre report clearly outlined how crucially important the export market is to Canada's pork industry and its hog producers. The FAPRI analysis shows that the world's leading pork producers, including Canada, will continue to grow and compete for share in world markets.

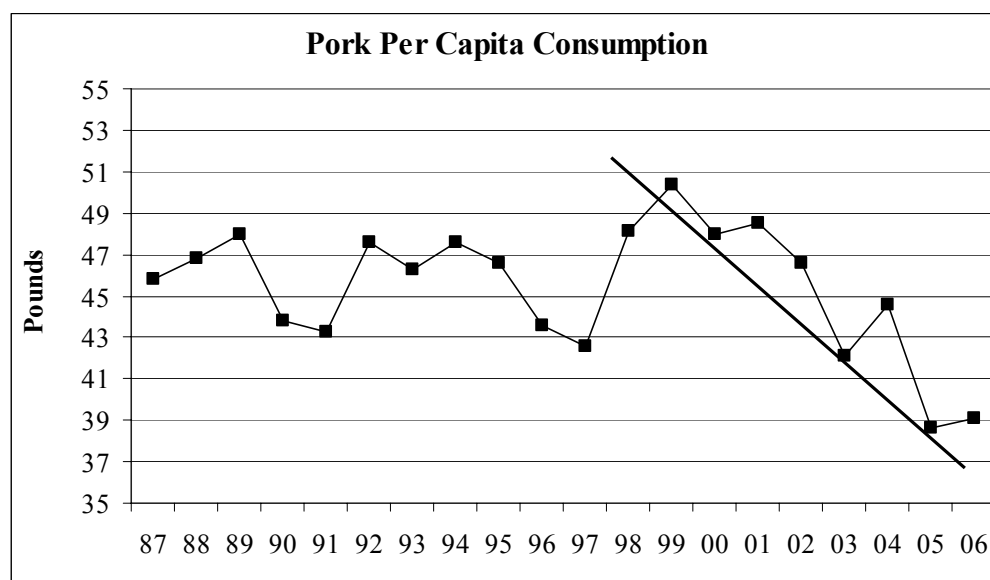
The main message garnered from FAPRI, however, is that the major import markets will remain very strong, growing markets for the world's pork producing countries. This means that the export market will continue to grow and be a source of dynamic change. The export market will always be exceptionally competitive. At the same time, however, the FAPRI research suggests

that the export market will not be a zero-sum game. That is, growth amongst competitors will not necessarily be at the expense of competitors. FAPRI sees Canada as continuing its world pork export leadership.

Based on the FAPRI analysis, the conclusion can be made that the Canadian industry can plan with a degree of certainty on growing export markets and a competitive position within those export markets.

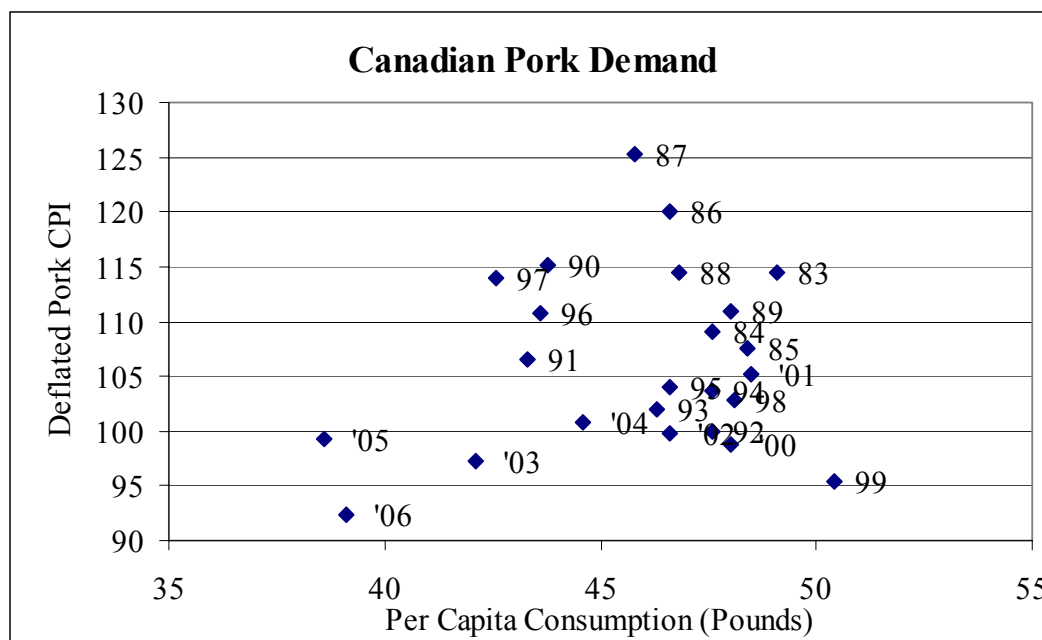
## 4.2 Canadian Domestic Demand

The following graph, figure 21, shows the per capita consumption of pork products in Canada over the last twenty years from 1987 to 2006. Per capita consumption is the total pork available (production + imports – exports) divided by the population. As can be seen, per capita consumption of pork has been decreasing in the last six years, since 1999.



**Figure 21** Source: Statistics Canada (Cansim 003-0037)

Demand is the combination of price and consumption. Demand illustrates not only the amount of product consumed, but also the price at which it was consumed. Normal demand behavior is that consumption declines when price increases and vice versa. For example, based on the per capita consumption graph above, if pricing had been increasing during the 1999 to 2006 period, it could be stated that demand had not changed.



**Figure 22** Source: Statistics Canada and George Morris Centre

A change in demand can be claimed when consumption increases along with increasing prices or when consumption decreases along with decreasing prices. In those cases, demand can be said to be increasing or decreasing respectively. Increases or decreases in demand are caused by changes in factors other than price. For example changes in incomes, preferences, or the prices of alternatives can all cause the demand for a product to change, either increasing or decreasing.

A negative relationship between price and consumption is normal and to be expected. It is the changes in demand that are caused by the external factors that are of particular interest to an industry. The previous graph, figure 22, shows Canadian pork demand from 1983 through 2006. On the vertical axis is the deflated Consumer Price Index for Pork while the horizontal axis shows per capita consumption.

The graph shows that not only has consumption been declining, as shown in the previous graph, but also that pricing has been declining. That combination illustrates declining domestic demand for pork.

In addition to the demand challenge faced by the industry, it is also facing increased competition from US packers in Canada. The following graph, figure 23, shows the two-year monthly trend in Canadian exports to the US and US exports to Canada. As can be seen, the trend appears to be an increase in US shipments to Canada and a decrease in shipments from Canada to the US. In other words, not only is the Canadian market not growing, but increasing amounts of the available market are being taken by US competitors.

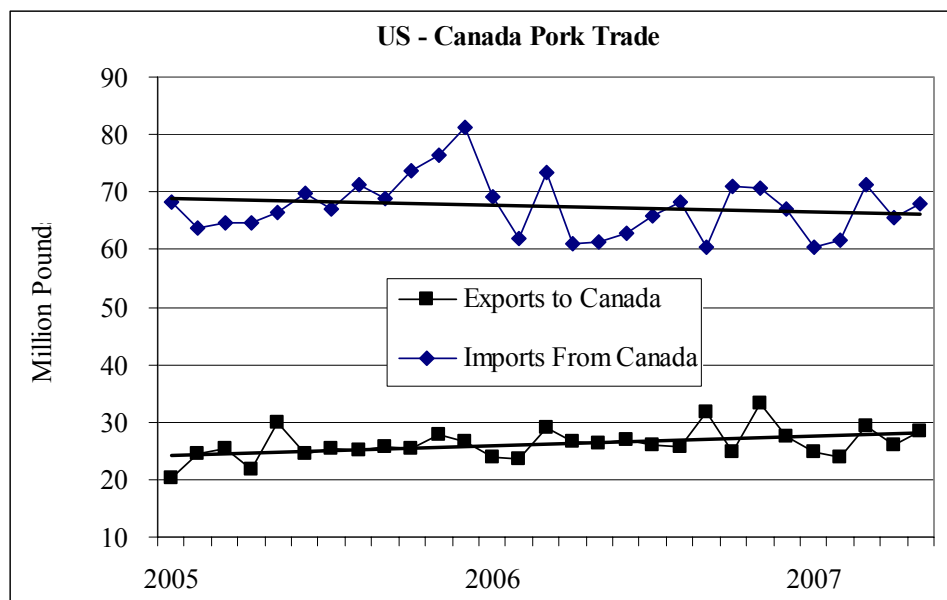


Figure 23 Source: USDA Economic Research Service Database

#### 4.2.1 North American Hog and Pork Industry Market Demand Prospects

This section of the report has illustrated that in terms of volume, the international market has become larger than the domestic market. Furthermore, while Canada is currently experiencing some export market slowdowns, the cause is related more to domestic production reductions. The reductions are not due to competitive challenges or weaknesses in international markets. In fact, FAPRI asserts that the international market will continue to grow and the major importers and major exporters will remain important participants. That is, Canada will continue to be a significant player in international markets and Canadian exports will continue to grow.

Alternatively, Canada’s domestic market appears to be suffering from declining demand. While this situation is arguably not permanent, history does not suggest that the industry can rely on the domestic market for growth.

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## **5.0 Manitoba Future Strengths and Weaknesses in the North American Context**

The previous sections of this report described the industry and what has made it grow and evolve. The prior sections also described the challenges that the industry is currently facing. This section looks at the future and how it might deal with the challenges and its prospects. The purpose of this section is to assess Manitoba's opportunities and threats within the overall pork industry.

### **5.1 Prospects for Livestock Feeding in Manitoba**

As identified above, Manitoba has encountered challenges in livestock production due to feed costs. This has been a protracted challenge, because the major rationale for livestock growth in Manitoba was the prospect of low-cost feeds. The purpose of this section is to look forward into the prospects for this most crucial component of the industry. The section seeks to place these challenges in the context of biofuel development in North America and the reorientation of the feed grain/protein complex.

#### **5.1.1 Feed grain and Livestock Issues Since 2000**

As described above, feed grain pricing in Manitoba and Western Canada has fluctuated significantly since the mid-1990's when the WTO Agreement on Agriculture was signed and the WGTA was repealed. In general, feed grain pricing increased relative to the US, and as a consequence comparative advantage in livestock feeding shifted in favour of the US Midwest. This became particularly evident in the years immediately following 2001, for a range of reasons. First, incidence of vomitoxin/fusarium increased in Manitoba barley and wheat crops which sharply decreased the extent to which local grains could be fed to livestock (especially hogs). Secondly, severe droughts were experienced throughout Western Canada in 2001 and 2002. Thirdly, the 2002 US Farm Bill increased subsidies for corn and soybean production, which had the effect of decreasing livestock feeding costs in the US.

With regard to the 2002 US Farm Bill, there were three programs authorized that clearly reduced corn prices- the marketing loan program, direct payments, and counter cyclical program payments. Each of these had the effect of maintaining or increasing acreage in corn compared with what otherwise would have occurred, which decreased the price of corn. With regard to the Marketing Loan program, the loan rates establishes an effective minimum price for corn, and separates the timing of cash sale of the crop under loan and registering for government payment. Under counter-cyclical and direct payments, payment is based on past production. Counter cyclical payments are triggered when actual prices fall below a target price; direct payments are paid regardless of price levels and current crops grown. The combined effect is to reduce the risk faced by corn growers in the US, and corn acreage responds as a result, reducing the price.

This means that the US government forced the price of corn lower but the producer did not absorb the full negative impact. Meanwhile in Canada, Ontario corn growers and western barley growers (barley is tied to corn), endured lower pricing without the benefits of the subsidies.

Finally, it has become increasingly evident since 2000 that innovation in Western grains has lagged that in the US based on yield alone, and probably also on functional attributes. The major cause of this is the product regulatory approval system in feed grains which has limited consideration of traits in product approval decisions, and as a consequence has suppressed investment in feed grain varietal research in Western Canada.

With the exception of the crop disease and drought in 2001 and 2002, the challenges are of a regulatory or policy related nature. With regard to crop disease and drought, these are part of the risk landscape that can and will be endured periodically throughout North America. These factors have passed and Manitoba producers have been able to move forward. In other words, none of Manitoba's problems in feed grains are intrinsic Manitoba-based production problems.

Nevertheless the “man-made” problems imposed on Manitoba production have been sufficient to impose losses or at least lower profitability on the Manitoba hog industry. It is these problems that Manitoba producers must face in the future.

#### Biofuels and Feedstuff Pricing

The feed grain market situation changed in late 2006 with a sudden spike in feed grain prices at the time of the US corn harvest. This situation resulted from sharply higher corn demand from US ethanol plants. As a consequence, the period since fall 2006 has been characterized by the following:

- Sharply higher feed grain prices
- Lower to steady protein feedstuff prices
- Sharply lower protein:energy feed price ratio
- Sharply lower prices for distillers' dried grains and solubles (DDGS). In the US Midwest, DDGS prices are currently lower than corn prices

These price effects have been reflected in Western Canada as well as in the US. The data shows that barely prices in late 2006 and early 2007 approach those observed during the 2001 and 2002 drought period.

#### 5.1.2 Prospects for Manitoba

As it stands, Manitoba's advantage in livestock production has eroded given its challenges related to feed grains. Ongoing exports of weanling and feeder pigs provide some indication of this. However, the changing dynamics of the feed grain and protein complex present the prospect of changing this.

First, US demand for corn as a feedstock for ethanol plants appears to be ever increasing. This has the effect of ratcheting up corn prices in the US. This effect is translated to Manitoba barley and feed wheat, which is priced competitively against corn. However, given that the demand for corn as a feedstock for biofuels in the US is growing much faster than the demand in Western Canada, it is possible that barley and feed wheat prices may not increase as much as corn prices do. This is important because competitiveness in livestock production has much more to do with relative feed costs between regions than the total feed cost itself. That is, whether profits in livestock are broadly high or low, resources will tend to flow to the region where available margins are the largest. Thus, if no further ethanol developments were to occur in Western



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Canada and the US continues on its ethanol development path, the livestock competitiveness prospects for Manitoba improve.

Secondly, related to the above, biofuel production growth is creating increased volumes of DDGS. DDGS is a feed ingredient that is used as energy and as a protein feedstuff in livestock diets. As DDGS production has increased, its price has decreased and in part, this has caused protein feedstuffs such as soy meal and canola meal to decrease in price as well. Because Manitoba has relatively little ethanol and DDGS production compared with the Midwest US, DDGS prices are higher in Manitoba than in the Midwest US. By itself, this presents a comparative advantage in livestock to the Midwest US. However, it must be understood in the context of relatively lower feed grain prices in Manitoba and relatively low proportions of DDGS that are used in most livestock species' diets. Thus, the livestock cost competitiveness effect of US biofuel development is ambiguous; it is likely to be moderately positive for Manitoba livestock.

Third, there are other developments that suggest improvements in Western Canada's feed grain efficiency are likely to occur. The western livestock industry is now more aware of the regulatory impediments to barley yields and is taking steps to have the impediments addressed. First, more attention will be focused on feed barley and barley varietal development that can provide higher yields, resistance to vomitoxins, and attributes that are useful in feeding livestock. Secondly, a broad recognition has developed that the regulatory approval system for seed and crop products in Canada contain significant inefficiencies and needs to be reformed. If reforms can be implemented, it should have the effect of increasing seed and crop product research and innovation, which can increase feed grain productivity, which in turn can increase livestock feeding competitiveness.

Finally, there are signs of a reversion toward the kind of international policy environment that favored the initial growth of livestock in Western Canada in the mid-1990's. It is likely that the US will need to reform its subsidy programs for the 2008 Farm Bill away from designs that focus on specific crops like corn, which will remove some of the price suppressing effects. There are two reasons to anticipate these changes. First, the US lost a WTO case on its cotton programs, and since the other crop programs are set up analogous to cotton, the US expects challenges to these programs if their designs are not changed. In fact, in 2007 Canada initiated a WTO challenge against US farm programs which appears to be going through a new incarnation. Secondly, in anticipation of a WTO Doha Round agreement, the US will need to spend much less on so-called price distorting subsidy programs. The ruling in the cotton case implies that all three programs described above could be interpreted as distorting, so they will need to be curtailed or redesigned in a way that is less price distorting.

The other important international policy factor is the prospect of a WTO Doha Round agreement which would increase Canada's export market access in meats. Current tariffs on beef and pork across WTO member countries range around 70%; current negotiations would see these reduced by 50-60% (i.e. the average tariff would fall to 28-35%). In effect, this would increase the demand for western Canadian meat exports, much the same as the WTO agreement on agriculture did in 1994.

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### **5.1.3 Summary on Prospects for Livestock Feeding**

The preceding suggests a moderately positive outlook for Manitoba livestock competitiveness in the future compared with history. Encouraging trends are beginning in terms of feed grains, and policy factors are lining up to reduce impediments that have hurt the industry in the past. In other words, the factors working against feed grain pricing are now widely known and producers are working to deal with them. The major factor that could act against this would be major ethanol developments in Western Canada that caused Manitoba barley and feed wheat prices to increase proportionally against US corn, or to increase more than proportionally. The driver for this would be a policy decision by the government to subsidize ethanol production on the prairies given that it is not economical without subsidies. This currently appears unlikely, but the understanding must exist that ethanol development in Western Canada is a negative for the livestock industry, especially in an environment of rising feed grain prices.

## **5.2 Manitoba and Prairie Packing Capacity Scenarios**

### **5.2.1 Current Rationalization**

As noted in section 3.2, the Canadian pork packing industry is facing daunting challenges. Primarily the industry has suffered from relatively small inefficient plants as well as lower revenue generating capability due to a lack of critical mass on by-product production. The appreciation of the Canadian dollar has resulted in increased Canadian operating costs relative to US competitors. In other words, the appreciation exposed the higher Canadian costs in US dollars relative to US plants. In addition, some plants, particularly in Quebec have labour costs that are not competitive compared to US (or other Canadian) operations. Finally, the packing industry is also suffering from labour availability challenges. This is particularly the case on the prairies, and even more so in Alberta.

These challenges have manifested themselves into an extended period of operating losses for pork packers in Canada. According to George Morris Centre estimates of pork packer margins, Canadian packers have lost money every year since 2003.<sup>6</sup> Based on margin calculations and applied to the Manitoba federal kill totals, it is likely that Manitoba packers lost \$45-50 million in total from 2004 to 2006.

These challenges have resulted in the two largest packers in Canada making major strategic decisions regarding their future operations. In 2006, Maple Leaf Foods announced that it would sell or close three plants on the prairies, one in Ontario and one in the Maritimes. This was in addition to divestment of plants in Quebec and Prince Edward Island as well as the sale of their feed business. The company is also significantly scaling back its hog production capacity.

Just as importantly, however, is the fact that Maple Leaf will finally be double-shifting its Brandon, Manitoba plant. All of Maple Leaf's prairie and in fact, all its Canadian hog slaughter capacity will be in Brandon. This plant will be the first in Canada to be a US-scale operation.

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<sup>6</sup> Margins are estimated based on R.A. Chisholm, Toronto, estimates of pork cut primal values, converted to a whole hog cutout. Hog costs and estimated operating costs are then deducted from the revenue from the pork and byproducts to determine a net margin per hog.

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Assuming that the plant can be efficiently managed, this means that Maple Leaf will operate a plant that is actually competitive with those in the US.

Montreal-based Olymel, which is the largest hog slaughter in Canada, also announced that it was going to undergo significant changes. It has closed slaughter and processing plants in Quebec and has scaled back wages in its largest Quebec-based hog slaughter operation. In addition, it has attempted and largely failed at instituting a second shift at its Red Deer, Alberta operation. Labour availability was the constraint in the second shift in Red Deer. Olymel was also an initial partner in the proposed Olywest hog packing operation in Winnipeg. As is widely known, Olymel dropped out of that venture for a variety of reasons, one of which was likely due to poor financial returns of the last few years.

In July of 2007, Olymel also made a very major move in Alberta by reducing its hog pricing formula by 12 cents per kilogram. This is a material reduction that could have serious negative ramifications for Alberta and to a lesser extent, Saskatchewan hog producers. A move of this magnitude raises questions about Olymel's ability to garner hogs for another attempt at a second shift. It also raises questions about Olymel's commitment to the prairie hog market. That is, will Olymel be a participant in the industry over the next several years?

### **5.2.2 Future Packing Scenarios on the Prairies**

As a starting point regarding the future of packing, the total marketings of live hogs needs to be tabulated. In that regard, total slaughter marketings on the prairies can be estimated at less than 200,000 head per week. That total includes slaughter on the prairies of about 165,000 per week, plus 35,000 slaughter hog exports (including sows and boars). In addition to that total there are about 90-95,000 weaner and feeder pigs that are exported off the prairies into the US every week.

From that point, the prairie slaughter capacity amounts to about 180,000 head per week. As such, from a slaughter hog perspective, marketings exceed prairie capacity by about 20,000 head per week.

With regard to the future, Maple Leaf is shutting three plants on the prairies that have a total capacity of about 45,000 head per week. That is roughly equal to the added capacity that will eventually evolve with the second shift at Brandon. As such, on the prairies, the net result is that there is little or no change in packing capacity, as a result of Maple Leaf's moves. For Manitoba, however, the overall impact of Maple Leaf's moves is a positive net result. Of the three plants Maple Leaf is closing, two are outside Manitoba and one is in Winnipeg. As such, while the total impact of the closed plants plus the added double shift is a net neutral for the prairies overall, for Manitoba, the province has gained at least 20,000 head capacity. At the very least it reduces Manitoba producers transport costs relative to the rest of the prairies. More importantly, it ensures longer term markets and more stability for the Manitoba producers.

From that point forward, the packing situation becomes one of optimistic or pessimistic scenarios, which are largely conjecture. Further complicating the scenarios is that whether optimistic or pessimistic, or neutral, either one could be plausible or defensible.

### Neutral Scenario

For example, a neutral scenario would see the current capacity situation (the net result of the Brandon double shift and the closures) stay the same. That is, Olymel at Red Deer would continue to operate a single, 45,000 head shift and Springhill would continue at around 15-20,000 per week. This scenario is realistic and defensible as a possible future for the prairies.

### Negative Scenario

A negative scenario that could play out in the next couple of years is a Red Deer closure and perhaps a closure elsewhere. This Red Deer closure was not seen as likely until this July with Olymel's big price reduction announcement. As noted above, this raises serious concerns about the future in Alberta.

### Optimistic Scenario

On the optimistic front from the producer's perspective, producers could see Olymel double shift as well as possible new plants in Saskatoon and Winnipeg. That would see capacity climb to about 255,000 head per week from the current 180,000. Capacity of that size would require that about half of the weaner and feeder exports would need to stay on the prairies.

Beyond those three scenarios, there are permutations and combinations that could evolve. For example, a positive or optimistic scenario for producers could evolve with just one of the three possibilities noted above. In the most optimistic scenario for producers, current capacity would expand by a double shift at Red Deer and possibly new plants in Manitoba and Saskatchewan. Even under his scenario, the total hogs required are available under the current sow base, assuming that the weaners and feeders would stay on the prairies. In other words, expansion is likely, but not necessary. Under the neutral scenario, current slaughter and live export levels would likely continue. Under the negative scenario, there would be larger producer attrition, particularly in Alberta. That is, the prairie sow base would need to contract by at least 100,000 head or 15%.

In any event, regardless of the overall prairie situation in packing, there are two important points to be made:

1. Manitoba will soon be home to the largest packing plant in Canada and this plant is likely going to be competitive with those in the US. Moreover, the Springhill plant will stay in production. As such, Manitoba is the only province to gain capacity based on known plans.
2. Manitoba has the easiest and least cost access to the most important US hog slaughter plants in the mid-west.

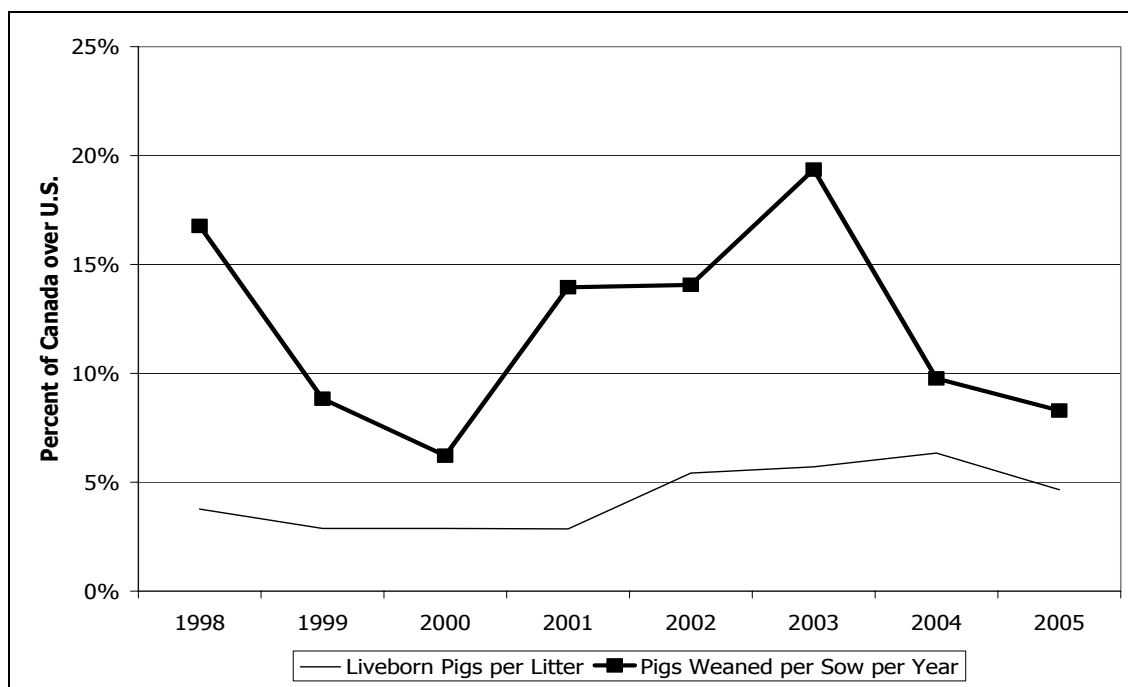
As such, while prairie scenarios can be debated, there is little overall concern regarding Manitoba's hog packing prospects.

## **5.3 Prairie Hog Producer Productivity**

Data on pig productivity in the U.S. and Canada suggest that Canada has had an advantage in farrowing exhibited by higher performance. Time series data obtained from PigCHAMP regarding breeding herd performance between Canada and the US provide some evidence. Figure 24 compares two key metrics of breeding herd efficiency: live born pigs per litter and pigs

weaned per sow per year. Since 1998, aggregate data from Canadian producers show a 12 percent average advantage in pigs weaned per sow per year or approximately an advantage of 2.77 pigs weaned per sow per year.

**Historic Differences in Canadian and US Sow Productivity**



**Figure 24** Source: PigCHAMP

Since common swine genetics are in use throughout North American and pig housing is essentially the same in the US and Canada, there is a possibility that labour productivity and management might be a significant determinant of differences in observed pig productivity. This does not necessarily mean that Canadians are intrinsically better hog managers. Furthermore these management factors can be copied and duplicated in the United States. Management, however, could be a factor due to limited marketing options for tail-enders and other off-market pigs. As a result, herd health and survival are more of a priority in Canada than in the US.

While labour productivity and management might be the keys, it is doubtful that they fully explain the Canadian advantage in this area. Another partial explanation for the Canadian advantage relates to herd health and survivability. These factors can be dependent upon management, as well as climate and geographic related herd densities. Cooler climates as well as less dense production locations can both be positive to herd health and survivability. These factors in turn are sustainable Canadian advantages. Finally, with regard to herd health, it is generally acknowledged that diseases common in the US are less common in Canada.

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## 5.4 Land Availability

### 5.4.1 Basic Location Factors for Hog Farming

While there are some necessary prerequisites for any region to become a hog farming region, the essential ingredient is that there must be somebody who wants to establish a hog farm. In North Carolina, for example, Wendel Murphy wanted to establish a large hog system and envisioned a way of doing it right where he lived. His success attracted feed mills, genetics companies and other farm supply businesses.

Obviously, if there is no market for hogs, there will be no hog farms. However, even in area where there is no formal or large scale marketing system there can be a few farms. For example a successful commercial operation could be established in Newfoundland that produced, perhaps 50 pigs per week and slaughtered them in a local abattoir and sold the pork in local communities.

While such an operation could be very successful for the owners, the incentive to replicate and expand would be very limited. The market is small. The feed sources are limited. The support structure is non-existent and transportation to other areas of the country is difficult.

So the essentials are:

- Access to feed sources.
- Good transportation services.
- Reasonable proximity to a market for the hogs.
- Some access to technical support, although this is becoming less important.

In the hog producing regions of Canada, and the US, there are two main business models for hog production. These are the land-based model and the livestock based model.

In the land based model, the ability to grow corn, or other feed grains that can utilize manure, is important. The control of feed cost is the dominant motivator. These people tend to be conventional family farmers who raise hogs as a way of generating income and adding value to crops produced.

In the livestock based model, the ability to locate farms, large enough to specialize, and separate enough to be bio-secure, is important. The biological performance of the animals is the dominant motivator. These operators tend to be business-oriented people with strengths in management and finance.

As an ideal example of the discussion above, it is noted that Corn Belt States have always been the primary pork-producing region of the United States. The reason for the region's dominance is simple: Corn Belt States together are the largest producers in the world of the two optimal inputs of hog feed rations—corn and soybeans. Commodity prices tend to be lowest at their production points, and corn and soybeans are no exception.

With feed costs accounting for 50-55 percent of the cost of producing a slaughter-ready hog, profit-maximizing behavior dictates that hog production be situated where feed costs are minimized. From 1980 to 2003, Corn Belt States have accounted for almost half of the U.S. hog

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inventory. So, in terms of U.S. hogs and grain production, the old adage “Livestock follows grain” rings true.

Iowa is, by far, the largest pork-producing State in the United States, largely by virtue of its huge grain production base. Over the past 25 years, Iowa has been the largest producer of corn and soybeans in the United States. Iowa also hosts a significant number of U.S. slaughter/processing facilities.

#### **5.4.2 Land, Hog Production and Human Population**

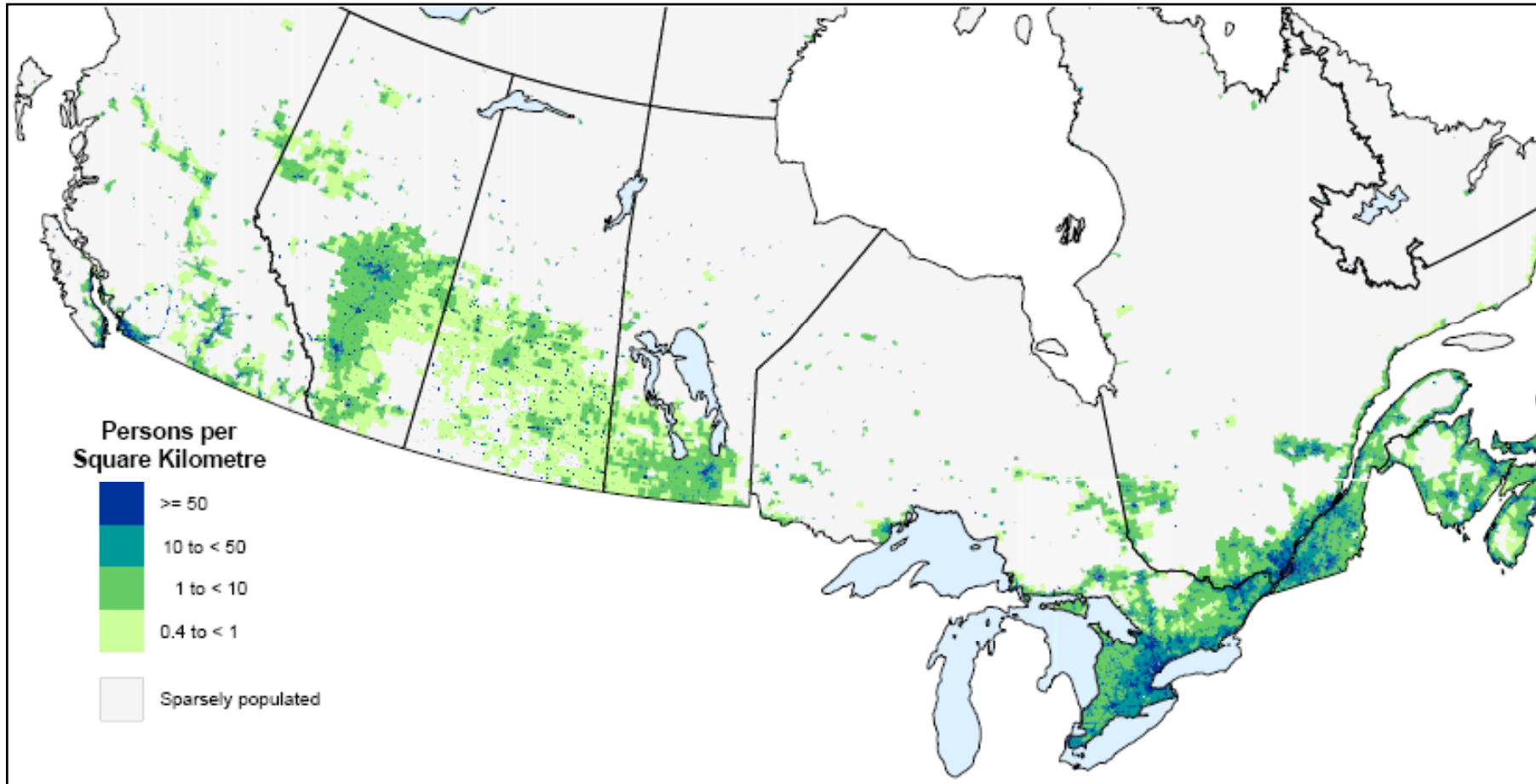
Beyond those points noted above, it is noted that hog production has not mixed well with a high-density human population. In recent years it has resulted in complaints regarding odour and concerns for environmental contamination from manure. This section compares the hog and human densities found in Manitoba with those in other provinces.

Given the location factors promoting hog production and the human population challenges, it apparent that a key factor in the future growth and prospects for the industry relate to land availability and more particularly to hog densities. This section of the report looks at hog densities in Canada from the perspective of human populations and the resulting prospects for growth.

The first figure below gives an overview of human population density across Canada. The map clearly shows the high population concentration regions: Southern Ontario, Southern Quebec, Southern Manitoba and Central Alberta. The collection of maps below shows that the highest concentration of hogs in Manitoba is in close proximity to the highest concentration of human population, Winnipeg. However, this is not dissimilar to the other provinces with high human population densities i.e. Southern Ontario and Southern Quebec. What is interesting to note is that regions directly surrounding Toronto in Ontario have lower hog densities than the major urban centres of Manitoba (Winnipeg) and Quebec (Montreal and Quebec City).

The pattern of higher hog densities in higher populated areas is evident in Saskatchewan however densities of both hogs and humans are less in Saskatchewan. Alberta (not shown) does not have very high hog densities. The highest is one county between Edmonton and Calgary that has 20-99.9 pigs per square kilometer but would appear to have relatively low human density of 1-10 people per square kilometer. These are similar densities of both hogs and humans found in the counties west of Winnipeg along the US border.

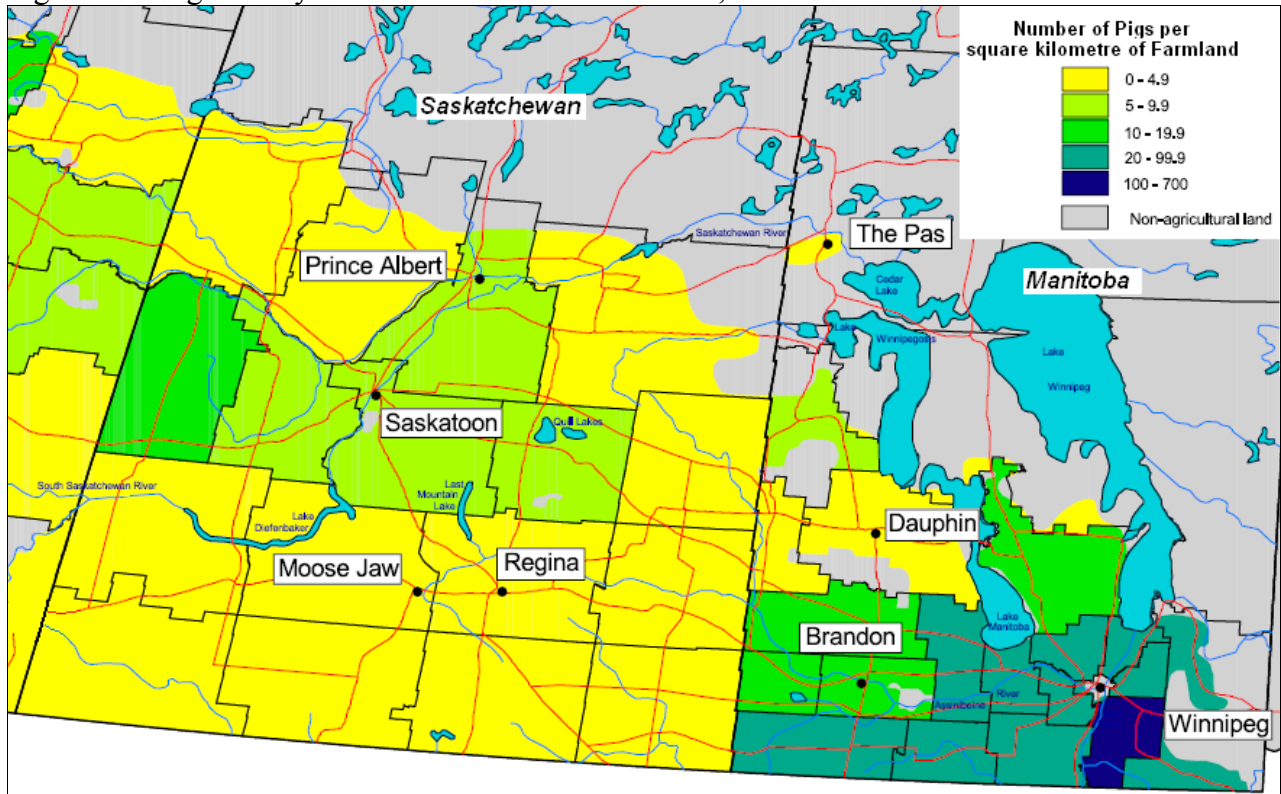
Figure 25: Canadian Population Density 2001



Source: (Statistics Canada, 2002)

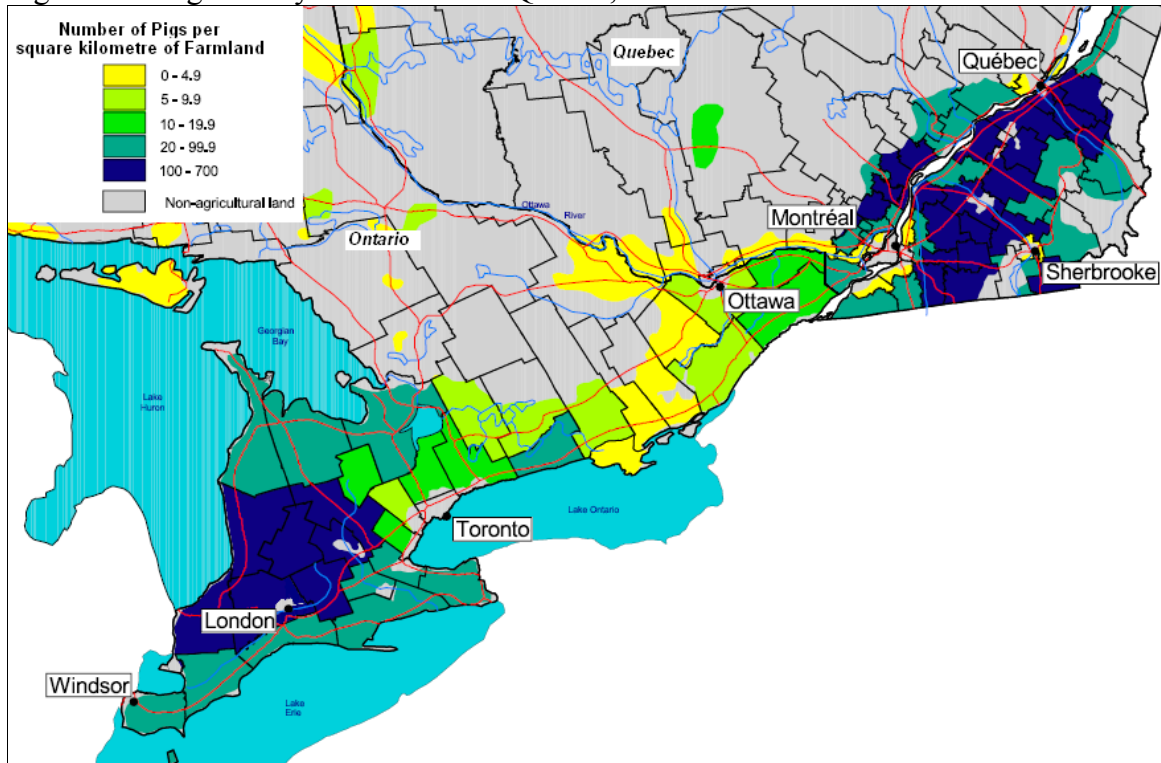


Figure 26: Hog Density in Saskatchewan and Manitoba, 2001



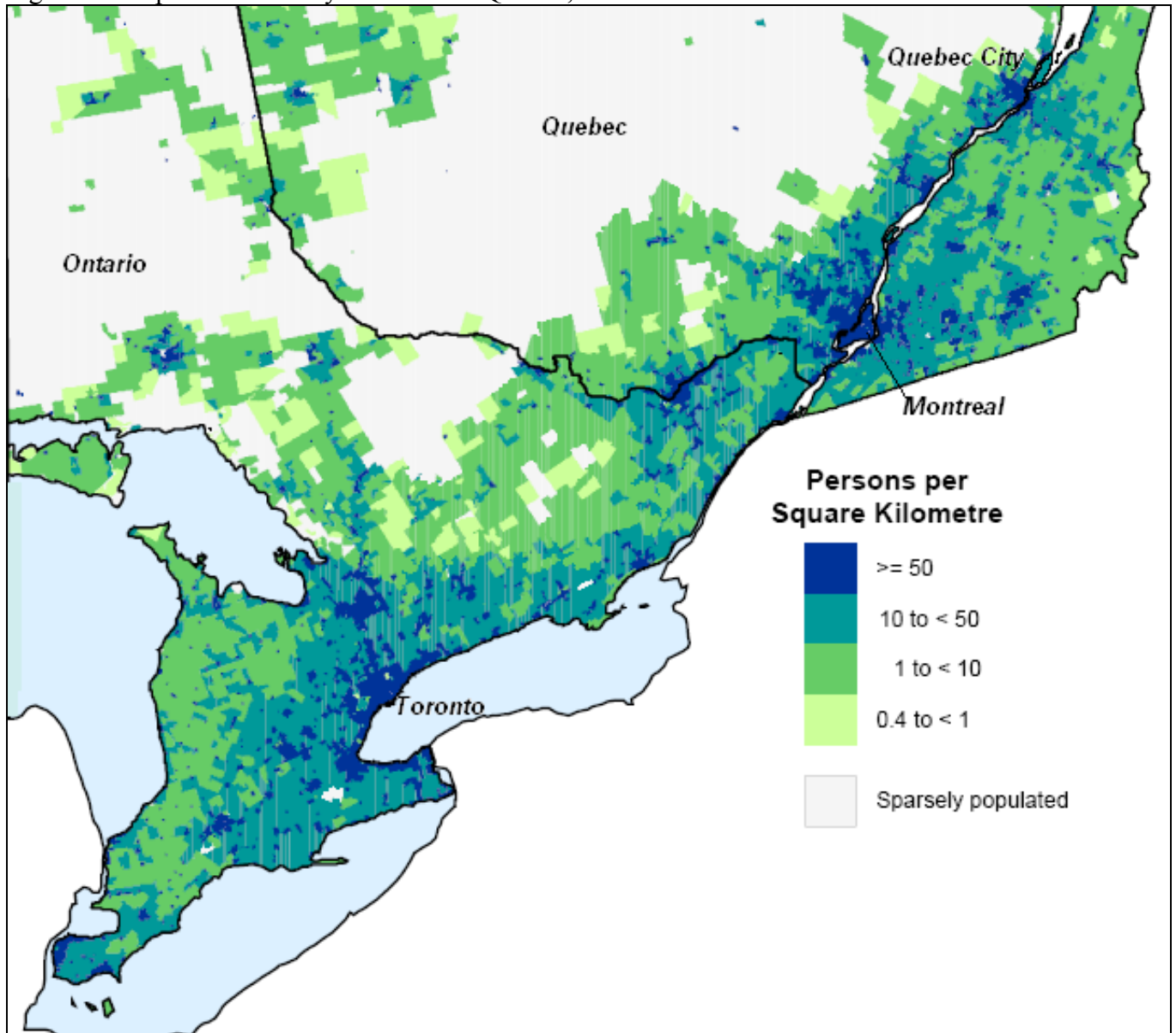
Source: (Rice, 2007)

Figure 27: Hog Density in Ontario and Quebec, 2001



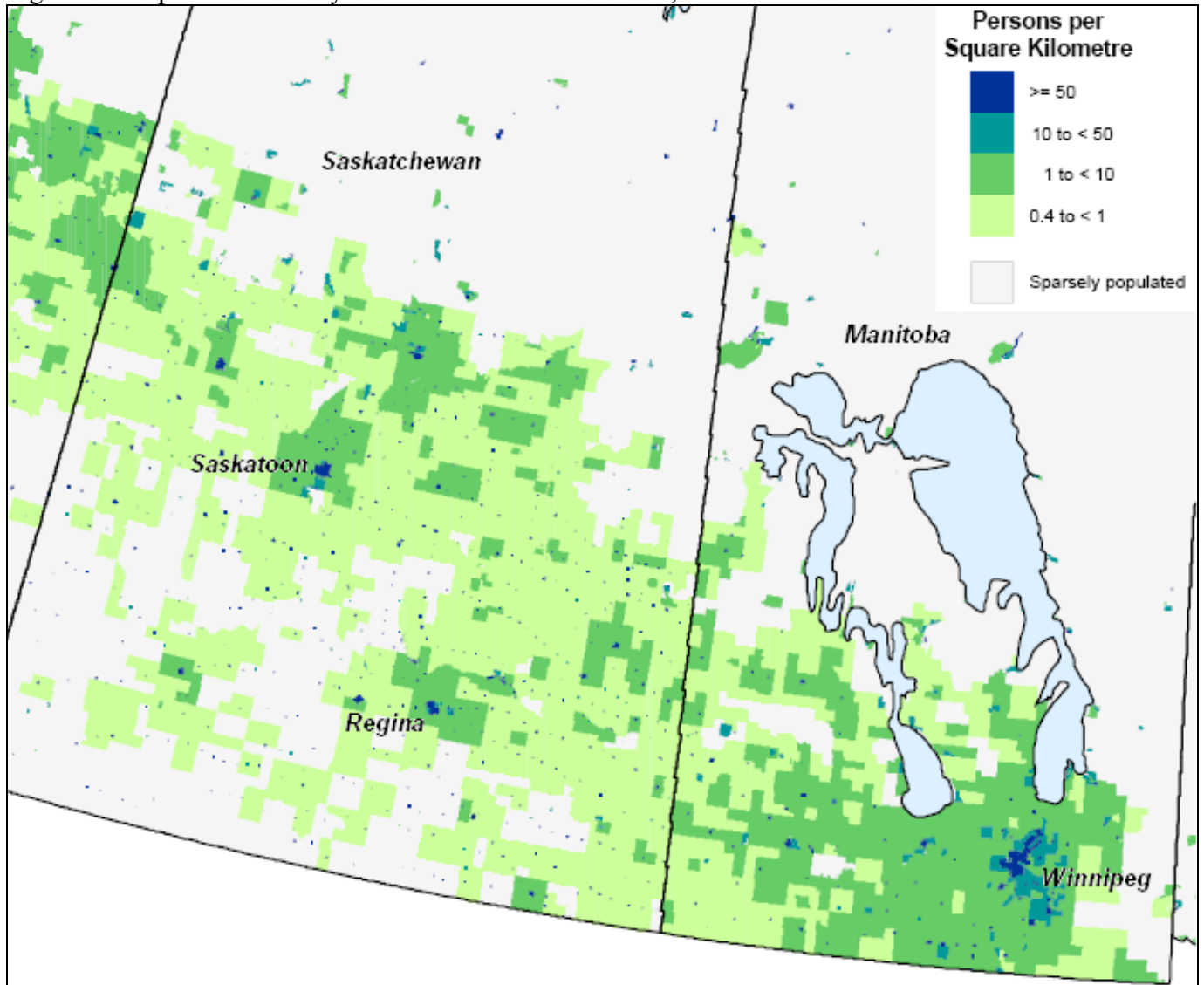
Source: (Rice, 2007)

Figure 28: Population Density Ontario and Quebec, 2001



Source: (Statistics Canada, 2002)

Figure 29: Population Density Saskatchewan and Manitoba, 2001.



Source: (Statistics Canada, 2002)

### **5.4.3 Implications and Perspective**

Hog density per square kilometer of arable farmland has been cited as a measure of industry potential when compared to the swine industry in other regions and countries. In Canada, Saskatchewan is at seven hogs produced per square kilometer; Alberta at seventeen, Manitoba at seventy-six, Ontario at 126, and Quebec at 208.

Compared to the United States and other major pork producing countries, hog production densities are not remotely an overriding issue for the prairie industry. Internationally by comparison, densities in Canada are low compared to Iowa at 212, North Carolina at 484 and the Netherlands at 1,350 pigs per square kilometer of arable farmland (Whittington, 2006).

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In addition, Canada has the second most arable land per person in the world next to Australia. Canada's arable land per person is nearly double that of competing nations such as Argentina, Brazil and the United States. In general, according to the Canadian Agri-Food Marketing Council, Canada has greater availability of fertile arable land relative to human and animal requirements than most if not all-major pork producing countries.

Clearly by any measure, the issue of hog densities is not a limiting factor in Canada let alone Manitoba regarding the future of the hog industry. The issue instead is proximity of production units to human population. In both Quebec and Manitoba, the major production regions are in reasonably close proximity to relatively higher density human population. The proximity has heightened awareness and concerns regarding environmental impacts of hog production and particularly its possible impact on humans. This at least partially explains the fact that those two provinces have instigated halts to expanded hog production.

The following section provides a detailed evaluation of the environmental implications of hog production and the impact of the environmental regulatory response to hog production.

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## 6.0 Environmental Overview

The purpose of this section is to provide a high level overview of Manitoba's regulatory regime relative to the main Canadian competing jurisdictions (Alberta, Saskatchewan, Ontario and Quebec), as well as Iowa (a US competing jurisdiction). In order to fully understand the requirements for legislation, additional sections have been included to provide context. The chapter starts with a discussion of the environmental risks posed by hog operations, followed by the voluntary and non voluntary approaches used in Manitoba and in competing jurisdictions to address environmental risks. The chapter concludes with a discussion of the future of legislation in Manitoba and the impact of environmental legislation in the jurisdictions investigated.

### 6.1 Environmental Risk Posed by Hog Operations

Environmental risk can be defined as the potential for adverse effects on living organisms associated with pollution of the environment by effluents, emissions, wastes, or accidental chemical releases; energy use; or the depletion of natural resources (US EPA, 2006).

Hog production has environmental risk associated with it as agricultural activities can have an impact on various elements of the environment, specifically, water, air, soil and biodiversity. The major source of environmental risk or degradation from hog farms is waste products - manure, urine, and bedding material (Aillery et al., 2005). The primary pollutants associated with hog manure are nutrients (particularly nitrogen and phosphorus), organic matter, solids, pathogens, and odorous/volatile compounds (US EPA, 2001). Hog manure is also a source of salts and trace elements, antibiotics, pesticides, and hormones. These pollutants can originate at several stages of production, including (Aillery et al., 2005):

- Production houses where hogs are confined;
- Manure storage structures such as tanks, ponds, and lagoons;
- Land where manure is applied.

The concentration of particular pollutants in manure varies with the type of hog, the size, maturity, and health of the individual animal, and the composition (e.g., protein content) of the feed (US EPA, 2001). Figure 30 identifies the linkages between hog production and the environment.

### Linkages between Hog Production and the Environment

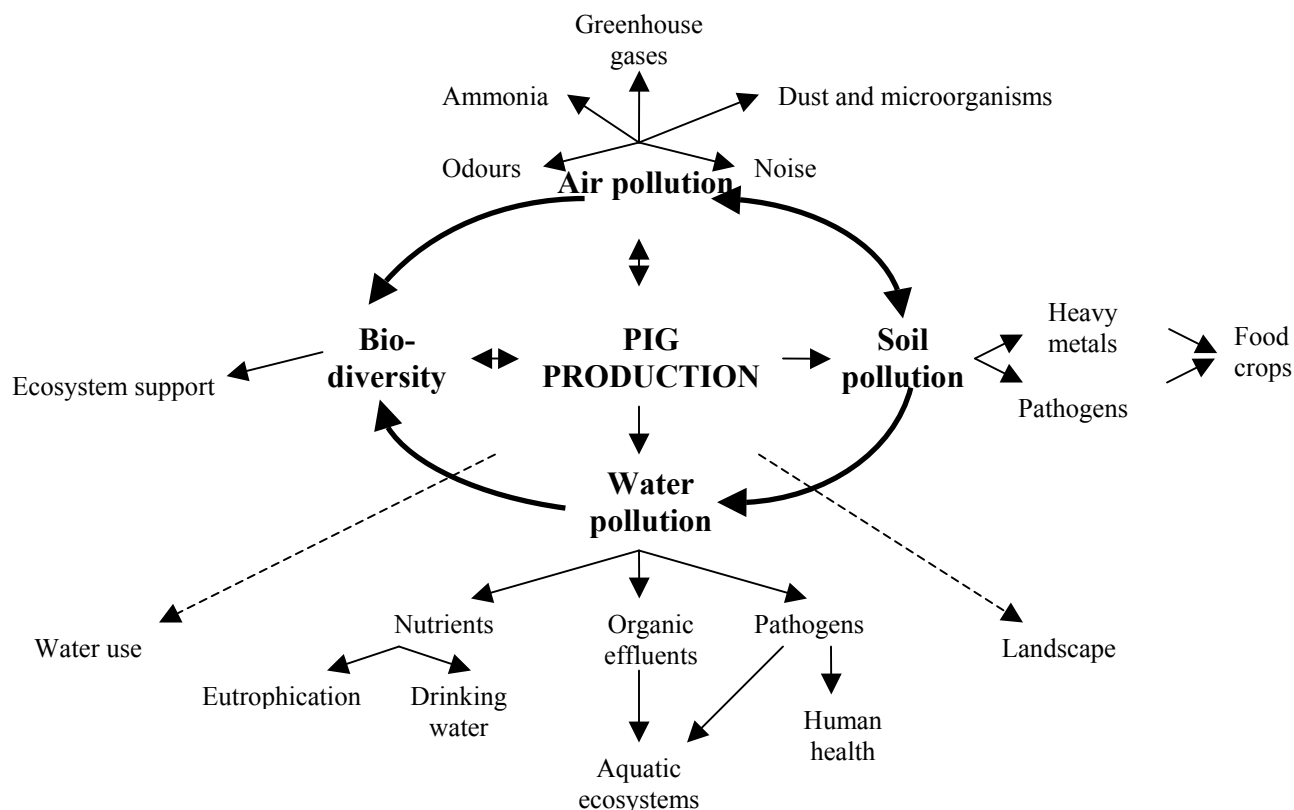


Figure 30 Source: (OECD, 2003).

The following sections provide a brief overview of the environmental risks posed by hog operations with respect to the four major elements of the environment: water, air, soil and biodiversity.<sup>7</sup>

#### Water

Water pollution from hog operations can occur from a number of sources including organic effluents, nutrients, pathogens, bacteria, hormones and antibiotics. Also a concern is the consumption of water and the impacts to the surrounding water tables.

#### Air

The production of hogs can contribute to air pollution in many different ways. The primary airborne emissions from pig farming are ammonia, methane and nitrous oxide which contribute to greenhouse gases. People living close to pig farms and those working in pig barns can also be exposed to airborne micro-organisms and dust as well as unpleasant odours and noise (ISU, 2002 as cited in (OECD, 2003); (Government of Manitoba, 2000)).

<sup>7</sup> For more detailed information of the risks posed to the environment from hog operations, refer to (Brethour et al., 2006).

### Soil

Pig production can harm soil quality and productivity through the accumulation of phosphorus, heavy metals (mainly copper and zinc), sodium and other soluble salts that are present in manure. As well, the presence of phosphate in feed leads to the production of cadmium in manure, which can also have negative impacts on the soil quality (from high concentrations of metals in the soil). The OECD (2003) found that pigs only absorb 5-15% of metal additives, and the rest is excreted.

Soils on which pig manure is applied can accumulate heavy metals, leading to crop contamination and possible human health problems, and it can also negatively impact soil performance (Haan et al., 1998 as cited in (OECD, 2003)).

Bacterial transport is also affected by soil pH. Long-term application of manure from pigs to land can result in a decrease in soil pH (Chang et al., 1991; Bernal et al., 1992 as cited in (Goss et al., 2001)). This will potentially reduce bacterial transport due to an increase in the number of binding sites available for bacterial adsorption and it may also affect bacterial survival. Application of swine manure induced larger changes in soil pH when compared to the application of cattle manure (Goss et al., 2001).

### Biodiversity

Land application of manure can have negative effects on biodiversity if managed improperly. Runoff from fields or storage systems can carry high numbers of nutrients as well as bacteria if the manure has not been incorporated or the bacteria have not been subject to stress. Phosphorus runoffs can also lead to an overgrowth of algae and aquatic plants in surface water. Increased nutrients, bacteria and overgrowth of algae and aquatic plants can negatively impact aquatic biodiversity. The entire ecosystem of the waterway can change in relation to increases in nutrients, bacteria and oxygen levels.

Given the multitude of environmental concerns from hog operations and the potential to impact water, air, soil and biodiversity, it is not surprising that the hog industry and various levels of government have responded with initiatives to reduce the risk. The following sections outline initiatives with respect to voluntary on-farm management and legislated regulation.

## **6.2 Environmental Farm Management**

Legislation and regulation have often been the principal policy tools used by Canada and its major trading partners to achieve environmental objectives (Kerr et al., 1998). However, as the challenges of the transition to sustainable production have become better understood and the limitations of regulations more apparent, the major stakeholders (government, industry and society) in environmental protection have begun to develop and experiment with other mechanisms (Kerr et al., 1998). Some of these mechanisms include market-based instruments, fiscal instruments and a range of voluntary and non-regulatory initiatives (Kerr et al., 1998).

One of the first voluntary approaches initiated to help Canadian agricultural producers reduce the impact of production was the development of the Environmental Farm Plan (EFP)<sup>8</sup>. EFPs help producers identify environmental risks and develop an action plan to mitigate these risks on their farming operations (Agriculture and Agri-Food Canada, 2005a; Agriculture and Agri-Food Canada, 2005b).

According to Wanda McFadden at the Farm Stewardship Association of Manitoba, between January 2003 and June 15, 2007, 740 livestock operations and 2,183 mixed operations in Manitoba completed an environmental farm plan. Unfortunately this data cannot be further filtered to identify solely the number of hog operations with an EFP.

The second voluntary and non-regulatory initiative instituted to address agricultural environmental risk in Canada is the concept of beneficial management practices (BMPs). The Prairie Farm Rehabilitation Administration defines a beneficial management practice as “any agricultural management practice that mitigates or minimizes negative impacts and risk to the environment, ensures the long term health of land related resources used for agriculture and does not negatively impact the long term economic viability of producers”(McGarry, 2004).

To address the issues of environmental risk posed by hog operations, producers in Manitoba have been using BMPs to manage risks on their farms for years. The following section explores the current levels of BMP adoption by hog farmers in Manitoba.

Research conducted by Le and Beaulieu (2005) examined factors leading to the implementation of BMPs for manure management on Canadian hog operations. BMPs for manure management provide a range of management options for the collection, storage, transportation, treatment and application of manure from hog operations. The report used data from the 2001 Farm Environmental Management Survey (FEMS) and 2001 Census of Agriculture representing 11,904 farms raising pigs across Canada. Although the information is slightly dated, it is useful as a point of reference. The results of the survey indicated that 48.9% of the hog producers surveyed in Manitoba had partially or fully implemented manure management BMPs.<sup>9</sup> Across Canada, the factors which positively influenced the adoption of BMPs included having a formal manure management plan, higher farm value, larger operations, having a female as the main operator and being a corporation. In addition, the results indicated that farmers in provinces with more comprehensive and stringent regulations for livestock operations were more likely to have implemented BMPs (Le and Beaulieu, 2005).

More recent data from the 2006 Census of Agriculture suggests that of the 19,054 farms in Manitoba, there are 768 farms which are predominant hog operations.<sup>10</sup> Similarly, of the

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<sup>8</sup> For more information on the Environmental Farm Plans in Manitoba, refer to the following website: <http://www.gov.mb.ca/agriculture/soilwater/farmplan/index.html>.

<sup>9</sup> Based on a sample size for Manitoba of 131 farmers.

<sup>10</sup> According to Statistics Canada, each census farm is classified according to the predominant commodity produced. This is done by estimating the potential receipts from the inventories of crops and livestock reported on the questionnaire. The commodity or group of commodities that accounts for 50% or more of the total potential receipts determines the farm type. For example, a census farm with total potential receipts of 60% from hogs, 20% from beef cattle and 20% from wheat, would be classified as a hog farm.



19,073,005 acres of farm land in Manitoba, 878,140 acres are owned by predominant hog operations.

The following tables (figures 31 and 32) present data from the 2006 Census outlining the number and percentage of predominant hog farms reporting soil conservation practices in comparison to all other farms.

**Figure 31** *Number of Predominant Hog Operations Reporting Soil Conservation Practices in Manitoba*

Soil Conservation Practice	Manitoba - Predominant Hog Operations		
	Number Reporting Soil Conservation Practices	Total Number of Operations	Percentage Reporting Soil Conservation Practices
Crop rotation	410	768	53%
Rotational grazing	104	768	14%
Winter cover crops	72	768	9%
Plowing down green crops	19	768	2%
Buffer zones around water	143	768	19%
Windbreaks or shelterbelts	391	768	51%

Source: (Statistics Canada, 2007).

**Figure 32** *Number of Other Operations Reporting Soil Conservation Practices in Manitoba*

Soil Conservation Practice	Manitoba - All Other Operations		
	Number Reporting Soil Conservation Practices	Total Number of Operations	Percentage Reporting Soil Conservation Practices
Crop rotation	11,633	18,286	64%
Rotational grazing	5,937	18,286	32%
Winter cover crops	1,338	18,286	7%
Plowing down green crops	921	18,286	5%
Buffer zones around water	2,808	18,286	15%
Windbreaks or shelterbelts	9,060	18,286	50%

Source: (Statistics Canada, 2007).

It is important to note that certain soil conservation practices listed above are likely not as relevant for hog operations such as rotational grazing. However, the data provides information on how hog farmers are managing other aspects of their farming operations such as different types of livestock and crops.

In addition, the 2006 Census provides information on manure production and use (figure 33), as well as manure application methods (figure 34) for predominant hog farms in Manitoba.

**Figure 33** *Manure Production and Use for Predominant Hog Farms in Manitoba*

Manure	Manitoba – Predominant Hog Operations
Farms reporting manure produced or used	719
Manure application on the operation	550
Manure sold or given to others	218
Manure bought or received from others	18
Other manure (composted, dried, processed, stored, etc.)	62

Source: (Statistics Canada, 2007).

**Figure 34** *Manure Application Methods for Predominant Hog Farms in Manitoba*

Manure Type	Manitoba - Predominant Hog Operations		
	Application Method		
	Incorporated or Injected (in the case of liquid manure)	Not Incorporated	Applied by Irrigation
Farms reporting composted manure	82	19	n/a
Acres	10,425	894	
Farms reporting solid manure	84	33	n/a
Acres	7,809	2,150	
Farms reporting liquid manure	336	135	17
Acres	103,648	17,761	2,852

Source: (Statistics Canada, 2007).

As part of the Agricultural Policy Framework, Canadian governments provide limited time payments to encourage adoption of beneficial management practices through programs such as the National Farm Stewardship Program (NFSP) and the Greencover Canada (GC) program. The NFSP (2005-2008) is a joint federal and provincial cost-share initiative to support environmental stewardship in agriculture by providing funding for producer adoption of BMPs (Brethour et al., 2007). The NFSP provides a maximum of \$50,000 in federal funding to producers, who have a reviewed Environmental Farm Plan, to adopt eligible BMPs (Agriculture and Agri-Food Canada, 2007a).

In Manitoba, the provincial component of the NFSP is the *Canada-Manitoba Farm Stewardship Program (CMFSP)* and is delivered by the Prairie Farm Rehabilitation Administration (PFRA).<sup>11</sup> The following tables (figures 35 and 36) provide summary statistics on BMP adoption by hog farmers in Manitoba. The statistics are cumulative from the start of the CMFSP up to March 31, 2007 (Agriculture and Agri-Food Canada, 2007a).

<sup>11</sup> For more background, please visit: [http://www.agr.gc.ca/env/efp-pfa/index\\_e.php?section=nfsp-pnga&page=intro](http://www.agr.gc.ca/env/efp-pfa/index_e.php?section=nfsp-pnga&page=intro).

**Figure 35 Hog Producers Accessing the Canada-Manitoba Farm Stewardship Program**

	Hog Producers Only	Provincial Totals (All Producers)	Hog Producers as a Percentage of Provincial Totals
Number of producers accessing CMFSP	178	2,351	7.6%
Number of Completed and Approved BMP Projects	320	4,267	7.5%
Total CMFSP Dollars (000s)*	\$823	\$8,228	10.0%
Average number of BMP projects per farm	1.8	1.8	N/A

\* Rounded to the nearest \$1,000.

Source: (Agriculture and Agri-Food Canada, 2007a).

**Figure 36 Breakdown of Farm Size (Using Total Number of Hogs per Farm) for Hog Producers who have accessed the CMFSP**

Total Number of Hogs on Farm	Hog Producers Accessing CMFSP (%)
<500	19.7%
500 - 999	19.1%
1,000 - 5,000	46.6%
>5,000	14.6%

Source: (Agriculture and Agri-Food Canada, 2007a).

#### Other General Statistics from the Canada-Manitoba Farm Stewardship Program:<sup>12</sup>

- Producers who are involved in hog production comprise approximately 7.5% of the total BMP projects in the CMFSP, and have received 10% of the CMFSP funding to date.
- Of all the hog producers participating in the CMFSP:
  - 90% are mixed farming operations, while 10% are solely livestock producers.
  - 15% raise hogs as their only livestock, while 85% have hogs plus additional livestock types.
- The 178 hog producers accessing the CMFSP represent 16.7% of the total number of hogs produced in Manitoba (based on provincial totals from the 2006 Census of Agriculture).

#### Other BMP Adoption Trends for Manitoba Hog Producers:<sup>13</sup>

- Most of the CMFSP funding accessed by producers has been used to adopt BMPs that improve on-farm manure management.

<sup>12</sup> Source: (Agriculture and Agri-Food Canada, 2007a).

<sup>13</sup> Source: (Agriculture and Agri-Food Canada, 2007a).

- Over 40% of the total BMP projects are comprised of BMPs that improve annual cropping practices.
  - Not surprising as 90% of all hog producers accessing the CMFSP are mixed farming operations, and most farms have adopted BMPs from more than one type of BMP category (as shown in figure 37).
- BMPs being adopted by hog producers are geographically distributed across all regions of Manitoba (Southwest, Northwest, Interlake, Central and Eastern).
- Areas of concentrated BMP adoption by hog producers are as follows:
  - 18% of BMPs adopted by hog producers are in the Rural Municipalities of Hanover, De Salaberry and Ste. Anne; and
  - 12% of BMPs adopted by hog producers are in the Rural Municipalities of Morris and Rhineland.

**Figure 37** *Summary of BMPs Being Implemented by Manitoba Hog Producers through the CMFSP*

Summary of BMP Categories Being Adopted		No. of BMP Projects (%)	CMFSP Funding (%)
Improving Manure Management	01 - Improved Manure Storage and Handling	17.8%	39.0%
	02 - Manure Treatment		
	03 - Manure Land Application		
	04 - In Barn Improvements		
Improving Annual Cropping Practices	14 - Improved Cropping Systems	41.7%	35.8%
	16 - Improved Pest Management		
Improving on Farm Waste and Product Management	08 - Product and Waste Management	15.0%	12.0%
Improving Nutrient Management Planning	24 - Nutrient Management Planning	4.5%	1.9%
Other	All Other BMP Categories	21.0%	11.3%

Source: (Agriculture and Agri-Food Canada, 2007a).

Although many of the BMPs adopted in Manitoba show promise, in most cases, their environmental effectiveness, technical feasibility and economic affordability have not been evaluated under Manitoba conditions (Flaten, 2006 as cited in Salvano et al., 2006). As an example, in a recent study in Eastern Manitoba, the effectiveness of vegetated buffer strips was much less than in other studies in other parts of the world (Sheppard et al., 2005 as cited in Flaten, 2006).

In more recent years, there has been the emergence of a new concept of environmental management referred to as ecological goods and services or simply ‘ecosystem services’.

### 6.3 Ecological Goods and Services

Boyd and Banzhaf (2006) define ecosystem services as components of nature, directly enjoyed, consumed, or used to yield human well-being. Ecological goods and services (EG&S) represent

the transformation of natural elements into a function useful to human beings, and can include such things as purification of air and water, maintenance of biodiversity, soil and vegetation generation and renewal, groundwater recharge through wetlands, greenhouse gas mitigation and aesthetically pleasing landscapes. Costanza (2007) takes this notion one step further and suggests that ecosystem services and the natural capital assets that produce them represent a significant contribution to sustainable human well being which is larger than the contribution of marketed goods and services.

One of the objectives of this section is to assess the contribution of the hog industry to ecological goods and services in the province of Manitoba. Manitoba currently has a pilot program entitled *Alternative Land Use Services (ALUS)* that is dedicated to enhancing the provision of ecological goods and services by farmers. The following paragraphs describe the program in more detail.

### **6.3.1 Alternative Land Use Services: Ecological Goods and Services Pilot Project**

Alternative Land Use Services (ALUS) is a program that presents an incentive-based approach to the conservation and protection of key environmental assets on privately-owned agricultural landscapes across Canada. Key environmental benefits of ALUS include clean water, improved flood control, fish and wildlife habitat, endangered species conservation, and carbon sequestration among others (Tyrchniewicz and Tyrchniewicz, 2007). Similar programs have been implemented under the Green Box provisions of the World Trade Organization in the United States, the European Union, New Zealand, Australia and several other countries (Tyrchniewicz and Tyrchniewicz, 2007).

ALUS is designed to balance the environmental demands of Canadians with policy requirements to foster a socially and economically viable agriculture and sustainable rural communities. The principle behind ALUS is that farmers and ranchers would receive payment for supplying ecological services that provide environmental benefits to the public at large from public resources on private land. Environmental goods and services (EG&S) eligible under ALUS include (Tyrchniewicz and Tyrchniewicz, 2007):

- **Wetland Services:** Landowners can enroll their wetland acres and receive an annual payment based on their type of agricultural and environmental use. The wetland must be less than 10 acres to be eligible.
- **Riparian Buffer Services:** Landowners can enroll their riparian areas and receive an annual payment based on their type of agricultural and environmental use. The riparian area must be at least 10m on each side of the water body and can be up to 100m.
- **Natural Area Services:** Landowners can enroll their natural areas and receive an annual payment based on their type of agricultural and environmental use. Natural areas include native grass lands, shrubs, and trees that have not been cultivated in the past 20 years.
- **Ecologically Sensitive Land Services:** Landowners can enroll up to 20% of their ecologically sensitive lands and receive an annual payment based on their type of agricultural and environmental use. For ALUS, ecologically sensitive lands are class 4 to 7 lands currently cultivated or have been in the past 20 years, but are at risk for severe water erosion, wind erosion, flooding, salinity, runoff or leaching. Perennial cover must be established on the land to be eligible. Farm groups have suggested that no more than

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20% ecologically sensitive lands should be taken out of production for this type of program.

To date, there are approximately 20,000 acres enrolled in the ALUS program in Manitoba<sup>14</sup>. We contacted the Project Manager to determine the number of hog producers participating in the program and the proportion of the total acres maintained by those producers. Unfortunately, because the program is still a pilot, the number of hog producers participating was small enough that there was concern that their confidentiality would be jeopardized if the data were provided.

In terms of the contribution of EG&S from the hog industry, it is important to note that some types of beneficial management practices contribute to ecological goods and services as well. For example, buffer strips<sup>15</sup>, contribute to the purification of water and thus contribute to EG&S. From the section above, the following BMPs<sup>16</sup> adopted by the hog industry also contribute to EG&S:

- Winter cover crops contribute to soil and vegetation generation and renewal
- Wind breaks and shelterbelts contribute to the maintenance of biodiversity, greenhouse gas mitigation and aesthetically pleasing landscapes.
- Improved cropping systems, for example, no tillage, contribute to soil and vegetation generation and renewal.

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<sup>14</sup> Source: Steve Ham, Project Manager for the ALUS program in Manitoba. 204-566-2270.

<sup>15</sup> Refer to figure 29 in the section above.

<sup>16</sup> It should be noted that not all BMPs contribute to EG&S, but rather manage the environmental risk posed by the operation. For example, manure management as a BMP deals with the risk posed by the farm, but does not contribute directly to EG&S in a manner that can be directly enjoyed, consumed, or used to yield human well-being.

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## 6.4 Comparison of Environmental Regulations by Jurisdiction

The purpose of this section is to compare Manitoba's current and proposed agri-environmental regulatory regimes with competing jurisdictions. Four competing Canadian jurisdictions have been selected for comparison to Manitoba: Alberta, Saskatchewan, Ontario and Quebec. In addition, the regulatory system affecting hog operations in Iowa is examined. Iowa was chosen because it is the largest hog producing state in the US and it is the destination for almost all of Manitoba's weaner and feeder exports.

### 6.4.1 Regulatory Objectives

To begin with, it is important to realize that the number and strength of environmental regulations in a particular jurisdiction may be a reflection of the intensity of agriculture in the region and the resulting environmental problems that may occur. Over the past decade, the number of hog operations in Canada has fallen; however, the average size of operations has risen. As a result, the density and concentration of hog production within the four major hog producing provinces (Quebec, Ontario, Manitoba and Alberta) has increased. As the intensity of agricultural production increases, one would typically expect the number and strength of environmental regulations to also increase. This concept was explored in more depth earlier in section 5.4.3.

In Canada, the environmental regulations are fairly reflective of the intensity of agricultural production. For example, the provinces with the largest number of hogs (Quebec, Ontario, Manitoba and Alberta) also tend to have more environmental regulations controlling agricultural operations. Not only are the regulations more numerous, they are also more detailed and restrictive.

Governments create legislation with a focus on preventing and reducing the environmental problems in their jurisdictions. While the overarching goal of environmental legislation is always the protection of the environment, the environmental problems within each jurisdiction vary and thus the objectives of the legislation may also vary. For example, the development of intensive livestock operations in Ontario created the need for legislation in the form of the *Nutrient Management Act* which sets out the legal requirements for the storage and handling of manure and other nutrients. In Manitoba, the gradual but steady increase in nitrogen and phosphorus contributions to water systems over the past several decades created the need for the *Water Protection Act* which aims to protect the province's water resources and aquatic ecosystems (Manitoba Water Stewardship, 2006a).

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### **6.4.2 Federal Legislation**

Hog operations are subject to federal environmental legislation in Canada and the United States. The legislation that applies to hog operations in Canada includes the *Canadian Environmental Protection Act*, the *Pest Control Products Act*, the *Water Act*, and the *Fisheries Act*. The federal legislation is largely punitive in nature, meaning that the laws were developed to punish polluters for negative impacts on the environment.

In the United States, under the *Clean Water Act*, the National Pollutant Discharge Elimination System (NPDES) permit program aims to control water pollution and includes a Concentrated Animal Feeding Operation (CAFO) rule. All confined feeding operations with more than 1,000 animal units are subject to NPDES permitting requirements (Iowa Department of Natural Resources, 2007b). As part of the CAFO permit, all swine CAFOs are required to implement a nutrient management plan, submit annual reports to the permitting authority, maintain a current permit, and keep records of nutrient management practices for at least five years (US EPA, 2002). Large CAFOs are also subject to additional requirements such as annual manure analysis, etc.

### **6.4.3 Current Legislation in Manitoba**

The legislation in Manitoba affecting hog operations includes the *Environment Act*, the *Water Rights Act*, the *Planning Act*, and the *Water Protection Act* as well as the corresponding regulations. The *Farm Practices Protection Act* and the *Pesticides and Fertilizers Control Act* are also relevant although not discussed in this report.

In Manitoba, responsibility for environmental management rests with the province and responsibility for land use planning rests with the municipality as it relates to livestock operations.

#### ***The Environment Act***

The *Livestock Manure and Mortalities Management Regulation* of the *Environment Act* identifies various approvals, land application restrictions, setbacks, and construction standards that are applicable in Manitoba.

#### **Construction Permits**

To begin with, a permit is required for building manure storage facilities and confined livestock areas.<sup>17</sup>

#### **Environmental Impact Assessment**

Hog operations in Manitoba are not subject to environmental impact assessments.

#### **Manure Management Plans**

Before applying manure to land for a growing season, producers must submit manure management plans for the growing season (applies to operations with 300 or more animal

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<sup>17</sup> Refer to Livestock Manure and Mortalities Regulation (42-98) – sections 6(1) and 16.1(1).



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units).<sup>18</sup> Manure management plans for the growing season must be submitted to Manitoba Conservation by July 10 for fall spreading and by February 10 for spring spreading. Manure management plans include livestock information, manure storage system information, the type, amount and nutrient composition of the manure, and details of field application (including when and where manure will be applied, soil nutrient levels, and crops to be grown).

In addition, every time producers want to spread manure, they must submit soil tests to Manitoba Conservation and upon approval, producers may spread manure.<sup>19</sup>

#### Separation Distances of Facilities from Water

Manure storage structures, field storage areas for manure, composting sites, confined areas and burial sites must be located at least 100 metres from surface watercourses, sinkholes, springs and wells (MAFRI, 2007b).

#### Separation Distances of Facilities from Dwellings, Land Boundaries and Neighbours

All new manure storage structures and confined livestock areas must be 100 metres from boundaries of operation.

#### Separation Distances for Manure Spreading from Water

Special Management Areas (SMA's) were a recent modification to the *Livestock, Manure and Mortalities Regulation*, which designate lakes and other watercourses as well as the Red River Valley and other floodplains as areas where special manure management practices are required. In terms of land application of manure, the regulation specifies minimum setback distances of manure spreading from surface water or surface watercourses depending on the manure application method and whether a permanent buffer strip exists, as shown in the following table.

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<sup>18</sup> Refer to Livestock Manure and Mortalities Regulation (42-98) – sections 13(1) and 13(4).

<sup>19</sup> Source: Marc Trudelle, Manitoba Conservation, 204-945-3789. Also, refer to Livestock Manure and Mortalities Regulation (42-98) – section 13(5).

**Figure 38**     *Setback Requirements for Manure Application from Water*

Surface Water or Surface Watercourse Feature	Manure Application Method	Manure Application Setback Width (metres) with Permanent Vegetated Buffer (metres)	Manure Application Setback Width (metres) without Permanent Vegetated Buffer
Lakes	Injection or low-level application followed by immediate incorporation	15 m setback, consisting of 15 m buffer	20 m setback
	High-level broadcast or low-level application without incorporation	30 m setback, including 15 m buffer	35 m setback
Rivers, creeks and large unbermed drains <sup>20</sup>	Injection or low-level application followed by immediate incorporation	3 m setback, consisting of 3 m buffer	8 m setback
	High-level broadcast or low-level application without incorporation	10 m setback, including 3 m buffer	15 m setback
All other types of surface water or surface watercourses	No manure application allowed.		

Source: (MAFRI, 2007b).

Separation Distances of Manure Spreading from Dwellings, Land Boundaries and Neighbours  
 Manitoba provides recommended separation distances of manure spreading from residential areas, residences and property lines, but there are no legislative requirements.<sup>21</sup>

#### Land Application of Manure – Nitrogen

The regulation sets enforceable limits on the amount of residual soil nitrate-nitrogen as well as the amount of nitrate-nitrogen that can be present in the soil at any point in time. These limits vary depending on the class of the soil.

#### Land Application of Manure – Phosphorus

In December 2006, the *Livestock Manure and Mortalities Management Regulation* of the *Environment Act* was amended to incorporate phosphorus as a consideration when determining land application practices. Therefore, the legislation now regulates manure application of phosphorus on the basis of a series of thresholds for soil test phosphorus levels. Each threshold has a specific intent and triggers a specific rate of manure application: on the basis of crop N requirements, up to two and one times P crop removal rates and prohibition of manure application when soil test phosphorus is above a certain threshold (Salvano et al., 2006). For example, if the soil test P threshold was 60ppm or less, there would be no restriction on the P application; if the soil P threshold was between 60-119ppm, the producer could apply P4 up to 2 times crop removal rate, if the soil P threshold was between 120-179ppm, the producer could

<sup>20</sup> Designated as Order 3 or greater drain on a plan of Manitoba Water Stewardship, Planning and Coordination, that shows designations of drains.

<sup>21</sup> Refer to the Farm Practices Guidelines for Pig Producers in Manitoba for more detailed information on the recommended setbacks. Source: (MAFRI, 2007b).

apply P4 at 1 times crop removal rate and if the soil P threshold was at or above 180ppm, no manure application would be allowed without written consent by the Department. The requirement for phosphorus based application of manure is gradually being phased in for different operations over time.

### Spreading Restrictions

Legislation related to land application includes a prohibition of winter spreading between November 10<sup>th</sup> and April 10<sup>th</sup> unless the operation is exempt from the regulation. Existing operations with fewer than 300 animal units of one type of livestock are exempt unless they have been ordered to cease winter application. Existing operations with 300 to 399 animal units have until November 10<sup>th</sup>, 2010 to comply with the regulation. Existing operations with more than 400 animal units and all new operations must comply with the prohibition on winter spreading (MAFRI, 2007b). As well, winter application on land with slopes greater than 12 per cent is not permitted.

In addition to the winter spreading restrictions, in December 2006, the *Livestock Manure and Mortalities Management Regulation* of the *Environment Act* was amended to allow for restrictions on fall spreading. Under the amendment, no person can apply livestock manure to land located in a regularly inundated area<sup>22</sup> between September 10<sup>th</sup> and November 10<sup>th</sup> of any year unless the manure is incorporated into the soil within 48 hours or the manure is injected. Exceptions to this prohibition include if perennial forages are established on the land or if the soil is not disturbed except for seed planting or commercial fertilizer application, and there is adequate crop residue on the land to control erosion.

### Days of Manure Storage

Manitoba legislation does not specify a minimum number of days of storage capacity for manure storage facilities. However, since livestock operations with 300 animal units or more must store all manure over winter, then there is an implied minimum number of days of storage indirectly legislated.

### *The Water Rights Act*

Under the *Water Rights Act*, an approval and/or a licence may be required to withdraw water from surface or groundwater sources. Producers require a licence for the use or diversion of water if they require more than 25,000 litres per day (MAFRI, 2007b).

### *The Planning Act*

In Manitoba, land use planning is the responsibility of local governments, as set out in the *Planning Act* (MAFRI, 2007b). Local governments use the *Planning Act* to establish local land use policies through the creation of a municipal or planning district development plans (MAFRI, 2007b). The plans designate areas for residential, recreational, commercial and agricultural uses, and local governments can use the plans to identify where prime agricultural land exists and where livestock operations can be developed. For example, municipalities or planning districts

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<sup>22</sup> A "regularly inundated area" means (a) an area subject to flooding on an average basis at least once every five years, and (b) the Red River Valley Special Management Area.

must specify areas where expansion or development of livestock operations may be allowed, allowed up to a maximum size, or not allowed (MAFRI, 2007b). Local planning documents also establish siting and development criteria, such as minimum separation distances between livestock and residential uses (MAFRI, 2007b). Zoning by-laws are enacted and must be consistent with the development plan. In areas where livestock development is allowed, operations with 300 or more animal units remain a conditional use in the zoning by-law (MAFRI, 2007b). The zoning by-law may designate operations with less than 300 animal units as permitted or conditional use.

As well, all operations with 300 or more animal units are subject to a Technical Review (MAFRI, 2007b). The purpose of the technical review is to provide the municipality or planning district with an overview of land use and development in the area as well as a review of the operation in the context of soil conditions, water resources, regulatory requirements and recommendations for siting, manure storage and manure application (MAFRI, 2007b). The review also facilitates the exchange of information between the applicant, local governments, provincial governments and the public (MAFRI, 2007b).

In addition, under the *Planning Act*, conditions may be imposed on the approval of conditional use livestock operations. For operations with less than 300 animal units, the following measures may be imposed: requiring covers on manure storage facilities and requiring shelterbelts to be established. For operations with 300 or more animal units, the operation may be required to implement recommendations from the Technical Review Committee in addition to the possibility of covers for manure storages and shelterbelts. As well, the owner of the affected property may be required to enter into a development agreement concerning timing of construction, traffic control, and construction or maintenance of roads (MAFRI, 2007b).

#### Public Notice

Public hearings are required for applications for conditional use livestock operations.

#### **The Water Protection Act**

The *Water Protection Act* was developed with the purpose of providing for the protection and stewardship of Manitoba's water resources and aquatic ecosystems (Government of Manitoba, 2007).

The key highlights from the *Water Protection Act* are as follows:

- Allows the government to set or adopt water quality standards, objectives and guidelines.
- Ability to designate any area of the province as a water quality management zone.
- Ability to govern, regulate or prohibit any use, activity or thing in a water quality management zone or any part of the zone.
- Ability to govern, regulate or prohibit the importation, possession, transfer or release of invasive species.
- Provides for the establishment of water conservation programs.
- Provides guidance as to how the government should respond to a serious water shortage.
- Allows for the designation of a watershed and the specification of its boundaries.
- Allows for the designation of a water planning authority for a watershed.

- Allows for watershed management plans to be submitted by the water planning authority within prescribed time frames.
- Outlines the contents of a watershed management plan.
- Establishes the Manitoba Water Council which has the following responsibilities:
  - To monitor the development and implementation of watershed management plans;
  - To review regulations respecting water quality management zones, and provide advice to the minister;
  - To advise the minister about matters relating to water generally;
  - To coordinate the activities of advisory boards and similar entities that perform functions relating to water;
  - To assist in reporting sustainability indicators relating to water.
- Establishes the Water Stewardship Fund to provide grants in support of watershed management plans, water conservation programs, as well as research, projects, activities and other purposes that further the purpose of the *Act*.
- Makes provisions for compliance and establishes offences and penalties for contravention of the *Act*.
- Allows for the establishment of regulations.

#### **6.4.4 Future Legislation in Manitoba**

##### **Nutrient Management Regulation**

Under the *Water Protection Act*, a draft Nutrient Management Regulation has been developed and was available for public comment until January 22, 2007. Note that further changes to the regulation may occur. The purpose of the draft *Nutrient Management Regulation* is to protect water quality by encouraging responsible nutrient planning and by regulating or prohibiting (Manitoba Water Stewardship, 2006b):

- the application to land of substances containing nitrogen or phosphorus; and
- the development of certain types of nutrient generating facilities in environmentally sensitive areas.

The draft regulation defines six water quality management zones<sup>23</sup> in which the application to land of substances containing nitrogen or phosphorus is regulated. In certain zones, land application of these substances is prohibited. In other zones, application limits are imposed in the absence of a registered manure management plan. In addition, the regulation provides for restrictions on the winter application of nutrients. The draft Nutrient Management Regulation also places restrictions on the development of certain types of nutrient generating facilities in environmentally sensitive areas. The regulation prohibits the construction, installation, siting, location, replacement, expansion and modification of manure storage facilities and confined livestock areas in certain zones except with permission from the government (Manitoba Water Stewardship, 2006b).

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<sup>23</sup> See appendix C for a description of the six water quality management zones.

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### **6.4.5 Current Legislation in Other Jurisdictions<sup>24</sup>**

This section provides an overview of specific requirements of the environmental legislation for competing jurisdictions, including Alberta, Saskatchewan, Ontario, Quebec and Iowa at the provincial and state level.

#### **Construction Permits**

The requirements for construction standards and approval are similar across the jurisdictions. In Alberta, the approval or registration of hog operations rests with the provincial Natural Resources Conservation Board (NRCB).<sup>25</sup> The procedures for proposed livestock operations are quite rigorous and the construction/expansion of confined feeding operations and manure storage is subject to hydro-geological assessments, site plans and engineering plans (Alberta Agriculture Food and Rural Development, 2002). In Quebec, proposed projects are subject to project notice or authorization certificates depending on the number of animal units<sup>26</sup> and annual phosphorus production. These certificates also rely on agro-environmental fertilization plans, the plans and specifications of storage, if applicable, and the information related to the reclamation of livestock manure or disposal.<sup>27</sup> In Iowa, proposed operations with 500-1,000 animal units must submit a construction design statement and a manure management plan. For proposed operations with more than 1,000 animal units, a construction permit is required in addition to the manure management plan.<sup>28</sup>

#### **Environmental Impact Assessment**

Quebec hog producers are more likely to be subject to environmental impact assessments than producers in other jurisdictions. The Quebec legislation requires environmental impact assessment and review procedures for the construction/expansion of buildings in a livestock operation whose total number will equal or exceed 600 animal units kept in the case of liquid manure production or 1,000 animal units in the case of semi-solid or solid manure production. In Saskatchewan, intensive livestock operation applications (large projects) are reviewed by the Environmental Assessment Branch of Saskatchewan Environment to see if they require an environmental impact assessment as defined by the *Environmental Assessment Act* (Saskatchewan Agriculture and Food, 2005). In Alberta, under the *Environmental Protection and Enhancement Act*, if the province considers that the potential environmental impacts of the proposed activity warrant further consideration, the province may require the person to submit an environmental impact assessment report. Iowa does not require an environmental impact assessment upon construction of a new hog operation.<sup>29</sup>

#### **Nutrient/Manure/Waste Management Plans**

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<sup>24</sup> This section provides a broad overview of the legislation which was reviewed as part of previous research conducted by the George Morris Centre. Source: Environmental and Economic Impact Assessments of Environmental Regulations for the Agriculture Sector: A Case Study of Hog Farming (Brethour et al., 2006).

<sup>25</sup> The Natural Resources Conservation Board (NRCB) is a regulatory agency of the Government of Alberta.

<sup>26</sup> Note that the definition of animal units varies by jurisdiction.

<sup>27</sup> Source: Agricultural Operations Regulation – sections 42 and 43.

<sup>28</sup> Source: Tom McCarthy, Iowa Department of Natural Resources, 563-927-2640. Additional information can be obtained at <http://www.iowadnr.com/afo/confine2.html>.

<sup>29</sup> Source: Tom McCarthy, Iowa Department of Natural Resources, 563-927-2640.

The environmental legislation regarding nutrient management plans is coherent across the jurisdictions in that most of the areas require producers to create plans specifying how they will manage nutrients and particularly manure within their operations. However, the specifics of the plans vary quite widely across the provinces. Some provinces such as Quebec require one plan that encompasses all aspects of nutrient management. Other provinces such as Saskatchewan require separate plans for different elements of nutrient management such as waste storage and waste management (Saskatchewan Agriculture and Food, 2005).

In addition, some areas require plans to be submitted annually while others require information submitted upon construction/expansion of facilities, but not a ‘formal’ plan. For example, Iowa requires manure management plans to be submitted annually for operations with more than 500 animal units (Iowa Department of Natural Resources, 2007a). In Alberta on the other hand, producer’s establishing a new operation or expanding an operation do not have to submit a formal plan to the NRCB; however, they must demonstrate that they have appropriate storage and land to dispose of the manure<sup>30</sup>. If the NRCB determines that the producer has sufficient land, the only future requirement is that the producer maintains records of their soil testing, the amount of manure spread, spreading locations, nitrates, etc.<sup>31</sup>

In Alberta, producers must not apply manure unless the soil has been tested within the previous three years. Note that this requirement does not apply to operations applying less than 500 tonnes of manure annually.<sup>32</sup>

#### Separation Distances of Facilities from Water

Different jurisdictions have diverse requirements for the setback of manure storage and livestock facilities from water. For example, in Saskatchewan, there are no requirements in the provincial legislation stating that manure storages and livestock facilities must be setback from water; however, where livestock operations are within 300 metres of surface water or 30 metres of a domestic well the operator must complete a manure storage plan and have this approved by the ministry of agriculture<sup>33</sup>. In Ontario, manure storages must be 15 metres from a drilled well (with depth of at least 15 metres and watertight casing), or 30 metres from any other well or 100 metres from a municipal well.<sup>34</sup> In Alberta, manure storages should be setback 100 metres from a spring or water well and 30 metres from a common body of water.<sup>35</sup> In Quebec, livestock and manure storage facilities must be 15 m from watercourses (also applies to lakes, swamps, ponds and marshes).

#### Separation Distances of Facilities from Dwellings, Land Boundaries and Neighbours

At the provincial level, Alberta specifies separation distances of facilities from neighbouring residences depending on multiple factors such as livestock odour production, type of livestock, and land zoning.<sup>36</sup> Despite the calculation, the minimum separation distance must be at least 150

<sup>30</sup> Source: Scott Cunningham, Approval Officer, NRCB, 403-340-5795.

<sup>31</sup> Source: Scott Cunningham, Approval Officer, NRCB, 403-340-5795.

<sup>32</sup> Refer to Standards and Administration Regulation (AR 267/2001) – section 25.

<sup>33</sup> Refer to Agricultural Operations Act – Saskatchewan;

<http://www.omafra.gov.on.ca/english/agops/otherregs2.htm#Saskatchewan>

<sup>34</sup> Refer to Nutrient Management Act, 2002 Regulation 267/03 – section 63.

<sup>35</sup> Refer to Standards and Administration Regulation – section 7.

<sup>36</sup> Refer to Standards and Administration Regulation – section 3(2) and Schedule 1.

metres. In Iowa, the state requires minimum separation distances from residences, businesses, churches, schools and public use areas depending on the year in which the operation was constructed, the type of structure, and animal unit capacity.<sup>37</sup>

#### Separation Distances for Manure Spreading from Water

Environmental legislation across the jurisdictions varies in terms of minimum separation distances for manure spreading from water. In Alberta, manure must not be applied within 30 metres of a water well, within 10 m of water body if subsurface injection, or within 30 metres of water body if incorporating within 48 hours.<sup>38</sup> In Ontario, agricultural source materials may not be applied to land within 15 m of a drilled well (with depth of at least 15 m and watertight casing) or within 30 m of any other well or within 100 m of a municipal well. As well, nutrients may not be applied to a field adjacent to surface water unless there is a vegetated buffer zone in the field that lies between the surface water and where the nutrients are applied. Saskatchewan provides guidelines for nutrient application rather than legislative requirements. In Iowa, separation distances of land application depend on the type of manure, the method of application, and whether or not a buffer is in place.<sup>39</sup> In Quebec, manure spreading must be 3 m from shoreline of watercourse, lake, swamp or pond and 1 m from agricultural ditches.

#### Separation Distances of Manure Spreading from Dwellings, Land Boundaries and Neighbours

In Iowa, a separation distance of land application of manure from buildings or public use areas applies in the case of liquid manure with surface application that is not incorporated within 24 hours; given this situation, the required separation distance is 750 feet.<sup>40</sup> As well, separation distances of 250 feet and 750 feet apply in the case of irrigated liquid manure at low pressure or high pressure, respectively. Otherwise, separation distances of manure spreading from buildings and public use areas do not apply (e.g. for injected manure or manure incorporated within 24 hours).

#### Land Application of Manure – Nitrogen

In Alberta, a producer must not apply manure if the nitrate-nitrogen in the soil after the manure is applied will exceed the limits specified in the legislation.<sup>41</sup> The limits depend on soil type, soil texture and the depth of the water table.

#### Land Application of Manure – Phosphorus

In Quebec, operations with liquid manure and annual phosphorus production of more than 1600 kg require a phosphorus report which must be updated annually relating to the analysis of livestock waste and the soil of cultivated parcels.<sup>42</sup> In Iowa, all manure management plans must be phosphorus index-based for operations with more than 500 animal units by 2008 (Iowa Department of Natural Resources, 2007a).

<sup>37</sup> Refer to <http://www.iowadnr.com/afo/files/distreq.pdf> for more information.

<sup>38</sup> Refer to Standards and Administration Regulation (AR 267/2001) – section 24.

<sup>39</sup> Refer to <http://www.iowadnr.com/afo/files/sepdstb4.pdf> for more information.

<sup>40</sup> Note that this separation distance does not apply: if a written waiver is issued by the owner of the building or public use area; if the manure comes from a small animal feeding operation (SAFO); or manure is applied by low pressure spray irrigation equipment (a 250 feet separation distance applies). A SAFO is defined as an animal feeding operation that has an animal unit capacity of 500 or fewer animal units.

<sup>41</sup> Refer to Standards and Administration Regulation – section 25.

<sup>42</sup> Refer to Agricultural Operations Regulation – section 35.



### Spreading Restrictions

One similarity among the jurisdictions is that they strongly discourage spreading manure on frozen or snow covered land. All of the jurisdictions analyzed have winter spreading restrictions except for Saskatchewan and Iowa. In Alberta, manure may not be applied on frozen or snow-covered land unless the NRCB approves a manure handling plan submitted by the owner or operator. In Quebec, manure may not be spread on frozen or snow covered land. Fertilizers may only be spread between April 1 and October 1 of each year. However, there is one exception to this rule; fertilizers may be spread after October 1 on ground that is not frozen or covered with snow if the agrologist who designed the agro-environmental fertilization plan specifies a new prohibition period and the proportion of livestock waste is less than 35% of the annual volume produced by the raising site. Iowa does not impose winter spreading restrictions.<sup>43</sup>

### Days of Manure Storage

Minimum manure storage requirements are legislated provincially in Alberta and Ontario. In the remaining provinces, there is no provincial legislation detailing minimum manure storage capacities, rather minimum capacities may be recommended by manure management guidelines or by government officials (as shown in figure 39). In Quebec, manure storage requirements are determined for individual hog operations during the establishment of agro-environmental fertilization plans. In Iowa, there are no specific requirements for manure storage capacities.<sup>44</sup>

**Figure 39** *Minimum Manure Storage Requirements by Province*

	AB	SK	ON	QC
Minimum manure storage capacity (days)	270 <sup>45</sup>	400*	240	n/a

\* Not legislated. 400 days of earthen manure storage is considered the standard practice and is recommended by government officials (Saskatchewan Agriculture and Food, 2005).

### Public Notice

In several jurisdictions, it is necessary for new and expanding hog operations to notify the public and neighbours regarding proposed development. In Alberta producers must notify their neighbours of development changes. Saskatchewan Agriculture and Food requires public notice if there is an application for an intensive livestock operation made. In Quebec, for developments where an environmental impact assessment statement is required, the statement is made public. As well, notice of the proposed project must be published in daily and weekly newspapers. Finally, any person may request a public hearing in connection with a proposed project. In Iowa, public notice in the local newspaper is required when constructing a new hog operation with more than 1,000 animal units.<sup>46</sup>

## **6.4.6 Comparison of Environmental Regulations by Jurisdiction**

Building upon the environmental legislation discussed above in the previous two sections,

<sup>43</sup> Note that winter spreading is not prohibited in Iowa but the state recommends that the practice be avoided.

<sup>44</sup> Source: Tom McCarthy, Iowa Department of Natural Resources, 563-927-2640.

<sup>45</sup> Does not apply to short term solid manure storage.

<sup>46</sup> Source: Tom McCarthy, Iowa Department of Natural Resources, 563-927-2640.

Figure 40 provides a summary of the specific requirements of the environmental legislation by jurisdiction, including Iowa.<sup>47</sup>

**Figure 40 Overview of Provincial and State Legislation by Jurisdiction<sup>48</sup>**

Requirement	Canada - Provincial Legislation					US
	AB	SK	MB	ON	QC	Iowa <sup>49</sup>
Construction permit	✓		✓			✓ <sup>50</sup>
Environmental Impact Assessment	If required <sup>51</sup>	If required <sup>52</sup>			✓	
Nutrient management plan	* <sup>53</sup>	✓	✓	✓	✓	✓ <sup>54</sup>
Phosphorus Specific Requirements			✓		✓	✓
Separation distances of facilities from water	✓		✓	✓	✓	✓
Separation distances of facilities from dwellings, land boundaries and neighbours	✓		✓			✓ <sup>55</sup>
Separation distances for manure spreading from water	✓		✓	✓	✓	✓ <sup>56</sup>
Winter spreading restrictions	✓		✓	✓	✓	n/a <sup>57</sup>
Days of manure storage	✓			✓		n/a
Public Notice	✓	✓ <sup>58</sup>			✓	✓

Source: Updated and adapted from (Brethour et al., 2006).

<sup>47</sup> More detailed information on the legislation can also be obtained by referring to the sources provided in Appendix B.

<sup>48</sup> Note that the review of legislation in Canada was based on the requirements for a large scale hog operation, specifically 600 sow farrow-to-finish.

<sup>49</sup> Note that the discussion of legislation for Iowa includes confined feeding operations but not open feedlot operations.

<sup>50</sup> For operations with 500-1,000 animal units, a construction design statement is required. For operations with over 1,000 animal units, a construction permit is required.

<sup>51</sup> In Alberta, under the Environmental Protection and Enhancement Act, if the province considers that the potential environmental impacts of the proposed activity warrant further consideration, the province may require the person to submit an environmental impact assessment report.

<sup>52</sup> Intensive livestock operation applications (large projects) are reviewed by the Environmental Assessment Branch of Saskatchewan Environment to see if they require an environmental impact assessment as defined by the *Environmental Assessment Act*.

<sup>53</sup> A formal plan is not required by the NRCA; however, documentation illustrating sufficient storage, land base and records of their manure disposal must be established and maintained by the producer.

<sup>54</sup> In Iowa, a manure management plan is required for confined feeding operations with more than 500 animal units as well as for new owners and those constructing, expanding, or modifying a confined feeding operation. Source: (Iowa Department of Natural Resources, 2004).

<sup>55</sup> Separation distances from residences, businesses, churches, schools and public use areas depend on the year when the operation was constructed and animal unit capacity. Source: (Iowa Department of Natural Resources, 2005).

<sup>56</sup> Separation distances regarding land application of manure depend on the type of manure, the method of application that is used and whether or not a buffer is in place. Source: (Iowa Department of Natural Resources, 2003).

<sup>57</sup> Under the Iowa Administrative Code, manure application on frozen or snow-covered land should be avoided, where possible. If manure is spread on frozen or snow-covered land, application should be limited to areas where land slopes are less than 4% or adequate erosion control practices exist. Therefore, winter spreading is not prohibited in Iowa but the state recommends that the practice be avoided. No animal feeding operation can cause water quality violations in the state. Source: (State of Iowa, 2006).

<sup>58</sup> Saskatchewan Agriculture and Food requires public notice that an application for an intensive livestock operation has been made. Source: [http://www.agr.gov.sk.ca/docs/programs\\_services/ILoreview2002.pdf](http://www.agr.gov.sk.ca/docs/programs_services/ILoreview2002.pdf).

In order to truly assess the relative impact of Manitoba's regulatory regime and compare it to competing jurisdictions (Alberta, Saskatchewan, Ontario and Quebec and Iowa), it would be necessary to conduct a cost analysis of compliance with the regulations. This was beyond the scope of this project, however, what was compared were the requirements under provincial/state regulations within each of the jurisdictions. From the comparison, it is clear that regardless of the jurisdiction, with the exception of Saskatchewan, the major pig producing provinces and Iowa are all moving toward more stringent environmental regulations to address environmental risk. That being said, modifications and additions to Manitoba's regulatory environment will have an economic impact as producers adjust to new and more stringent regulations. As one example of the potential economic impact, the following section discusses a recent study which estimated the potential cost of complying with the changes to the phosphorus modification in the *Livestock Manure and Mortalities Management Regulations*.

#### **6.4.7 Impact of Environmental Regulations in Manitoba**

A recent study completed at the University of Manitoba conducted an economic assessment of the proposed phosphorus regulations (as part of the amendments to the *Environment Act*) in Manitoba. The research was completed in two phases. The first, completed by (Salvano et al., 2006) focused on how the P-based regulations could affect maximum manure application rates for individual pig producers. To show how the new regulations would affect application rates, the researchers examined three different nutrient management options: the rates recommended under previous N-based regulations; up to two times (2X) the rate of crop P removal; and up to one time (1X) crop P removal rates (MLMMI, 2007). They also examined five nutrient management scenarios ranging from a situation where the additional land base required to comply with the new regulation was readily available to one where manure had to be treated to remove P before spreading (MLMMI, 2007).

The study suggested the costs of complying with the P regulations were as follows (Salvano et al., 2006):

- Farrowing operations faced higher costs than finishing operations.
- Grain corn cropping systems required the least additional land; forage crops the most.
- If sufficient land for accommodating the manure was not available within a 20km radius, significant additional costs were incurred.
- Use of phytase in finishing rations lowered manure management costs substantially.
- Exporting manure N to other farms and replacing it with synthetic fertilizer decreased net returns by 22% and 54% on cropping operations.

In the second part of the study (Mann and Grant, 2006) analyzed the manure management options available to producers to comply with the P-based regulations and estimated the economic impact of the P-based nutrient management regulations on a provincial scale. The study calculated the land area required by hog operations to meet current N-based manure application standards and mapped these values as area circles. Using GIS technology, they overlaid area circles to represent the area required to comply with the P-based application rates. If the additional land needed to meet the new regulations could be contained within the farm's existing land base, the added costs involved to meet the P-based application rates would be extra time, fuel and equipment wear and tear to go the additional distance. But if the outer circle

overlapped another operation's P-based spreading perimeter, producers would have to consider alternatives – either transporting the surplus manure to distant fields or installing on-farm treatment equipment to remove phosphorus (MLMMI, 2007).

Both options involved additional costs, depending on the trucking distances involved. The study assumed that if there was less than 25% overlap producers will truck the proportion of excess manure and those with over 25% overlap will treat the manure (Mann and Grant, 2006). A treatment system capable of handling up to 2.5 million gallons of manure annually carries an estimated yearly cost of \$55,000 (Mann and Grant, 2006).

The study concluded that the estimated added annual cost to the Manitoba pig industry under a maximum threshold regulation of 2x Phosphorus removal was \$17.88 million, representing 18% of the estimated annual 2005 producer net income (Mann and Grant, 2006). The estimated annual cost under a maximum threshold regulation of 1x Phosphorus removal was \$27.86 million, representing about 28% of the estimated annual 2005 producer net income (Mann and Grant, 2006).

(Mann and Grant) suggest that an estimated 57% of Manitoba's pig producers currently have enough land under the 1x Phosphorus removal threshold. Approximately 10% of producers will have to truck up to 20km; 5% will have to truck up to 40km; and 30% will need to install phosphorus-removal equipment on their farms.

The research also pointed out that the added costs are not distributed evenly across the province. Under the 1x Phosphorus removal threshold, the R.M. of Hanover will incur the greatest annual cost increases -- \$6.68 million. Other southeastern Manitoba rural municipalities like La Broquerie, De Salaberry, Morris and Ste-Anne will see estimated annual cost increases of \$2.92 million, \$1.87 million, \$1.61 and \$1.2 million respectively (Mann and Grant, 2006).

To date, no research has been released which estimates the economic impact of the proposed Nutrient Management Regulations (from the *Water Protection Act*) in Manitoba. This is largely in part because the regulations have not been finalized. However, during the provincial government consultation process the need for an economic analysis of the proposed regulations was heard throughout the various meetings from participants (Manitoba Water Stewardship and Manitoba Conservation, 2006). Concerns about the potential costs associated with the proposed regulations included: costs associated with upgrading septic fields, removing land from production, developing additional manure storage capacity, and soil testing (Manitoba Water Stewardship and Manitoba Conservation, 2006). Other issues addressed included whether the potential economic impacts of the proposed regulation would affect not only producers but also industry, government and the general public in urban and rural areas (Manitoba Water Stewardship and Manitoba Conservation, 2006) and whether the benefits associated with the proposed regulation could be assigned a dollar value (Manitoba Water Stewardship and Manitoba Conservation, 2006).

Given the information on the current and proposed nature of environmental regulations in Manitoba in comparison to competing jurisdictions, the following points become evident:

The recent changes to the *Livestock Manure and Mortalities Management Regulation* and the proposed *Nutrient Management Regulations* in Manitoba will likely increase the restrictiveness of the regulations when compared to other jurisdictions. This is due to the following changes:

- Inclusion of phosphorus as part of the regulatory process.
- Restrictions on nutrient applications in certain zones.
- Restrictions on the construction and expansion of livestock operations in certain zones.

## 6.6 Summary

Agricultural activities can have an impact on various elements of the environment, specifically, water, air, soil and biodiversity. There are a number of potential risks to the environment from hog production. Some of these include:

- Degraded water quality impacting animal and human health
  - Accelerated eutrophication
  - Pathogen and bacteria in water supply
  - Increased salinity of water supply
  - Depletion of dissolved oxygen in water supply
  - Reduction in aquatic life
  - Turbidity and siltation of the water supply
  - Antibiotics and hormones in the food supply
- Toxicity of the soil at high nutrient levels
  - Impacts on soil quality from the accumulation of heavy metals
  - Decreased soil pH for long term application of hog manure
- Increased greenhouse gas and air pollutant emissions
- Odour and noise pollution
- Impacts on aquatic biodiversity

Given the multitude of environmental concerns related to hog operations, it is not surprising that the hog industry and various levels of government have responded with initiatives to reduce the risk.

Some of the voluntary approaches taken in the province of Manitoba to address environmental risk have been the completion of environmental farm plans and the adoption of beneficial management practices. In Manitoba, 740 livestock operations and 2,183 mixed operations have completed an environmental farm plan.

Significant environmental initiatives reported in the 2006 Census of Agriculture include: 53% of predominant hog operations in Manitoba are using a crop rotation; 51% have established windbreaks or shelterbelts on their farms; and 19% are using buffers to protect water ways. All of these practices help to protect the environment.

The following points describe specific beneficial management practice (BMP) adoption under the national/provincial financial assistance programs:

- Producers who are involved in hog production comprise approximately 7.5% of the total BMP projects in the Canada Manitoba Farm Stewardship Program (CMFSP), and have received 10% of the CMFSP funding to date.

- The 178 hog producers accessing the CMFSP represent 16.7% of the total number of hogs produced in Manitoba (based on provincial totals from the 2006 Census of Agriculture).
- Most of the CMFSP funding accessed by producers has been used to adopt BMPs that improve on-farm manure management.
- Over 40% of the total BMP projects are comprised of BMPs that improve annual cropping practices.
- BMPs being adopted by hog producers are geographically distributed across all regions of Manitoba (Southwest, Northwest, Interlake, Central and Eastern).
- Areas of concentrated BMP adoption by hog producers are as follows:
  - 18% of BMPs adopted by hog producers are in the Rural Municipalities of Hanover, De Salaberry and Ste. Anne; and
  - 12% of BMPs adopted by hog producers are in the Rural Municipalities of Morris and Rhineland.

These statistics illustrate that adoption of BMPs by hog producers has been an important part of addressing the environmental risk in Manitoba and that hog producers are active participants in these programs. It should be noted however, that the effectiveness of BMPs at addressing environment risk in the province of Manitoba has yet to be determined.

Despite the voluntary initiatives, governments often decide to use legislation and regulation to fully address perceived environmental risk.

In order to truly assess the relative impact of Manitoba's regulatory regime and compare it to competing jurisdictions (Alberta, Saskatchewan, Ontario and Quebec and Iowa), it would be necessary to conduct a cost analysis of compliance with the regulations. This was beyond the scope of this project, however, what was compared were the requirements under provincial/state regulations within each of the jurisdictions. From the comparison, it is clear that regardless of the jurisdiction, with the exception of Saskatchewan, the major pig producing provinces and Iowa are all moving toward more stringent environmental regulations to address environmental risk. That being said, modifications and additions to Manitoba's regulatory environment will most certainly have an economic impact as producers adjust to new and more stringent regulations. A recap of some of the changes includes:

- Inclusion of phosphorus as part of the regulatory process.
- Restrictions on nutrient applications in certain zones.
- Restrictions on the construction and expansion of livestock operations in certain zones.

In terms of the specific economic impacts of these changes, a recent study by the University of Manitoba attempted to estimate the potential economic impact of the phosphorus changes within the Livestock Manure and Mortalities Management Regulation. The study concluded that the estimated added annual cost to the Manitoba pig industry under a maximum threshold regulation of 2x Phosphorus removal was \$17.88 million, representing 18% of the estimated annual 2005 producer net income (Mann and Grant, 2006). The estimated annual cost under a maximum threshold regulation of 1x Phosphorus removal was \$27.86 million, representing about 28% of the estimated annual 2005 producer net income (Mann and Grant, 2006).

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(Mann and Grant) also suggested that an estimated 57% of Manitoba's pig producers currently have enough land under the 1x Phosphorus removal threshold. Approximately 10% of producers will have to truck up to 20km; 5% will have to truck up to 40km; and 30% will need to install phosphorus-removal equipment on their farms.

The research also pointed out that the added costs are not distributed evenly across the province. Under the 1x Phosphorus removal threshold, the R.M. of Hanover will incur the greatest annual cost increases -- \$6.68 million. Other southeastern Manitoba rural municipalities like La Broquerie, De Salaberry, Morris and Ste-Anne will see estimated annual cost increases of \$2.92 million, \$1.87 million, \$1.61 and \$1.2 million respectively (Mann and Grant, 2006).

The *Nutrient Management Regulations* propose six water quality management zones in which the application to land of substances containing nitrogen or phosphorus will be regulated. As a result of the various water quality management zones, the restrictiveness of the regulations will not be the same across the province and across the zones. The restrictiveness of the regulations will increase the most in environmentally sensitive zones. Within environmental sensitive zones it will most certainly be more difficult for the hog industry to grow and prosper (in some cases growth is expected to be prohibited). That being said, having the regulations in place is a necessity for the protection of Manitoba's water resources given the types and magnitudes of potential risks in the environmentally sensitive zones.

Anticipated costs of the *Nutrient Management Regulations* identified by producers at the provincial government consultations include: costs associated with upgrading septic fields, removing land from production, developing additional manure storage capacity, and soil testing (Manitoba Water Stewardship and Manitoba Conservation, 2006).

Unfortunately, at this time the regulations and zones have not been finalized, therefore it is difficult to determine the number of hog operations in Manitoba that would be impacted by the increased restrictiveness of the regulations in general and more specifically within the environmentally sensitive zones. This will be an important factor in determining the overall impact of Manitoba's environmental regulations on the hog industry and its ability to grow, prosper and compete in the future.

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## Appendix A: Weaner/Feeder Sector Overview

As noted briefly above in the Manitoba Structural Evolution section 2.2, one of the most remarkable developments in Canadian agriculture has been the birth and growth of the isowean trade between Manitoba and the US Midwest. This sector is often not considered when reviewing trends in Canadian hog marketing despite the fact that it is the fastest growing livestock sector. The lack of focus on the sector is primarily due to the fact that such a large portion of the value-adding and marketing is in fact occurring in the United States. It is beyond the scope of this project to explain the rationale for this export growth except to note that Canadian sow production advantages have matched well with US mid-west finishing advantages (see section 4). Canada has developed specialization and expertise in isowean production while US hog farmers are operating nurseries and/or finishing barns. This has occurred for the following reasons:

- Private family farms in the U.S. mid-west have experienced the challenge of continuing farrowing operations, the on going labour problems especially, as the farrowing segment is the most labour-intensive.
- US farms have also experienced great difficulty in procuring prolific, healthy isoweans.
- US farms, particularly in Iowa and southern Minnesota have a competitive advantage in finishing hogs due to lower grain costs.

This section of the report provides a profile the Canadian weaner sector with a particular focus on the western industry. The section describes the industry from a production and marketing perspective.

### **Western Production Development and Lessons**

The isowean piglet (isowean being the abbreviated term for isolation wean) originally was developed in an effort to replace total repopulation of the sow herd. The piglet, after nursing on the sow for an average of 18-20 days, as well as being supplemented with creep feed and water or milk pellets, was removed from the farrowing barn location completely and moved to a nursery barn a distance away from its origin. In an effort to break the disease continuum of farrow to finish or farrow to nursery operations, this particular methodology was widely implemented in Manitoba in commercial herds in the mid-1990's.

The system was originally designed for disease elimination by breeding stock producers who primarily used the concept to eliminate disease to produce healthier breeding stock. It was thought that rather than starting clean sow herds and pig systems with Caesarean derived pigs, early weaning coupled with medication programs could produce similar results. It would cost less, take less time, and still retain the genetic resources of the parent herd.

A few veterinarians first developed the medicated early wean technique in the mid 70's for the purpose of establishing new breeding herds from enlisting farrow to finish herds. This process featured several procedures designed to reduce potential disease spread from sows to piglets:

1. Use of small groups of older sows from closed breeding herds;
2. Removal to isolated farrowing facilities during late gestation;

3. Medication of sows before farrowing and during lactations;
4. Induced, attended farrowing to ensure piglets receive colostrum and antibiotics immediately;
5. Medication of piglets throughout the suckling period as well as complete processing (i.e. tail – docking, castrations, etc.) ; and
6. Weaning the biggest, healthiest piglets possible by or just before 21 days of age to an isolated nursery to retain isowean status.

Some veterinarians hypothesized that it could be applied routinely on a large scale for commercial pig production. The key concept was that disease transmission could be reduced or eliminated provided pigs removed from the sow herd were still protected by passive maternal immunity and not exposed to older, diseased pigs. Another goal was to successfully co-mingle large numbers of farms' offspring. Many or most of the early projects involved intensive sow medication and vaccination programs, intensive piglet injections prior to weaning and extensive medication programs involving inject-able, water soluble and feed grade antibiotics to pigs upon arrival at the off site location. That nearly eliminated major pathogens in pigs 10-15 days of age.

Many early successes with breeding stock companies and commercial systems fueled some of the massive expansion in large-scale confinement systems.

The performance and results of these early weaning systems brought the following production challenges and lessons:

1. The sow was less forgiving than was first anticipated. Weaning younger than 17 days of age plays a significant role in unacceptable reductions in wean-to-first service interval, farrowing rate and total born.
2. Compliance with strict maximum age limitations (21 days) and minimum weight requirements (10 lbs. / 5 kg) is very difficult, especially as newer genetics boost litter sizes.
3. Depopulation became a technique of the past. It was too costly and time consuming. Multi-site systems made segregating the pigs easy to do. In reality, multi-site systems have far less depopulations because disease outbreaks are typically much shorter in duration than on farrow-to-finish farms which were often forced to depopulate.
4. There were false expectations in the early wean work showing success with medicated early wean (MEW) and separated early wean (SEW) that were expected to be carried into field conditions. This resulted in a greater learning curve than was initially anticipated.
5. Labour became hard to find. Labour shortages resulted in more instances of poor piglet care and increased mortality rate as well as poor farrowing house management practices and not following established isowean protocol. There has been much use by Canadian and American producers alike, of contract nurseries, finishers and wean-to-finish barns. This rapid expansion has for years created serious staffing shortages on both sides of the border as well as brought many new personnel to the industry. Personnel training has not always been as extensive or as good as it should have been. By the autumn of 2003 Manitoba experienced the beginning of what has now become a trend – the immigration of veterinarians and people having a B.Sc. degree as Swine Care Workers from the Philippines. This has given the hog industry the much needed qualifications and expertise on the front lines to facilitate improved production.
6. Diseases changed. The diseases of the '70s and '80s have been greatly reduced or all but eradicated by early weaning multi – site systems. In their place we now have PRRS (porcine

respiratory syndrome) and SIV (swine influenza virus). PRRS lacks good vaccines and basic knowledge for long – term predictable control. Vaccines seem to help with SIV but are costly and labour – intensive for large systems. Both diseases still circulate site to site. PRRS and SIV have seemingly adapted very well to the early wean systems and don't seem to have any age – specific weaning time for elimination. An outbreak or out right epidemic of either, especially in the mega – sized operations of the U.S., can actually affect markets supplies and pricing.

7. Co-mingling affects health status. It was already known early on that the industry could not successfully co-mingle 40-60 pounders (referred to as nursery pigs in Canada and feeder pigs in the U.S.). It was thought that by modified medicated early wean (MMEW) the industry could co-mingle pigs of almost any health status. In fact the industry learned that this is not an acceptable practice. Co-mingling very selectively has met with varying degrees of success. This was a finding of significance because, as a direct result of this, farrow to wean operators were pushed to expand their herds to fill, for example 1,000 head nursery barns in the U.S. When a barn could be filled with single source pigs, especially in one week's worth of farrowing, health status, size consistency and more even growth all came together for better returns. These nursery successes follow all the way to market.
8. Barn utilization changed. During the 1980's and 1990's, the typical practice was for producers to sell a pen of pigs and replaced it with a new pen of pigs. Very seldom did they have empty pig spaces. Now, with many larger producers needing to go all in all out (AIAO) because of the continuous flow of large members of piglets, this has lead to some inefficiency in barn utilization. This problem is compounded by differences in growth rate between barrows and gilts and the new packer grids with a narrow range of acceptable pigs qualifying for maximum premiums, penalizing the heavies.

Despite the challenges, early-weaned pig systems still hold many advantages such as:

- Disease control and elimination;
- Specialized labour;
- Reducing or eliminating the need for periodic depopulation / repopulation;
- Early weaning systems have made it possible to allow co-mingling an adequate number of single – age pigs weekly to fill nursery or finishing sites that can be cost effective and run AIAO by site. This has facilitated cooperatives where smaller private producers (less than 1,000 head per week) have been able to capitalize on the economies of scale of a cooperative arrangement to fit these facilities.

AIAO by site advantages becomes very obvious in the instance of a disease outbreak. The infected nursery or finishing sites are just naturally depopulated as part of their scheduled flow, thus removing the disease along with the pigs going out without any undue difficulties or additional costs. This is important as it has allowed for the large – scale use of contracting with significant leverage and geographic specialization

Pig growth rates have improved as a direct result of:

- Early wean systems;
- The use of better genetics;
- Artificial Insemination (A.I.) facilitating an improvement in genetics;
- More phase feeding;
- Split sex feeding; and,

- 
- The use of all in all out (AIAO) systems.

The industry is continuing to develop procedures and protocols, genetics and nutrition to increase average birth weights, consistency of birth weights, lactation or milk output and weaning weights and decreased weight separation at weaning. These production enhancements are major contributing factors to fairly common goals in breeding departments of 25 pigs per sow per year.

In summary, the key factors that drive, or are important to the production of weaner pigs are the following:

- Disease control;
- Absences of disease outbreaks;
- Health status;
- Genetics;
- Controlled environment;
- Industry mode:
  - Maintenance
  - Expansion;
- Environmental issues, ie: allowable building permits in suitable locals, manure storage and disposal;
- Cost of production (C.O.P.) ie: (commodities) feed, labour; Availability of labour.



## Appendix B: Sources of Legislation

Province	Statute/Regulation/ By-law	Source
<b>Iowa</b>	Iowa Administrative Code: Animal Feeding Operations	<a href="http://www.legis.state.ia.us/Rules/Current/iac/567iac/56765/56765.pdf">http://www.legis.state.ia.us/Rules/Current/iac/567iac/56765/56765.pdf</a>
	Iowa Department of Natural Resources	<a href="http://www.iowadnr.com/afo/">http://www.iowadnr.com/afo/</a>
	Federal Rules	<a href="http://www.iowadnr.com/afo/federalrules.html">http://www.iowadnr.com/afo/federalrules.html</a>
	Clean Water Act Requirements	<a href="http://www.epa.gov/npdes/pubs/cafo_brochure_swine.pdf">http://www.epa.gov/npdes/pubs/cafo_brochure_swine.pdf</a>
<b>AB</b>	Land Use Bylaw 2000/10	<a href="http://www.reddeercounty.ab.ca/county_services/index.php?main_id=144">http://www.reddeercounty.ab.ca/county_services/index.php?main_id=144</a>
	Agricultural Operations Practices Act	<a href="http://www1.agric.gov.ab.ca/\$department/deptdocs.nsf/all/acts8699?opendocument">http://www1.agric.gov.ab.ca/\$department/deptdocs.nsf/all/acts8699?opendocument</a>
	Regulation 257/2001	<a href="http://www1.agric.gov.ab.ca/\$department/deptdocs.nsf/all/acts8524?opendocument">http://www1.agric.gov.ab.ca/\$department/deptdocs.nsf/all/acts8524?opendocument</a>
	Regulation 268/2001	<a href="http://www1.agric.gov.ab.ca/\$department/deptdocs.nsf/all/acts8523?opendocument">http://www1.agric.gov.ab.ca/\$department/deptdocs.nsf/all/acts8523?opendocument</a>
	Regulation 267/2001	<a href="http://www1.agric.gov.ab.ca/\$department/deptdocs.nsf/all/acts8525?opendocument">http://www1.agric.gov.ab.ca/\$department/deptdocs.nsf/all/acts8525?opendocument</a>
	Environmental Protection and Enhancement Act	<a href="http://www.qp.gov.ab.ca/documents/Acts/E12.cfm?frm_isbn=0779727215">http://www.qp.gov.ab.ca/documents/Acts/E12.cfm?frm_isbn=0779727215</a>
	Regulation 276/2003	<a href="http://www.qp.gov.ab.ca/documents/Regs/2003_276.cfm?frm_isbn=0779740416">http://www.qp.gov.ab.ca/documents/Regs/2003_276.cfm?frm_isbn=0779740416</a>
	Water Act	<a href="http://www.qp.gov.ab.ca/documents/Acts/W03.cfm?frm_isbn=0779727428">http://www.qp.gov.ab.ca/documents/Acts/W03.cfm?frm_isbn=0779727428</a>
	Beneficial Management Practices: Environmental Manual for Hog Producers in Alberta	<a href="http://www1.agric.gov.ab.ca/\$department/deptdocs.nsf/all/epw5838">http://www1.agric.gov.ab.ca/\$department/deptdocs.nsf/all/epw5838</a>
<b>SK</b>	Zoning Bylaw	Rural Municipality of the Lake of Rivers. Received faxed copy of zoning by-law. Contact: Mervin Guillemin, Administrator, 306-642-3533.
	Agricultural Operations Act	<a href="http://www.qp.gov.sk.ca/documents/English/Statutes/Statutes/A12-1.pdf">http://www.qp.gov.sk.ca/documents/English/Statutes/Statutes/A12-1.pdf</a>
	Regulation 1	<a href="http://www.qp.gov.sk.ca/documents/English/Regulations/Regulations/A12-1R1.pdf">http://www.qp.gov.sk.ca/documents/English/Regulations/Regulations/A12-1R1.pdf</a>
	Environmental Management and Protection Act	<a href="http://www.qp.gov.sk.ca/documents/english/Statutes/Statutes/e10-21.pdf">http://www.qp.gov.sk.ca/documents/english/Statutes/Statutes/e10-21.pdf</a>
	Regulation 1	<a href="http://www.qp.gov.sk.ca/documents/english/Regulations/Regulations/e10-21r1.pdf">http://www.qp.gov.sk.ca/documents/english/Regulations/Regulations/e10-21r1.pdf</a>
	Establishing and Managing Livestock Operations Guidelines	<a href="http://www.agr.gov.sk.ca/docs/livestock/beef/production_information/Livestock_Guidelines05.pdf">http://www.agr.gov.sk.ca/docs/livestock/beef/production_information/Livestock_Guidelines05.pdf</a>
<b>MB (current and proposed legislation)</b>	Zoning Bylaw 2061	Contact: Rural Municipality of Hanover office, 204-326-4488.
	Hanover Bylaw 2077	Contact: Rural Municipality of Hanover office, 204-326-4488.
	Environment Act	<a href="http://www.canlii.org/mb/laws/sta/e-125/20051114/whole.html">http://www.canlii.org/mb/laws/sta/e-125/20051114/whole.html</a>
	Regulation 42-98	<a href="http://web2.gov.mb.ca/laws/regs/pdf/e125-042_98.pdf">http://web2.gov.mb.ca/laws/regs/pdf/e125-042_98.pdf</a>
	Water Rights Act	<a href="http://web2.gov.mb.ca/laws/statutes/ccsm/w080e.php">http://web2.gov.mb.ca/laws/statutes/ccsm/w080e.php</a>
	Planning Act	<a href="http://web2.gov.mb.ca/laws/statutes/ccsm/p080e.php">http://web2.gov.mb.ca/laws/statutes/ccsm/p080e.php</a>
	Water Protection Act	<a href="http://web2.gov.mb.ca/laws/statutes/ccsm/w065e.php">http://web2.gov.mb.ca/laws/statutes/ccsm/w065e.php</a>

Province	Statute/Regulation/ By-law	Source
	Farm Practices Guidelines for Hog Producers in Manitoba	<a href="http://www.gov.mb.ca/agriculture/livestock/pork/swine/bah00s00.html">http://www.gov.mb.ca/agriculture/livestock/pork/swine/bah00s00.html</a>
	Water Protection Act	<a href="http://web2.gov.mb.ca/laws/statutes/ccsm/w065e.php">http://web2.gov.mb.ca/laws/statutes/ccsm/w065e.php</a>
	Draft Nutrient Management Regulation	<a href="http://www.gov.mb.ca/waterstewardship/wqmqz/index.html">http://www.gov.mb.ca/waterstewardship/wqmqz/index.html</a>
ON	Nutrient Management Act	<a href="http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/02n04_e.htm">http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/02n04_e.htm</a>
	Regulation 267/03	<a href="http://www.e-laws.gov.on.ca/DBLaws/Regs/English/030267_e.htm">http://www.e-laws.gov.on.ca/DBLaws/Regs/English/030267_e.htm</a>
	Environmental Protection Act	<a href="http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/90e19_e.htm">http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/90e19_e.htm</a>
	Ontario Water Resources Act	<a href="http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/90o40_e.htm">http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/90o40_e.htm</a>
	Lakes and Rivers Improvement Act	<a href="http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/90i03_e.htm">http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/90i03_e.htm</a>
	Environmental Assessment Act	<a href="http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/90e18_e.htm#P551_44798">http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/90e18_e.htm#P551_44798</a>
QC	By-law No. 184-03	<a href="http://www.mrcrouville.qc.ca/UserFiles/File/Documents_PDF/rci184-03.pdf">http://www.mrcrouville.qc.ca/UserFiles/File/Documents_PDF/rci184-03.pdf</a>
	Environment Quality Act	<a href="http://www.canlii.org/qc/laws/sta/q-2/20051216/whole.html">http://www.canlii.org/qc/laws/sta/q-2/20051216/whole.html</a>
	Agricultural Operations Regulation	<a href="http://www2.publicationsduquebec.gouv.qc.ca/dynamicSearch/telecharge.php?type=3&amp;file=/Q_2/Q2R11_1_A.htm">http://www2.publicationsduquebec.gouv.qc.ca/dynamicSearch/telecharge.php?type=3&amp;file=/Q_2/Q2R11_1_A.htm</a>
	Regulation Respecting Environmental Impact Assessment and Review	<a href="http://www.canlii.org/qc/laws/regu/q-2r.9/20051216/whole.html">http://www.canlii.org/qc/laws/regu/q-2r.9/20051216/whole.html</a>
	Groundwater Catchment Regulation	<a href="http://www.canlii.org/qc/laws/regu/q-2r.1.3/20060412/whole.html">http://www.canlii.org/qc/laws/regu/q-2r.1.3/20060412/whole.html</a>

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## Appendix C: Representative Counties/Municipalities by Province

Province	Representative County/Municipality
Alberta	Red Deer County
Saskatchewan	Rural Municipality of Lake of the Rivers
Manitoba	Rural Municipality of Hanover
Ontario	Huron County, Municipality of South Huron
Quebec	Montérégie County, Rouville (Regional Municipality), Saint-Mathias-sur-Richelieu (municipality)

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## Appendix D: Water Quality Management Zones

The draft regulation defines six water quality management zones which can be described in the following manner (Manitoba Water Stewardship, 2006a, Manitoba Water Stewardship, 2006b):

- Zone N1 – Highly productive agricultural lands, low risk of nitrogen loss to surface or ground water when good management practices are followed, but a relatively high risk of phosphorus loss to surface water. About sixty percent of land in central and southern Manitoba is located within this zone.
  - Consists of land characterized as soil class 1, 2 or 3 other than 3M, 3ME, 3MI, 3MN, 3MP, 3MT or any other subclass of soil class 3 having an “M” designation<sup>59</sup>.
- Zone N2 – Moderately productive agricultural lands, more intensive nitrogen management is required than in zone N1 because there is a greater risk of nitrate loss to groundwater through leaching. Approximately ten to fifteen percent of land in central and southern Manitoba is located within this zone.
  - Consists of land characterized as soil class 3M, 3ME, 3MI, 3MN, 3MP, 3MT or any other subclass of soil class 3 having an “M” designation as well as soil class 4 and soil subclass 5M (if irrigated).
- Zone N3 – Marginally productive lands, with moderate risk of nutrient loss to surface or ground water. The zone is only suitable for perennial forage crops. About ten to fifteen percent of land in central and southern Manitoba is located within this zone.
  - Consists of land characterized as soil class 5 that is not included in zone N2.
- Zone N4 – Generally non-productive agricultural lands that present a significant risk of nutrient loss to surface or ground water. There should be no application of nitrogen or phosphorus in zone N4. About fifteen percent of land in central and southern Manitoba is located within this zone.
  - Consists of land characterized as soil class 6 or 7 or land comprised of unimproved organic soils.
- Zone N5 – Land not used primarily for agricultural purposes.
  - Consists of land in a city, town, village, local urban district, or a community as defined in the Northern Affairs Act.
  - Consists of a lot (2 ha or less) shown on a plan of subdivision.
  - Consists of land that is in a built-up area.
- Nutrient Buffer Zone
  - Consists of land adjacent or in proximity to water – specific distances and water bodies are outlined in the draft regulation.

Notes: Land that would otherwise be in any of nutrient management zones N1 to N4 is deemed not to be in that zone if it is in zone N5; and land that would otherwise be in any of nutrient management zones N1 to N5 is deemed not to be in that zone if it is in the Nutrient Buffer Zone.

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<sup>59</sup> Agricultural capability subclass M soils are soils with coarse textures (<http://www.gov.mb.ca/agriculture/soilwater/soil/fbe01s05.html>)

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