Alberta Government

FOOD SECURITY IN THE CONTEXT OF AGRICULTURAL LAND LOSS IN ALBERTA

A POLICY RESEARCH DOCUMENT 2017

Policy, Strategy and Intergovernmental Relations Alberta Agriculture and Forestry

Authors:
Rowshon Begam, PhD
Land Use and Resource Policy Coordinator
rowshon.begam@gov.ab.ca

Shiferaw Adilu, PhD
Director, Policy Coordination and Research
shiferaw.adilu@gov.ab.ca

This report is not intended to reflect Alberta Agriculture and Forestry's policy position on the subject of agricultural land availability or food security. It is a data based analysis that attempts to examine the relationship between domestic food security concerns and domestic food production from the perspective of agricultural land availability.

Alberta Government
Agriculture and Forestry

Table of Contents

1. Context

Alberta's renewable and non-renewable natural resources have promoted tremendous growth during the post Leduc Era (1947-1970s) of oil and gas exploration and created opportunities for Alberta's economy and people. In the last 50 years, the population in Alberta has grown by almost four times while Alberta's Gross Domestic Product has increased by more than 15 times from over $21 billion in 1961 to over $333 billion in 2015 [1,2]. Business incorporation in Alberta has doubled in the last two decades. Industrial development and diversification, municipal development, infrastructure, recreation, and conservation interests have all been growing with increasing competition for land. While all these sectors are considered more or less equally important, some outcompete others based on social needs or demands, economic values, and special interests. Since the 1950s, more and more lands have been brought under industrial, municipal, and infrastructure development. In some cases, agricultural lands were either converted for nonagricultural uses or fragmented by nonagricultural developments. At the same time, there were instances where undeveloped lands were brought under agricultural operations.

Alberta has the second largest number of farms in Canada (around 21 per cent) after Ontario; the second largest farm area (roughly 32 per cent) after Saskatchewan; and the largest cattle herd (over 41 per cent of the national total) [3-5]. In 2016, Alberta's total farm cash receipts (FCR) were $13.5 billion, the second largest after Saskatchewan accounting for over 22 per cent of the national total [6]. Alberta is also the third largest exporter of agriculture and agrifood products in Canada after Saskatchewan and Ontario, accounting for 18 per cent of the national total [7,8]. Alberta's agricultural product export value was $10 billion in 2016 following a record high of $10.2 billion in 2015 [9]. Yet, concerns with long term food security continue to arise and are often connected to the loss of agricultural land to other developments.

During the Land-use Framework public consultation in 2008, concerns were registered regarding conversion of high quality agricultural land to other uses. Of particular concern was the Highway 2 corridor between Edmonton and Calgary, where much of the current development has occurred on prime agricultural land. Subsequently, Agriculture and Forestry (AF) and Municipal Affairs explored the issue. In 2011 the Government of Alberta (GoA) determined the need to resume monitoring and reporting of agricultural land loss, while expecting municipalities under regional plans to minimize loss of agricultural land using the available tools. AF has since been reporting annually on agricultural land fragmentation and conversion in the Province [10].

AF also compiles data and analyzes changes in farming structure, productivity, profitability, demographics, post-harvest processing, marketing, and other aspects of the sector. Analyses of these changes inform policy directions and program development to ensure the sustainability of safe and quality food production for Alberta into the future.

Despite an increasing production and export trend, long term concerns for food security are often communicated to the GoA.

This report focuses on Alberta's current and projected ability to produce food to meet domestic (and global) demand in the context of availability of agricultural land into the future. Food production is not only a function of the availability or fertility of agricultural land but also impacted by weather, pests, technological advancements, provincial and national policies, commodity prices and market access, among others. While all of these issues are complex enough to warrant separate reports, this report, at a broad level, only attempts to assess Alberta's agricultural production potential into the future, from an agricultural land availability perspective, based on the current land loss rate and current technological (yield) change. The projected production is then compared to domestic demand (consumption) to provide a data-based perspective to the issue of food security in Alberta[i]

2. The evolution of agriculture in Alberta

The current structure of agriculture in Alberta is much different from the one that existed decades ago. In 1931, when the farm population count was first compiled, 51.3 per cent (over 375,000) of Alberta's population lived on a farm. By 2011, the farm population, at under 130,000, accounted for only 3.6 per cent. Meanwhile, the total population of Alberta grew over four times during the same period [11,12]. The number of farms decreased from over 97,000 in 1931 to under 41,000 in 2016. However, the total farm area increased from 39.0 million acres in 1931 to 50.3 million acres in 2016 with the average farm size getting larger - from 400 acres in 1931 to 1237 acres in 2016 [3,5,11]. Over time, Alberta's agriculture industry has shifted from small scale to commercial farming with the largest ten per cent of farms (with $500,000 or more in gross farm receipts) producing over 70 per cent of the total provincial gross farm receipts [3].

Technological change may be considered the most important underlying factor behind the structural change in the agriculture sector. Farm mechanization, and use of fertilizer and

[i] The definition of 'Food Security' used by the FAO reads as *"food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life".*

pesticides shaped the structure of Alberta's agriculture industry during the 1970s while breeding and biotechnology started to play a role in the 1980s [13]. As a result, farm size continued to increase over time, and so did farm productivity. For example, the current average yields per acre for barley, oats, and wheat are 270, 260, and 330 per cent, respectively compared to that in 1931 [14].

Alberta's agriculture sector relies greatly on the export market. Domestic demand, despite population growth, is too small to absorb most of the agricultural production. Alberta agrifood exports currently reach over 100 countries worldwide. Market access and market development are key in continuing the growth of the industry as is investment attraction to process more of the primary production [15].

3. Agricultural land in Alberta

3.1. Available farmland

The Land Suitability Rating System (LSRS) which is based on the Canada Land Inventory[ii], has grouped Alberta's soil into 7 Classes based on physical and chemical properties of soil such as texture, pH, stoniness, chemical composition, and moisture holding capacity. According to this classification, soils in Class 1 have the highest capability to support agricultural activities and are defined as having none to slight limitations. In contrast, soils in Classes 6 and 7 have the lowest capability and are defined as unsuitable for crop production [16, 17]. In general, LSRS classes 1-3 are considered prime agricultural land. Approximately 40 per cent (61.3 million acres) of Alberta's total land in both green and white zone[iii] fall in Class 2 and 3[iv], which is more than the current total farmland in Alberta (50.3 million acres), suggesting that approximately 18 per cent of the Class 2 and 3 land is either being used for nonagricultural purposes or has remained undeveloped.

The population of Alberta is projected to increase to 6 million by 2041 [18] which may

[ii] Canada Land Inventory (CLI) is a comprehensive survey of land capability for agriculture, forestry, recreation, and wildlife that adopted the classification system of soil capability for agriculture by the National Soil Survey Committee. According to CLI, there are seven classes of agricultural land capability where Class 1 lands have the highest and Class 7 lands the lowest capability to support crop production. The LSRS system is slightly more specific than the CLI system with a few more factors taken into consideration for differentiating subclasses. The LSRS system also allows for the classification of organic soils that could not be done with the CLI system. Differences between the two systems are minor and the LSRS system can be substituted for the CLI system without substantially changing land use implications.

[iii] For administrative purposes, Alberta is divided into two broad land use zones: green and white zone. The green zone (forested portion) is mostly public land where agriculture is limited to grazing only if compatible with other uses. The white zone (settled portion), on the other hand, is privately owned largely used for agricultural operations.

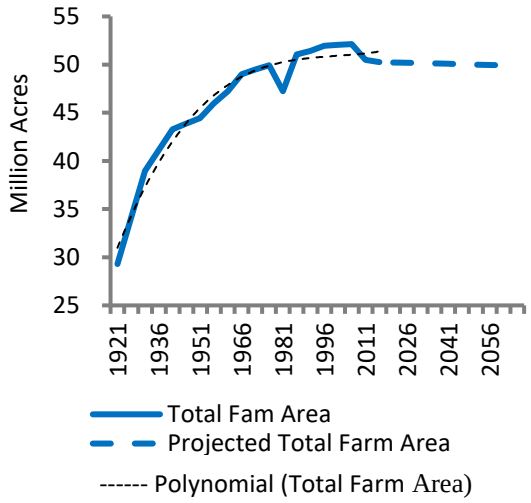
[iv] Alberta has no LSRS Class 1 land.

result in an expansion of urban areas. This may bring more land, presumably some of the prime agricultural land along the Calgary to Edmonton corridor, under urban development. Note that 60 per cent of the urban and periurban growth in the Calgary to Edmonton corridor during the 1988 and 2010 period occurred on agricultural land [16]. However, in terms of total agricultural land, the effect of urban expansion appears to have been offset by new land that was brought into agriculture. For example, according to the Agricultural Land Fragmentation and Conversion Report, Alberta lost approximately 78,200 acres to nonagricultural usage and gained 78,550 acres during 2011-2016, resulting in a net gain of 350 acres of agricultural land [10].

Some agricultural operations such as field crops, fruits and vegetables require LSRS Class 1-3 land while others such as intensive livestock operations, grazing, and greenhouse facilities may take place on all land classes including LSRS Class 4-7. However, in order to give emphasis to the loss of prime agricultural land, in this report we have projected total farmland in Alberta over the next 50 years based on projected loss or gain of LSRS Class 2 and 3 land (Figure 3.1). We have not considered potential net conversion of LSRS Class 4-7 land into agriculture which makes the projected land availability and agricultural production a conservative estimate.

According to AF's Fragmentation and Conversion of Agricultural Land reports, Alberta has lost a total of approximately 34,700 acres of LSRS Class 2 and 3 land to nonagricultural usage during the last five years (2012-2016) [10]. If this trend continues and no new land is brought into agriculture, Alberta will lose 347,000 acres of prime agricultural land over the next 50 years resulting in a decrease in the total farmland area from 50.25 million acres in 2016 to 49.90 million acres in 2066 (Figure 3.1).

Figure 3.1. Total farmland area in Alberta (1921-2016) and a projection (2021-2066).

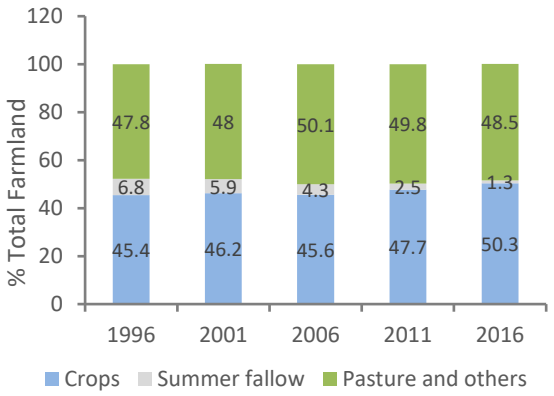


3.2. Agricultural land use intensity

Agricultural land use intensity is a term more used in sub-tropical countries or in greenhouses where up to three crops can be harvested from a given land area each year. For Alberta, where one crop is harvested from a given land area each year, intensity would relate to the degree of utilization of available farmland in a given year for either crop

production or pasture compared to summer fallow which has seen a steady decline for the last two decades[v]. According to Census data, the share of total farmland used for crop production in Alberta increased from 45.4 per cent in 1996 to 50.3 per cent in 2016 [3,11,19, 20]. The Crop production category includes area under crops, hay, fruits, field vegetables, sod, and nursery. Likewise, pasture land (native and tame) and others (unimproved, Christmas trees, woodlands and wetlands) collectively increased to 48.5 per cent of the total farmland in 2016 from 47.8 per cent in 1996. Both crop production and pasture expanded presumably at the expense of summer fallow (Figure 3.2).

Figure 3.2. Distribution of farmland in Alberta by use.



4. Production and consumption projections of agricultural products in Alberta

Availability of agricultural land and other natural factors are important determinants of production capacity to meet domestic food demand. However, in the last half century or longer, technology and better management practices have contributed more to increasing agricultural productivity, hence total production, in both crop and livestock sectors in Alberta and across the globe. The following section projects production of the major crops in Alberta for the next 50 years based on projected availability of total farmland. This projection is compared with projected provincial consumption[vi] of these crops over the next 50 years to predict Alberta's food security status into the future. While the consumption projection is based on a gradually increasing population, the production projection considered a decreasing availability of agricultural land and current yields.[vii]

In this report, a representative set of products were chosen from each of the three agricultural production sectors - field crops, livestock, and

[v] The practice of summer fallow increases availability of nutrients (especially nitrogen from mineralization) and soil water storage and helps to control weeds. Therefore, it is often used to improve crop production on organic farms where fertilizer is not available or applied.

[vi] Consumption includes human food, seed requirements, industrial use, loss in handling, animal feed, waste and dockage, and other domestic disappearance.

[vii] While technological change and innovation are major determinants of crop yield, it is difficult to accurately forecast their contribution because it is hard to accurately predict when the next technological change or innovation will occur and what the magnitude of the jump in production will be. Therefore, a "conservative" approach was followed for the projection of crop yield in this report by using the recent three-year yield average as a constant yield factor over the next 50 years.

fruits and vegetables. Historical data demonstrated that the top five field crops in Alberta excluding tame hay are wheat, canola, barley, oats, and dry pea. For the livestock sector, the production and consumption of meat (beef and veal, pork, lamb and mutton), dairy, poultry and egg were considered. For the fruits and vegetables sector all vegetables listed in the Statistics Canada CANSIM tables for farm and greenhouse vegetables (except potato) and fruits were included.

4.1. Projection methodology and data source

Relevant data were collected from Statistics Canada CANSIM tables as well as from additional sources such as AF internal sources for area and/or production of tame hay, greenfeed, and silage [21], beef and veal [22], and Canadian Dairy Information Centre (CDIC) for dairy [23]. AF internal data was used for Alberta's agrifood import value and per capita agrifood import cost [24]. Population data was obtained from a projection by Statistics Canada and Alberta Treasury Board and Finance [18].

To project agricultural land availability, the net loss of agriculturally suitable land (LSRS Class 2 and 3) during the 2011-2015 period was used to extrapolate future loss of farmland over the next 50 years. The projected area for each crop is based on the average share of total farmland seeded to that crop in the recent three Census years. Realistically, the area seeded for each crop is more likely to be determined by economic, biotic, and abiotic factors. However, predicting these factors for the next 50 years is far too complicated and conjectural. Since the focus of this analysis is food security in the context of agricultural land loss, the use of historical shares to project future land allocation by crop type is a reasonable approach to project the minimum secured production of each crop based on the total available farmland into the future (see Appendix A for details on the production and consumption of field crops).

For livestock, the production projection was a mere continuation of the recent seven-year average unless otherwise specified. A seven-year average was used with an assumption that livestock production requires a seven-year turnover cycle (see Appendix B for details).

Alberta's fruits and vegetables production data used in this report likely understate actual production since the data taken from Statistics Canada suppresses some production data for confidentiality reasons (see Appendix C for details on the production and consumption of fruits and vegetables).

Alberta's domestic consumption of each product was calculated by multiplying the national per capita consumption by Alberta's population. Projected increases in domestic consumption were calculated by multiplying projected population by the 2014-2016 three year average per capita consumption, assuming

increases in total consumption of each product are driven by population growth.

5. Results and discussion

5.1. Field Crops

Wheat

Alberta is known for the quantity and quality of wheat it produces. Wheat is one of the most important field crops in Alberta accounting for approximately $1.9 billion per year in FCR [25]. There are more than 14,000 farmers growing wheat on about 6.8 million acres of land in Alberta each year [26].

Total land seeded to wheat peaked during 1989-1992 followed by a slow decline over the last two decades. However, wheat production continued to increase due to an increase in yield per acre (Figure 5.1.a). Alberta's total wheat production in 2016 was almost 10 million tonnes which is projected to continue more or less over the next 50 years.

Alberta's domestic wheat consumption on the other hand was 0.95 million tonnes in 2016, and is projected to increase to 2 million tonnes, an increase from 10 per cent to 22 per cent of the total production in 2066. This suggests that Alberta's wheat production will remain surplus[viii] by up to 80 per cent over the next 50 years (Figure 5.1.b).

Figure 5.1.a. Production of wheat in Alberta

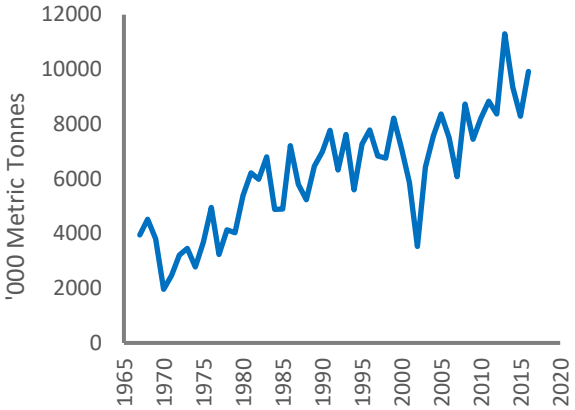
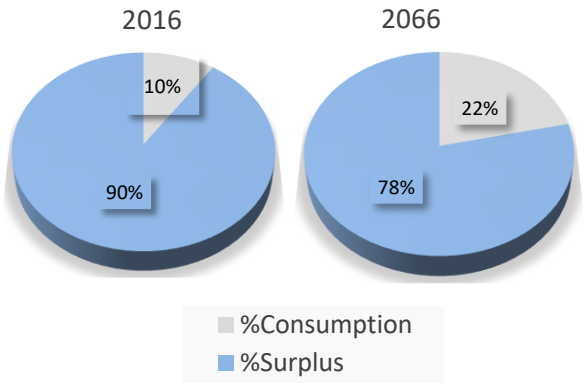


Figure 5.1.b. Consumption of wheat in Alberta, actual (2016) and projected (2066)



Canola

The canola sector contributes approximately $10 billion per year to the Canadian economy of which Alberta contributes almost 30 per cent [27]. In terms of farm revenue, canola is the number one crop in Alberta, accounting for an average of $2.7 billion in FCR per year during 2011-2015, although, in terms of acreage, it is second after wheat [25,26]. Canola production

[viii] Surplus shows the difference between provincial production and consumption (human food, seed requirements, industrial use, loss in handling, animal feed, waste and dockage, and other domestic disappearance) in a given year.

in Alberta showed a steep increase over the past 50 years reaching almost six million acres in 2016. Alberta is the second largest canola producing province after Saskatchewan, producing 5.8 million tonnes or more each year since 2013 [14] and is projected to continue this trend into the future (Figure 5.1.c).

Figure 5.1.c. Production of canola in Alberta

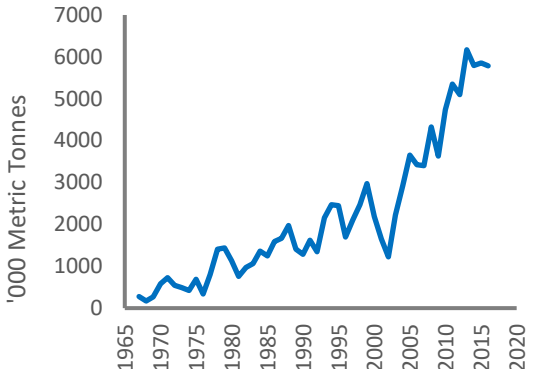
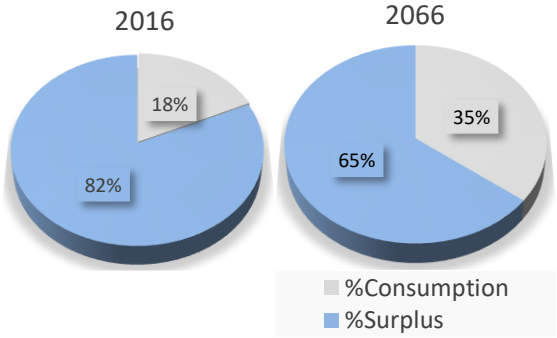


Figure 5.1.d. Consumption of canola in Alberta, actual (2016) and projected (2066)



While, the two main canola products are oil for human consumption and meal for livestock feed, Canada exports canola as seed, oil, and meal to over 50 countries around the world [27]. The domestic consumption of canola in Alberta in 2016 was 1.05 million tonnes which is less than 20 per cent of production. This is projected to increase to 1.8 million tonnes over the next 50 years which is one-third of the projected production (Figure 5.1.d).

Barley

The Canadian barley industry produces about 8 million tonnes of barley annually, over half of which comes from Alberta [14]. High quality barley is used in malting for beer and food products. Alberta leads the nation by producing nearly half of Canadian malt exports on an annual basis [28]. In 2016, Alberta produced 4.4 million tonnes of barley accounting for $266 millions in FCR [6, 14]. Alberta's barley export value in 2016 was $142 million [9].

Barley consumption is calculated differently than other crops due to the fact that the majority of barley is consumed as feed and Alberta has the largest livestock population in the country (see Appendix A for detail).

Barley is one of the few principal field crops in Alberta that is decreasing in production (Figure 5.1.e). Despite that, 44 per cent of barley production was surplus in Alberta in 2016. If production and feed consumption remain the same as in 2016, and human consumption doubles over the next 50 years, Alberta will remain surplus in barley production by over 40 per cent (Figure 5.1.f).

Figure 5.1.e. Production of barley in Alberta

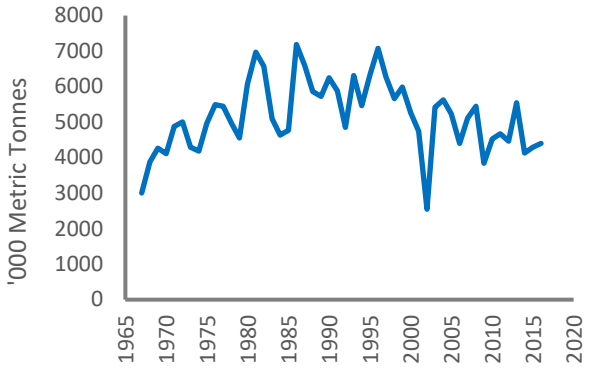
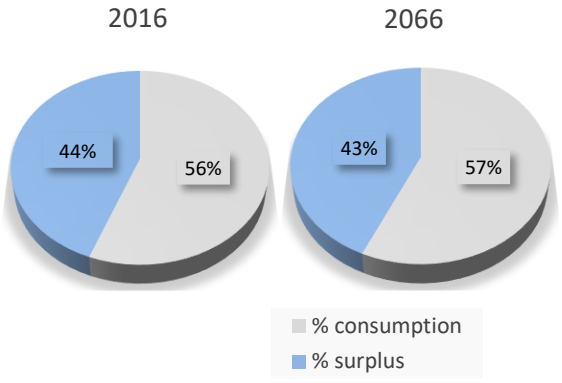


Figure 5.1.f. Consumption of barley in Alberta, actual (2016) and projected (2066)



Oats

The area and production of oats showed a decrease over the past 50 years (Figure 5.1.g), yet it remains one of the top four major crops in Alberta. In 2016, only 0.72 million acres of land was seeded with oats, a 71 per cent decline from 40 years ago, producing 0.62 million tonnes of the crop. Oat yield increased by 43 per cent in the last 40 years.

While oats are consumed as food, feed, and forage, there is also a history of oat ingredients being used in cosmetics and beauty products. In 2016, the total domestic consumption of oats in Alberta was 0.12 million tonnes, less than one-fifth of the total production. Production of oats in 2066 is projected to be 1.2 million tonnes. Oats consumption is projected to double over the next 50 years yet remain at one-fifth of the projected production (Figure 5.1.h).

Figure 5.1.g. Production of oats in Alberta

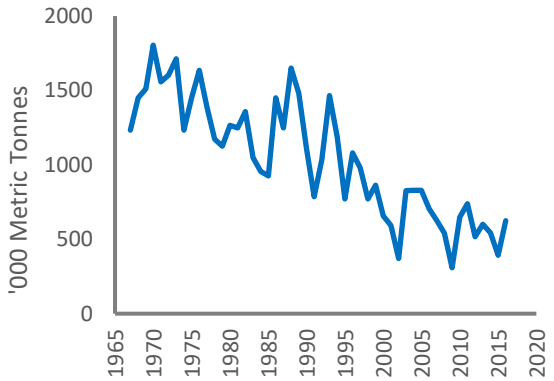
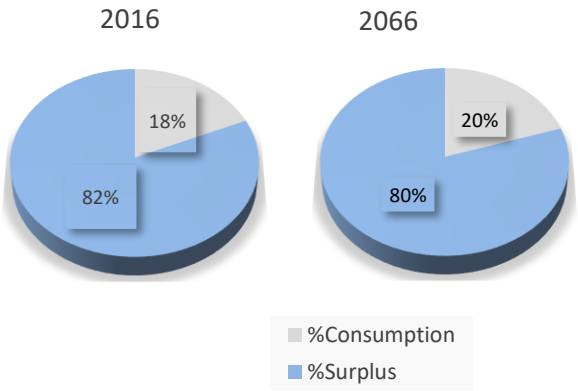


Figure 5.1.h. Consumption of oats in Alberta, actual (2016) and projected (2066)



Dry Pea

Dry pea (green, yellow and other) production in Alberta shows a steep growth over the past decade due to an increase in both area and yield per acre (Figure 5.1.i). Alberta has the second highest area and production of dry pea

in Canada after Saskatchewan [14,29]. A large part of dry pea produced in Alberta as well as in Canada are intended for exports mainly to India and China. In 2016, Alberta produced 2.3 million tonnes of dry pea and accounted for an export value of over $80 million [9]. Less than 10 per cent of the total production was consumed in Alberta in 2016. Although dry pea production shows a steep increase, projected production is based on the average area seeded for this crop during the recent three census years. According to this projection, Alberta will produce at least 1.15 million tonnes of barley in 2066. If consumption doubles, Alberta is projected to consume one-fourth (27 per cent) of the production, in 2066 (Figure 5.1.j).

Figure 5.1.i. Production of dry pea in Alberta

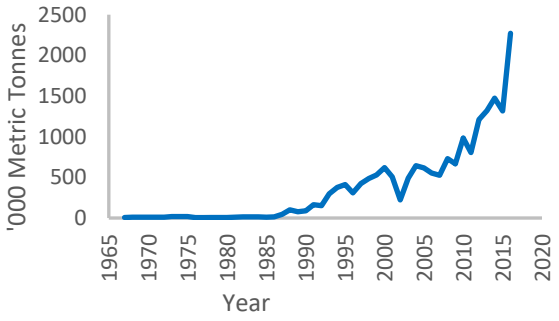
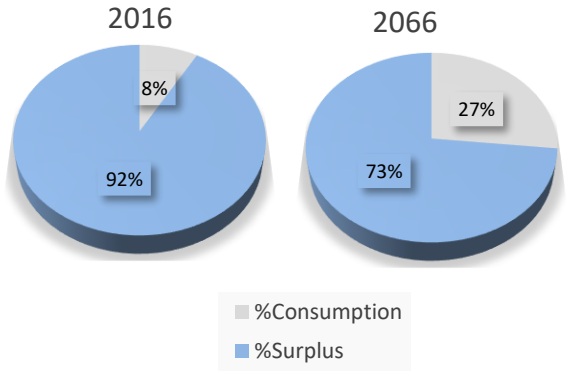


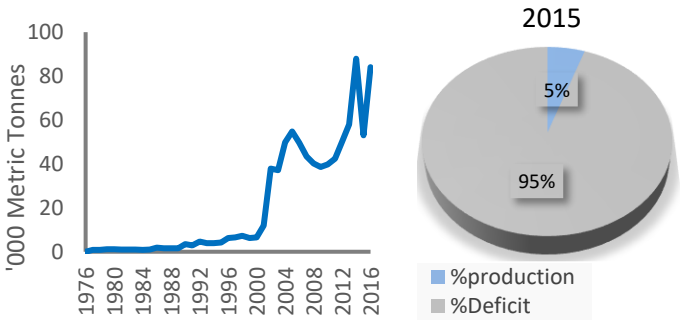
Figure 5.1.j. Consumption of dry pea in Alberta, actual (2016) and projected (2066)



5.2. Fruits and Vegetables

Commercial production of fruits and vegetables has significantly trended upwards in the last 15 years, yet Alberta produces far less than (approximately 5 per cent) its total consumption with the remaining being imported (Figure 5.2.a). In 2016, Alberta produced 84 million tonnes of fruits and vegetables.

Figure 5.2.a. Production and consumption of fruits and vegetables in Alberta

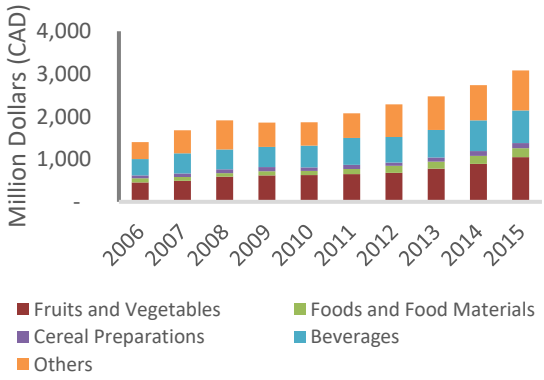


Canada's recent three-year average per capita fruits and vegetables consumption was estimated to be 0.24 tonnes per year, making Alberta's current total consumption over one

million tonnes. This is projected to double in the next 50 years due to an increase in Alberta's population. With a push for healthy eating, the gap between domestic production and consumption is likely to grow further. Production projections for fruits and vegetables are not made in this analysis as land availability is not yet a limiting factor[ix].

Fruits and vegetables comprise 30 per cent of Alberta's current total agrifood imports which is higher than the combined import of all other agrifood products except beverages (Figure 5.2.b). The fruits and vegetables sector can be identified as an important area of focus in which to increase production and to minimize possible food security challenges.

Figure 5.2.b. Alberta's annual agrifood import cost



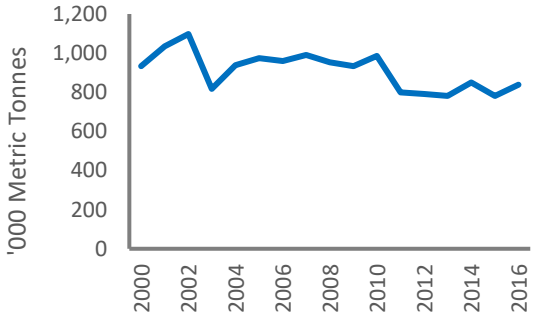
5.3. Livestock

The livestock sector in Alberta is dominated by the cattle/beef industry for which Alberta is the largest producer and exporter in Canada.

Beef and Veal

Alberta accounts for over 41 per cent of the total cattle herd and 73 per cent of total processed beef in Canada. Over 80 per cent of Alberta's beef and veal are exported to interprovincial or international markets [30]. Over the past 15 years, Alberta produced 800-900 thousand metric tonnes of beef and veal annually despite a declining trend in production (Figure 5.3.a). In 2016, domestic consumption of beef and veal was only 14 per cent of the total production (Figure 5.3.b).

Figure 5.3.a. Production of beef and veal in Alberta

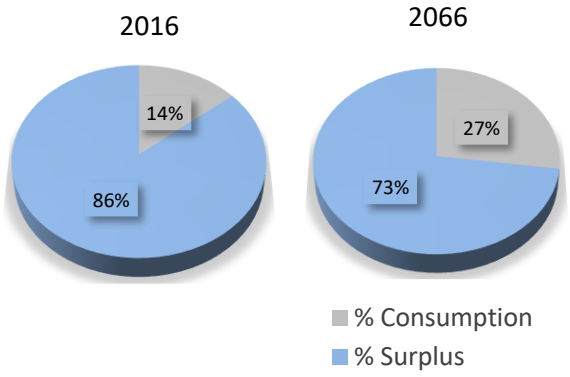


An extrapolation of the recent seven-year average of beef and veal production (Figure 5.3.a) (approximately 833 thousand metric tonnes), and consumption projected on the

[ix] A recent report identified eight challenges affecting the competitiveness in Alberta's commercial fruits and vegetables production: import competition, food trends, climate, labour, storage capacity, innovation support, industry organizational structure, and branding.

basis of population growth show that annual consumption in Alberta over the next 50 years will be approximately a quarter of annual production (Figure 5.3.b).

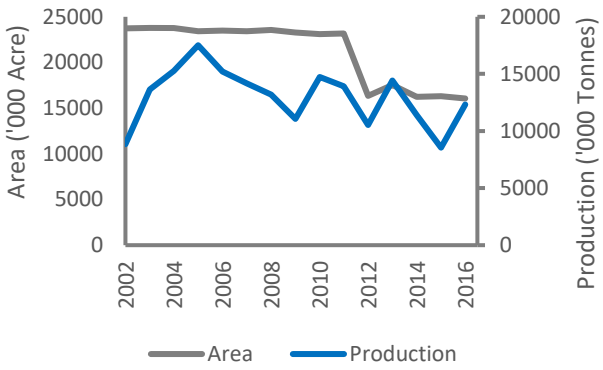
Figure 5.3.b. Consumption of beef and veal in Alberta, actual (2016) and projected (2066)



The declining trend in beef and veal production might be a result of a combination of factors including the herd downsizing following the 2003 Bovine Spongiform Encephalopathy impact, recurring economic slowdown, and decreasing red meat consumption domestically and in the United States (the main export market).

Beef and veal production relies on the supply of greenfeed, silage, hay and pasture. While pasture land has increased slightly over time (Section 3.2), farmers harvest a significant acreage of annual crops such as spring wheat, barley, oats, mixed grains, triticale and dry pea as greenfeed and silage. There is a decline in the combined area of greenfeed, silage, and tame hay since 2012 mainly because provincial cattle numbers declined in recent years, and grain and oilseed prices were near record highs. [21]. However, production did not show a clear trend (Figure 5.3.c). Annual fluctuation in yield per acre played a role in production. For example, in 2016, the harvested area for green feed decreased by 35 per cent while production increased by 10 per cent compared to 2015 due to an increase in yield [21].

Figure 5.3.c. Combined area and production of tame hay, greenfeed, and silage



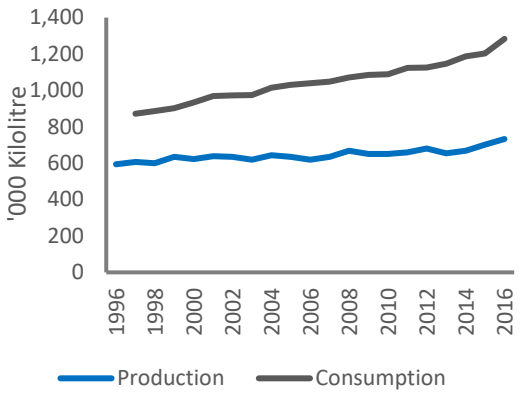
Dairy

Alberta's dairy industry is controlled by a supply management system. Under this system, a licensed producer can produce only the quota allocated to them by Alberta Milk while Alberta processors' entitlement is determined by the quota allocated to Alberta by the Canadian Dairy Commission [31]. At the same time, administratively established cost-based market pricing and import control influence the level of domestic consumption.

Dairy consumption volume in Alberta is higher than the volume produced locally (Figure 5.3.d), with the gap increasing over time. In 2016 Alberta produced 57 per cent of its

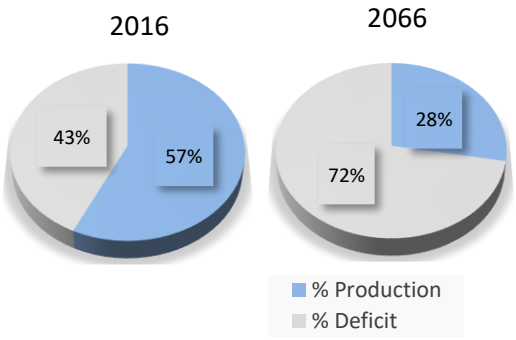
consumption, the balance was primarily supplied by those provinces that, for historical reasons, control the lion's share of the national quota.

Figure 5.3.d. Production and consumption of dairy in Alberta



The production and consumption of dairy products under the current system are not related to land availability in Alberta or Canada. Thus, long term projections are made under the assumption that the supply management system stays in place for the projected period, and recent production and consumption trends prevail. If the seven-year average dairy production rate continues for the next 50 years, Alberta will produce less than 30 per cent of its consumption which will further decrease with population growth at current per capita consumption (Figure 5.3.e).

Figure 5.3.e. Consumption of dairy in Alberta, actual (2016) and projected (2066)



Pork

According to the 2011 census, the pork industry was the fourth largest agricultural industry in Canada, after canola, dairy, and cattle. Quebec, Ontario, and Manitoba dominate this industry followed by Alberta constituting over 14 per cent of the total pork exports at the national level [32,33]. Pork production in Alberta shows a declining trend overall that can be attributed to a host of reasons including market conditions and a relative drop in red meat consumption (Fig. 5.3.f).

On average, Alberta produces over three times more pork than the provincial consumption. In 2016, Alberta produced over 0.3 million tonnes of pork. If Alberta sustains the recent seven-year average production of pork (approximately 0.3 million tonnes) for the next 50 years, while consumption doubles with population growth, consumption will still be less than 80 per cent of the provincial production (Figure 5.3.g).

Figure 5.3.f. Production of pork in Alberta

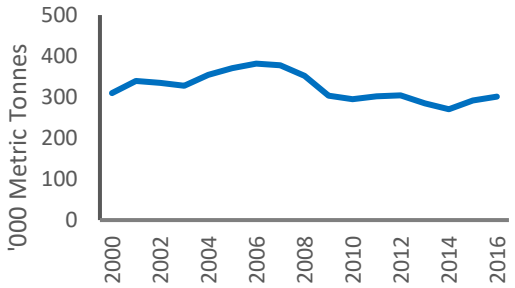
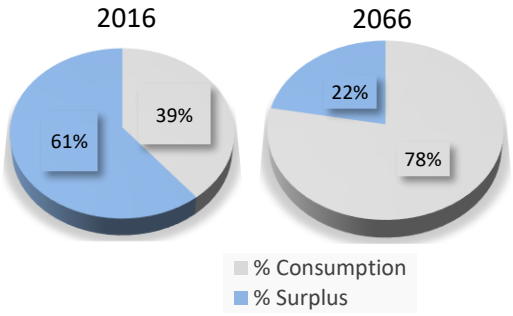


Figure 5.3.g. Consumption of pork in Alberta, actual (2016) and projected (2066)



Poultry

Like dairy, poultry production is subject to a supply management system [34,35]. At the national level, Ontario and Quebec lead the poultry industry. Canada produced approximately 1.4 billion kilograms of chicken in 2016 of which 60 per cent was produced in Quebec and Ontario, 14 per cent in British Columbia and 10 per cent in Alberta [36,37].

Over the past two decades, poultry consumption in Alberta has gradually outpaced growth in production (Figure 5.3.h). In 2016, Alberta produced 75 per cent of the total provincial poultry consumption which is projected to reduce to approximately 40 per cent resulting in a deficit of over 60 per cent over the next 50 years (Figure 5.3.i).

Like dairy, the production of poultry is marginally determined by the availability of agricultural land. Thus, future production is a mere continuation of the recent three-year average, while consumption is projected on the basis of population growth with per capita consumption staying the same.

Figure 5.3.h. Production and consumption trends of poultry in Alberta

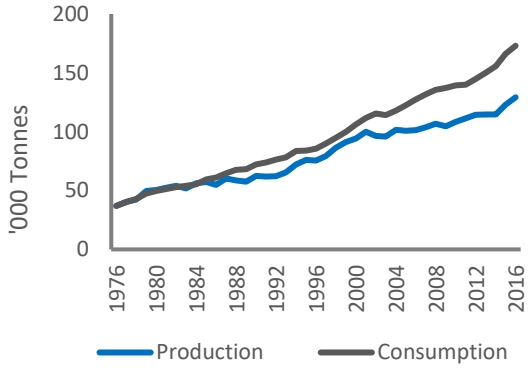
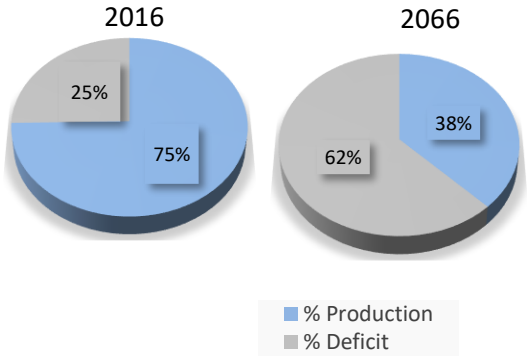


Figure 5.3.i. Consumption of poultry in Alberta, actual (2016) and projected (2066)



Egg

Part of the supply management system, the egg industry too is dominated by Ontario and Quebec followed by British Columbia and Manitoba. In 2016, Alberta ranked fifth producing 64.7 million dozen eggs [38].

In the last two decades, egg production and consumption in Alberta showed a gradual upward trend; however, egg consumption is growing faster than provincial production (Figure 5.3.j). In 2016, Alberta produced 57 per cent of its annual egg consumption.

The projected egg production is based on the assumption that the current quota system will remain in place, while consumption projection is based on population growth with per capita consumption assumed to remain the same. Accordingly, Alberta will produce less than 30 per cent of the projected consumption over the next 50 years (Figure 5.3.k).

Figure 5.3.j. Production and consumption of egg in Alberta

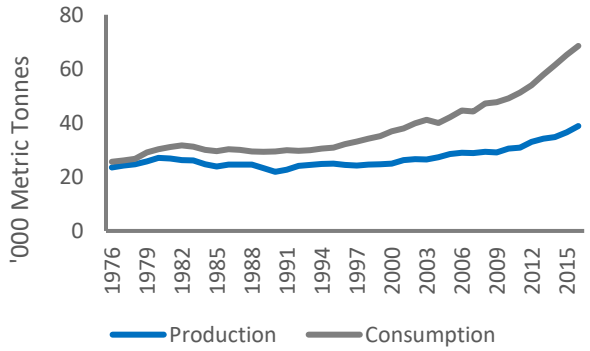
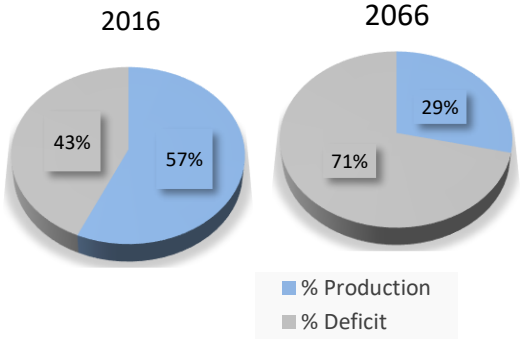


Figure 5.3.k. Consumption of egg in Alberta, actual (2016) and projected (2066)



Mutton and Lamb

Alberta's annual mutton and lamb production exceeds consumption by almost 50 per cent although production shows a declining trend (Figure 5.3.l). Being a niche sector, the reason for the decline may be a lack of new entrants as the older generation retires or businesses close.

Unlike production, mutton and lamb consumption in Alberta shows a steady growth. If the current trend for mutton and lamb production continues over the next 50 years, the projected consumption due to population growth will slightly exceed production (Figure 5.3.m). This suggests that Alberta's current mutton and lamb production capacity, if sustained, will be able to meet the increasing demand for the next 50 years.

Figure 5.3.l. Production and consumption trends of mutton and lamb in Alberta

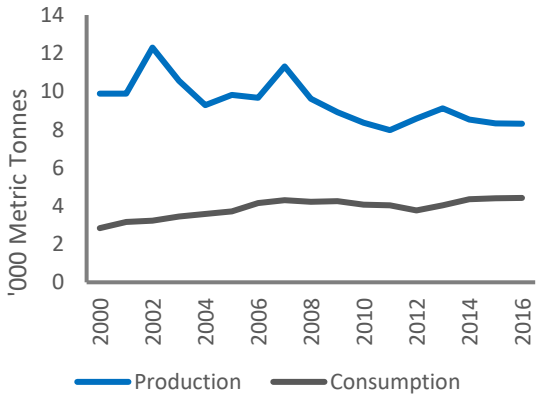
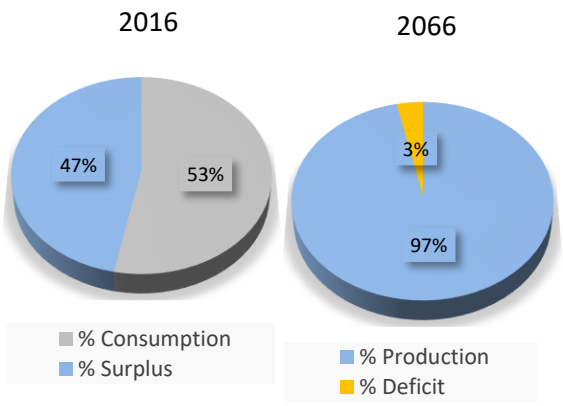


Figure 5.3.m. Consumption of mutton and lamb in Alberta, actual (2016) and projected (2066)



6. Conclusion

Alberta is a surplus producer in the crop sector. In the livestock sector, Alberta produces a surplus in beef and veal, pork, mutton and lamb while it is deficit in dairy, poultry, and egg products. In the fruits and vegetables sector, Alberta is significantly deficit except for potatoes.

Looking 50 years forward, the Province will remain substantially surplus in major field crops even under a conservative production projection. In other words, under the current rate of agricultural land loss, the crop sector will produce more than what will be required for domestic consumption. Alberta has a comparative disadvantage in fruits and vegetables production due to climatic conditions. Greenhouse production of vegetables is constrained by a short growing season and high energy costs for year round production, which adds competitiveness challenges to the sector. Availability of farmland, hence expansion, is not likely a limiting factor for this sector [39].

Alberta will continue to produce beef and pork in surpluses relative to domestic consumption over the next 50 years, even if the production projections do not include potential gains in LSRS Classes 4-7 land, suitable for grazing [10]. However, Alberta falls short in meeting domestic consumption of dairy, poultry, and eggs under the existing supply management system which is unrelated to land availability.

Whereas losing agricultural land at the current rate will not lead to food insecurity for Alberta, and for Canada as a whole, increased competition for farmland from other industries may escalate land prices. This will cause competitive challenges for the agriculture sector leading to higher food prices. These factors along with the rate of agricultural land loss may inform future considerations for a provincial policy to maintain a viable agricultural land base in Alberta.

For now, the Government of Alberta is committed through regional land use plans to monitoring and reporting agricultural land fragmentation and conversion annually. At the same time, municipalities are expected by the government, and will likely continue to face pressure from their constituency, to minimize agricultural land loss by directing development to areas less suitable for agricultural operations.

The Province has published an Efficient Use of Land Implementation Tools Compendium to provide municipalities and/or private individuals with planning tools to minimize the built environment's footprint, thereby reducing agricultural land conversion to other uses [40]. Conservation easements are enabled under the *Alberta Land Stewardship Act* for use by private land owners that are interested in protecting agricultural land in perpetuity.

Meanwhile, as a major agricultural surplus jurisdiction, Alberta seeks to expand access to global markets for exports, seize local opportunities and add value to primary agricultural products. Higher profits from the market place will in turn encourage research and innovation which will lead to higher productivity, address environmental objectives, and respond to consumer demand for specific food attributes. Research and innovation may play a key role in reducing import dependence for fruits and vegetables, creating income and employment opportunities at home.

Acknowledgement

We thank Vitor Dias for starting this work, and Darren Chase, Karen Cannon, Karen Sundquist, Lisa Morin, Anne Huennemeyer, Austin Leitch, Chris Panter, and Rosalie Cunningham for their comments on this report.

Bibliography

1. **Alberta Economic Fast Facts** [http://www.albertacanada.com/business/overview/economic-results.aspx]
2. **The Alberta GPI: Economy, GDP, and Trade**, Pembina Institute; 2002.
3. **Census of Agriculture, 2011** [http://www.statcan.gc.ca/pub/95-640-x/2011001/p1/prov/prov-48-eng.htm]
4. **Cattle and Calves on Farms in Alberta** [http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sdd16289]
5. **Census of Agriculture 2016** [http://www.statcan.gc.ca/pub/95-640-x/2016001/article/14808-eng.htm]
6. **CANSIM Table 002-0001** [http://www5.statcan.gc.ca/cansim/a05?lang=eng&id=0020001]
7. **Alberta Agri-Food Exports, 2006-2015** [http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/sdd16029/$FILE/2006-2015AlbertaExpReport.pdf]
8. **Alberta Agri-Food Exports 2007-2016** [http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sdd16473]
9. **Alberta Agri-Food Exports 2007-2016**, Government of Alberta; 2017.
10. **Fragmentation and Conversion of Agricultural Land in Alberta** [http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/luf16125]
11. **Census of Agriculture, 2006** [http://www.statcan.gc.ca/ca-ra2006/agpop/ab-eng.htm]
12. **Census of Agriculture 2011: Highlights and Analysis** [http://www.statcan.gc.ca/eng/ca2011/ha]
13. **Technology and Structural Change in Alberta Cereal Agriculture**, Alberta Agriculture; University of Alberta; 1988.
14. **CANSIM Table 001-0010** [http://www5.statcan.gc.ca/cansim/a47]

15. **Agriculture and Forestry Sector Growth and Diversification Strategy 2017** [https://ext.sp.agric.gov.ab.ca/af-policy/SitePages/Home.aspx]
16. Martellozzo F, Ramankutty N, Hall RJ, Price DT, Purdy B, Friedl MA: **Urbanization and the loss of prime farmland: a case study in the Calgary–Edmonton corridor of Alberta**. *Regional Environmental Change* 2014, **15**(5):881-893.
17. **Land Suitability Rating System Development**; 2007.
18. **Population Projection: Alberta and Census Divisions, 2016-2041** [http://finance.alberta.ca/aboutalberta/osi/demographics/Population-Projections/2016-2041-Alberta-Population-Projections.pdf]
19. **Census of Agriculture, 2001** [http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sdd5710/$file/2001census-id-md-county-data.pdf?OpenElement]
20. **Agriculture Statistics Factsheet** [http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sdd12807]
21. **Annual Greenfeed and Silage Production Survey Results** [http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/All/sdd4191]
22. **Beef and Veal**, Statistics and Data Development, Alberta Agriculture and Forestry; 2017.
23. **Milk Production By Province** [http://aimis-simia-cdic-ccil.agr.gc.ca/rp/index-eng.cfm?action=rR&pdctc=&r=234]
24. **Fruits and Vegetables**, Statistics and Data Development Section, Alberta Agriculture and Forestry; 2017.
25. **Alberta Farm Income Update 1988-2016** [http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/sdd16223/$FILE/ab_farm_income_report_january2017.pdf]
26. **Alberta Crop Production Statistics** [http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sdd12061]
27. **The Economic Impact of Canola on the Canadian Economy**, LMC International; 2013.
28. **Alberta Barley- Industry Overview** [http://www.albertabarley.com/about-us/industry-overview/]
29. **2016 Specialty Crop Report** [http://publications.gov.sk.ca/documents/20/97099-Specialty%20Crop%20Report%202016%20WEB.pdf]
30. **Alberta Beef Producers** [http://www.albertabeef.org/page/beef-production-chain]
31. **Marketing of Agricultural Products Act: Alberta Milk Marketing Regulation**; 2002.
32. **Canadian Agriculture at a Glance- The changing face of the Canadian hog industry** [http://www.statcan.gc.ca/pub/96-325-x/2014001/article/14027-eng.pdf]
33. **Alberta Pork Passion for Performance** In: *Alberta Pork Annual General Meeting*. 2015.
34. **Marketing of Agricultural Products Act: Turkey Marketing Regulation**; 1998.
35. **Marketing of Agricultural Products Act: Alberta Chicken Producers Marketing Regulation**; 2000.
36. **Canada's Poultry and Egg Industry Profile**, Agriculture and Agri-Food Canada; 2017.
37. **CANSIM Table 003-0018** [http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=0030018&&pattern=&stByVal=1&p1=1&p2=-1&tabMode=dataTable&csid=]
38. **CANSIM Table 003-0020** [http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=0030020&&pattern=&stByVal=1&p1=1&p2=-1&tabMode=dataTable&csid=]
39. **Profitability of Vegetables, Potatoes, and Fruit**, Alberta Agriculture and Rural Development; 2012.
40. **Efficient Use of Land Implementation Tools Compendium** [https://open.alberta.ca/publications/9781460118702]
41. **CANSIM Table 001-0041** [http://www5.statcan.gc.ca/cansim/a26]
42. **CANSIM Table 003-0083** [http://www5.statcan.gc.ca/cansim/a26]
43. **Carcass Weight** [http://aimis-simia.agr.gc.ca/rp/index-eng.cfm?menupos=1.02.08&pdctc=&r=135&action=pR&LANG=EN]
44. **CANSIM Table 002-0010** [http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=20010]

45. **Dairy Product Conversion** [http://www.americasdairyland.com/dairy/milk/milk-facts]
46. **CANSIM Table 003-0088** [http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=0030088&&pattern=&stByVal=1&p1=1&p2=-1&tabMode=dataTable&csid=]
47. **CANSIM Table 003-0102** [http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=0030102&&pattern=&stByVal=1&p1=1&p2=-1&tabMode=dataTable&csid=]
48. **CANSIM Table 003-0094** [http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=0030094&&pattern=&stByVal=1&p1=1&p2=-1&tabMode=dataTable&csid=#customizeTab]
49. **Marketing Your Lambs, A Resource Module for Producers of Alberta Lamb**, Alberta Livestock and Meat Agency; 2014.
50. **CANSIM Table 001-0013** [http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=10013]
51. **CANSIM Table 001-0009** [http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=10009]

Appendix A: Projection Methodology and Data Source for Field Crops

The area and production data for field crops were taken from the Statistics Canada CANSIM table 001-0010 (or 001-0017) [14]. Domestic consumption data for the field crops, termed as 'Total Domestic Disappearance' was obtained from Statistics Canada CANSIM table 001-0041 [41]. The total domestic disappearance data included human food, seed requirements, industrial use, loss in handling, feed, waste and dockage, and other domestic disappearance. Statistics Canada does not compile this data by province or territory. An average per capita consumption data was produced by dividing the total domestic consumption by the total population of Canada. The national per capita consumption data was then multiplied by Alberta's population to calculate Alberta's total domestic consumption.

Alberta's barely consumption was calculated in two steps: 'animal feed, waste and dockage' was removed from the 'Total Domestic Disappearance' data in CANSIM table 001-0041. National per capita consumption was calculated based on human food, seed requirements, industrial use, loss in handling, and others. This was multiplied by Alberta's population to obtain Alberta's human consumption. Human consumption data was added to Alberta's barley feed consumption to calculate total provincial barley consumption in a given year. Alberta's annual barley feed consumption data was calculated by multiplying the national total 'animal feed, waste and dockage' (CANSIM table 001-0041) by Alberta's share of the national cattle herd. Alberta's cattle herd (per cent of the national total) was calculated from CANSIM table 003-0032. For projected total consumption in 2066, the average of 2014-16 per capita human consumption was multiplied by projected population in 2066. Feed consumption in 2066 was assumed to remain more or less the same as in 2016.

Alberta's population data and projection, estimated by Statistics Canada and Alberta Treasury Board and Finance, was available until 2041 [18]. The data was extrapolated until 2066 by using an average annual population growth rate of 1.2 per cent. This net growth rate was estimated by Statistics Canada and Alberta Treasury Board and Finance for the period of 2036-2041 [18]. This data was used to estimate consumption and projected consumption of all products described in appendix A, B, and C.

Appendix B: Projection Methodology and Data Source for Livestock

Beef and Veal

Production in the form of beef, veal, and live cattle export (interprovincial and international) was taken into account to estimate total beef and veal production in Alberta. Total beef and veal production data was obtained from Statistics and Data Development Branch, AF, as well as Statistics Canada CANSIM table 003-0083 [42]. Number of cattle for period 1 and 2 in CANSIM table 003-0083 were combined to obtain annual total. In the absence of available data on live cattle export before 2000, we presented beef and veal production data from 2000 to 2016. Production data (in heads x1000) was converted to weight by multiplying with the average weight of warm carcass of cows and calf published for each year by

Agriculture and Agri-Food Canada [43]. Live export cattle heads were converted to weight using the same factors used for cows/beef. For beef, we adjusted 1.5 per cent weight loss due to shrinkage and 2.04 kilogram of head meat recovery with each warm carcass weight to estimate the net production. For veal, we adjusted 15 per cent weight loss due to shrinkage, 0.23 kilogram weight loss for kidneys, and 0.36 kilogram head meat recovery with each warm carcass weight to estimate the net production [22]. Alberta's beef and veal consumption data was calculated from CANSIM table 002-0010 [44]. Canada's total domestic disappearance of beef and veal were considered as total domestic consumption. The table did not include other categories such as manufacturing or waste that we also considered as domestic consumption for other food classes where data was available.

Area and production data for tame hay, greenfeed and silage was collected from Statistics Canada CANSIM table 001-0010 (or 001-0017) as well as Statistics and Data Development Branch, AF [14, 21].

Dairy

The total dairy production data presented the total volume of milk produced at the farm in Alberta [23]. The dairy consumption data for fluid milk and cream for Alberta was available in volume (litres) from CDIC. We converted other dairy product consumption data from weight (kilogram) to volume (litre) using appropriate conversion factors. For example, 1kg of cheddar cheese, cottage cheese, butter, yogurt, evaporated milk, and ice cream were equivalent to 10 litre, 6.25 litre, 21.2 litre, 1 litre, 2.1 litre, and 1.4 litre fluid milk, respectively [45]. Consumption data for cheese, butter, yogurt, evaporated milk, and ice cream was available in per capita national consumption that was calculated by CDIC as [Beginning Stocks + Production + Imports - Exports - Ending Stocks]/Canada population.

Pork

Alberta's annual pork production data referred to the total disposition of pork (x1000 heads) in the respective year. Total disposition data included animal slaughtered in Alberta, death and condemnations, and interprovincial and international export. Data was collected from Statistics Canada CANSIM table 003-0088 and 003-0102 that contained data only from 2000 to 2016 [46, 47]. Alberta's pork production data was converted from number of head to metric tonne by multiplying number of pork with the average carcass weight in Alberta in the respective year published by Agriculture and Agri-Food Canada [43]. Alberta's annual pork consumption data was calculated from the total national pork consumption data from Statistics Canada CANSIM table 002-0010. Total consumption of pork in a given year included the volume of domestic disappearance, manufacturing, and waste.

Egg

Alberta's annual egg production and Canada's annual egg consumption data was collected from Statistics Canada CANSIM Table: 003-0020 and 002-0010, respectively [38, 44]. Total egg consumption data was converted from dozen to metric tonne assuming weight for each egg to be 50 grams (standard weight of a large egg).

Poultry

Poultry included chicken (including stewing hen) and turkey. Alberta's total poultry production data was collected from Statistics Canada CANSIM table 003-0018, and national total poultry consumption data was collected from Statistics Canada CANSIM table 002-0010 [37, 44]. Total production included the amount of home consumption (by farms) and the amount sold off farm.

Lamb and Mutton

Alberta's annual sheep (final products are termed as lamb or mutton depending on the age of sheep during slaughter) production data was collected from Statistics Canada CANSIM table 003-0094 [48]. The data represented annual total disposition of sheep (head x1000) in period 1 and 2. Total disposition included animal slaughtered in Alberta, interprovincial and international export, and death and condemnation in the respective year. In the absence of data on sheep weight during slaughter, we assumed the average weight of a dressed sheep to be 120 pounds (54.4 kg) which is the minimum weight of sheep and desired weight of lamb for certain buyers [49]. A sum of domestic disappearance, manufacturing, and waste data, as available, from Statistics Canada CANSIM table 002-0010 was taken as total consumption in Canada in a given year [44]. For sheep, there was no data on manufacturing and waste. Domestic disappearance data was more or less equal to the sum of beginning stock, production, and import minus export and ending stock.

Appendix C: Projection Methodology and Data Source for Fruits and Vegetables and Others

Alberta's fruits and vegetables production data was collected from Statistics Canada CANSIM table 001-0013, 001-0009, 001-0006 that included farm vegetables (potato excluded), greenhouse vegetables, and fruits [50, 51]. Production of fruits and vegetables as reported in these CANSIM tables may reflect less than the actual production because some data were unreliable to include and some were suppressed for confidentiality purpose. Alberta's fruits production data was available from 2002 to 2016 in CANSIM table 001-0009. Alberta's total domestic consumption of fruits and vegetables data was calculated from CANSIM table 002-0010. Data on domestic disappearance, manufacturing, and waste was considered as total domestic consumption. Fresh, processed, dried, canned and all other categories of fruits and vegetables reported in this table were considered in total consumption. Total consumption data may not accurately reflect the fresh weight because processed fruits and vegetables may gain or lose weight.

Alberta's total agrifood import data was collected from the Economics and Competitiveness Branch, AF [24]. Total agrifood import data was grouped into five categories- fruits and vegetables, foods and food materials, cereal preparations, alcoholic and non-alcoholic beverages and others. Fruits and vegetables included fresh, chilled, dried, and preparations. Alcoholic and non-alcoholic beverages excluded juice and whiskey.