Assessing the Sustainability of the Canadian Beef Industry

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Canfax Research Services
Sustainability Assessment

There were three main sections to the National Beef Sustainability Assessment:

- **Environmental Assessment**
  - Assessed climate change, fossil fuel use, water use and air and land pollution potentials through the E-LCA and biodiversity, carbon soil sequestration, water use and water risk through the land use assessment.

- **Social Assessment**
  - Assessed the practices and processes that promote the well-being of stakeholders including, workers, local communities as well as animals.

- **Economic Assessment**
  - Assessed; long-term profitability, long-term cost of production, domestic consumer demand international consumer demand.
Process

Multi-stakeholder process
Multiple review and consultation processes
Professionals and experts engaged throughout

Multiple sources of information
Top-down, bottom-up iterative approach
National statistics provided a base with more details from surveys and literature review
Environmental Assessment

E-LCA

- Climate change
- Fossil fuel use
- Water use & pollution potential
- Air pollution

Followed ISO and LEAP guidelines

Land-Use Assessment

- Biodiversity
- Soil carbon sequestration
- Water use and risk
<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow-calf</td>
<td>63,291 head</td>
</tr>
<tr>
<td>Backgrounding</td>
<td>26,887 head</td>
</tr>
<tr>
<td>Yearlings</td>
<td>14,703 head</td>
</tr>
<tr>
<td>Finishing</td>
<td>150,084 head</td>
</tr>
<tr>
<td>Replacements</td>
<td>9,056 head</td>
</tr>
</tbody>
</table>

77 Farms Surveyed with 266,600 head
Functional Unit

kilogram of live weight
refers to just the farming stage of the life cycle; and

kilogram of packed boneless beef
(delivered and consumed)
includes all stages in the life cycle, from farming to consumption

Environmental life cycle stages

FARMING  TRANSPORTATION  PACKING  SECONDARY PROCESSING  RETAIL  CONSUMPTION

between farms and packers
Results Climate Change

11.4 kg CO₂ eq./kg live weight at farm gate; OR 30.8 kg CO₂ eq./kg of packed boneless beef, which is then delivered and consumed.

Diagram showing the breakdown of climate change contributors:
- Farming (74%)
  - Manure (confined)
  - Energy
  - Animal transport
  - Manure (pasture)
  - Feed production
  - Enteric CH₄
Results Fossil fuel depletion

0.6 kg oil eq./kg live weight at farm gate; OR 2.0 kg oil eq./kg of packed boneless beef, which is then delivered and consumed.
Results Water
631 L of blue water/kg of packed boneless beef OR 235 L/kg LW

Figure 5
Contributions of different life cycle stages to the Canadian beef industry’s blue water footprint (Total: 631 litres of blue water/kg of packed boneless beef [delivered and consumed]). (Note: individual items may not add to the total due to rounding).
## Results Water

Gross blue water footprint Values (Indicative reference points, as not directly comparable)

<table>
<thead>
<tr>
<th></th>
<th>Farm’s gate (liters/kg of live weight)</th>
<th>Packers’ stage (liters/kg hot carcass)</th>
<th>Packer’s gate (liters/kg bone-free meat)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada, National Beef Sustainability Assessment (CRSB, 2016)</td>
<td>235</td>
<td>382</td>
<td>508</td>
</tr>
<tr>
<td>United States (Capper, 2011)</td>
<td>1,100</td>
<td>1,763</td>
<td></td>
</tr>
<tr>
<td>Southern Australia (Ridoutt et al., 2011)</td>
<td>16-1,067</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA (Rotz et al, 2013)</td>
<td>2,790</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Net Blue Water Footprint values

*not comparable to CRSB study*

<table>
<thead>
<tr>
<th></th>
<th>Packer’s gate (liters/kg bone-free meat)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global (Water Footprint Network, 2015)</td>
<td>550</td>
</tr>
<tr>
<td>USA (Water Footprint Network, 2015)</td>
<td>525</td>
</tr>
</tbody>
</table>
Results Water pollution potential

Freshwater eutrophication 5.8 g P eq./kg live weight at farm gate; OR 15.3 g P eq./kg of packed boneless beef, which is then delivered and consumed.

Marine eutrophication 75.8 g N eq./kg live weight at farm gate; OR 197.6 g P eq./kg of packed boneless beef, which is then delivered and consumed.
Results Food Waste

Meat waste occurring during secondary processing, retail and consumption (Note: individual items may not add to the total due to rounding).

Potential edible meat

**FARMING & PACKER**

1.24kg

**PROCESSING**

0.06 kg of waste

0.05 kg of waste

**RETAIL**

0.12 kg of waste

**CONSUMPTION**

Consumed Meat = 1kg
packed boneless beef (delivered and consumed)

19% post harvest losses attributed to meat waste

19%

Meat waste
Results Food Waste

Reducing Food Waste by 50% could:
1. Avoid the release of 1.6 Mt CO₂ eq per year
2. Save up to 31 billion litres of water

Reducing meat waste by 50% could...

- Avoid the release of 1.6 Mt CO₂ eq per year,
- Save up to 31 billion litres of water,
- More than the greenhouse gas emissions of the Northwest Territories in 2014¹
- Equivalent to the total average water consumed by all Canadians in 3 days!²

¹Environment Canada ²Average daily use: 300 litres
Mt CO₂ eq – megatonnes of carbon dioxide equivalent

Find the facts at www.crsb.ca
Methodology Land Use

Land use was calculated using feed rations, average yields for feed stuffs by province to estimate acreage. Tremendous diversity in rations depending on location, production system, type of animal.

Figure 3-3 Detailed average rations used in this analysis (dry matter intake %)
Results Land Use

It takes between 37 square metres (m²) and 93 m² of land to produce one kg of live weight in Canada.

Figure 3
Land used for beef production in Canada

<table>
<thead>
<tr>
<th></th>
<th>Million acres</th>
<th>Million hectares</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ma</td>
<td>44.2</td>
<td>17.9</td>
</tr>
<tr>
<td>Mha</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beef Production</td>
<td>52.2</td>
<td>(21.1 Mha)</td>
</tr>
<tr>
<td>Pasture</td>
<td>44.2</td>
<td>(17.9 Mha)</td>
</tr>
<tr>
<td>Hay</td>
<td>4.5</td>
<td>(1.8 Mha)</td>
</tr>
<tr>
<td>Barley</td>
<td>2.8</td>
<td>(1.1 Mha)</td>
</tr>
<tr>
<td>Other feed crops</td>
<td>0.7</td>
<td>(0.3 Mha)</td>
</tr>
</tbody>
</table>

Calculation based on area needed to produce feed crops for cattle, excluding natural land from pasture, divided by total available land in crops and summerfallow land in Canada.
The Importance of Sustainable Grazing practices on Native and Unimproved pasturelands

From 1981 to 2001, Canada’s agricultural land lost 5% of its capacity to sustain biodiversity, mostly as a result of intensification in Eastern Canada. While 31% of farmland is pasture in the West; only 9% of farmland is pasture in the East. The decline came from reduced species richness and suitable habitat for terrestrial wildlife.

Native rangelands and unimproved pasture provide the highest capacity to sustain biodiversity in agricultural areas.

The main concern for biodiversity is not conversion of forest and wetlands (which has slowed in recent years), but losses of native prairie grasslands.

Currently less than 20% (30 million acres) of Canada’s grasslands remain intact. Grasslands are considered an endangered ecosystem.

The disappearance of grasslands has led to an overall loss of 44% of the populations of grassland species since the 1970s, with individual species showing declined of up to 87%.

Conservation of grassland species largely depends on sustainable cattle grazing practices.
Biodiversity is a complex issue

Overview of the pressures (brown) or benefits (green) that livestock have on biodiversity. Adapted from LEAP, 2015
Wildlife Habitat Capacity of Farmland Indicator (WHAFI) developed by AAFC

**Habitat Suitability model** – combines species geographical ranges, habitat preferences and environmental data to ID unsuitable habitat within a species range.

**587 species of wild** terrestrial vertebrates in Canada in four different taxonomic groups (137 mammals, 370 birds, 42 amphibians and 38 reptiles)

Each 30m grid of agricultural land cover was classified for each species as:

- **primary habitat** without this habitat the species cannot use the area
- **secondary habitat** species will use several habitat types for the same purpose
- **tertiary habitat** habitat not required, but species occasionally observed in it
- or **unsuitable habitat**

A habitat capacity matrix was then constructed for each terrestrial vertebrate species known to use agricultural land and adjacent habitats in Canada for one or more specific habitat requirements (breeding, feeding, loafing, cover, staging and wintering).
WHAFI customized for beef industry

The WHAFI has mainly been applied to assess the impact of relative changes in land cover types on the wildlife habitat capacity of agricultural land in Canada at the SLC polygon level. In order to better reflect the impact of beef cattle production at a broader scale, Deloitte customized the WHAFI for agricultural land at the provincial level. The approach followed for the development of the index was as following:

• The average habitat use values for breeding and feeding (Matrix Combined Values, MCVs) of each land cover at the SLC polygon level were obtained.

• The average MCV of each land cover in each ecozone was then derived, since there was little variability among these values.

• These average MCVs represent habitat capacity intensity values (capacity to provide habitat to various species per unit of surface) calculated through the WHAFI methodology.
Habitat use values highlight the importance of grasslands.

Results are conservative as wetlands in pastures are excluded.

Matrix combined values (MCV) per land cover and ecozone.
Canada’s boreal forest
The largest contiguous forest ecosystem on earth, covering a quarter of Canada’s land area.

Over 40% of boreal forests are under industrial forest management; while the remaining are typically in the North and both less productivity and less biodiversity rich.

Threats to the boreal forest include: habitat loss, conversion of forest types, alteration of forest stands; age-class distribution and structural diversity and increased isolation of old forest fragments, leading to varying impacts on biodiversity.

While generally not suited to agriculture, livestock operations are found on the Southern edges where it meets the prairie grasslands and about 5 million ha are cultivated for crops (primarily in Alberta and Saskatchewan).
Results Biodiversity

- Land used for beef cattle production
- Other agricultural use

Figure 4

Habitat capacity index values for land used for beef cattle production and other agricultural areas.

- 33% or 52.2 Ma
- 67% or 107.2 Ma

- 68% or 414
- 32% or 196
Method Carbon Sequestration

Average Stock of Carbon per land use type

<table>
<thead>
<tr>
<th>Carbon stock per ha per land use per province</th>
<th>Average</th>
<th>Cropland</th>
<th>Improved</th>
<th>Unimproved</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cropland</td>
<td>Average</td>
<td>75.9</td>
<td>71.2</td>
<td>74.5</td>
</tr>
<tr>
<td>Improved pasture</td>
<td>BC</td>
<td>65.70</td>
<td>68.59</td>
<td>75.10</td>
</tr>
<tr>
<td></td>
<td>AB</td>
<td>81.30</td>
<td>83.40</td>
<td>80.30</td>
</tr>
<tr>
<td></td>
<td>SK</td>
<td>87.60</td>
<td>85.30</td>
<td>88.20</td>
</tr>
<tr>
<td></td>
<td>MB</td>
<td>11.60</td>
<td>9.60</td>
<td>13.30</td>
</tr>
<tr>
<td></td>
<td>ON</td>
<td>63.90</td>
<td>60.80</td>
<td>67.20</td>
</tr>
<tr>
<td></td>
<td>QC</td>
<td>82.50</td>
<td>84.60</td>
<td>80.70</td>
</tr>
<tr>
<td></td>
<td>NB</td>
<td>65.60</td>
<td>62.50</td>
<td>68.20</td>
</tr>
</tbody>
</table>

| Improved pasture                             | BC      | 67.50   | 79.30   | 71.60      |
|                                              | AB      | 75.10   | 83.40   | 78.20      |
|                                              | SK      | 60.10   | 65.30   | 64.10      |
|                                              | MB      | 91.30   | 92.50   | 88.40      |
|                                              | ON      | 74.90   | 73.30   | 76.70      |
|                                              | QC      | 123.40  | 122.30  | 120.50     |
|                                              | NB      | 72.50   | 69.70   | 73.30      |

| Unimproved pasture                           | BC      | 82.1    | 74.1    | 87.4       |
|                                              | AB      | 68.4    | 69.8    | 67.7       |
|                                              | SK      | 92.5    | 91.3    | 90.7       |
|                                              | MB      | 101.7   | 101.7   | 101.7      |
|                                              | ON      | 150.1   | 150.1   | 150.1      |
|                                              | QC      | 150.1   | 150.1   | 150.1      |
|                                              | NB      | 130.7   | 130.7   | 130.7      |
Results Stock of Carbon (up to 30cm depth)

Approximately 1.5 billion tonnes of carbon are currently stored in the lands used by beef producers thanks to soil carbon sequestration.

Land for beef cattle feed represents about 32% of total Canadian stocks of Carbon - 964 million tonnes in natural land for pasture; and 589 million tonnes in cropland, tame pasture, hay, and other land.

Beef cattle production helps preserve approximately 1.5 BILLION tonnes of carbon in Canada.

The estimated value of this storage is $82.5 billion.¹

¹If regulatory frameworks in Canada were to put a price on carbon. Estimate based on conversion of carbon to CO₂ eq. at $15/tonne (low range from AB, BC).
Results Carbon Sequestration

Land management practices, such as reduced tillage, can offset some of the emissions of beef production. When offsets are taken into consideration, the net GHG footprint of beef production is estimated to decrease by 8% to 10.5 kg CO₂ eq./kg live weight.
Social Assessment

- Working Conditions
- Animal Welfare
- Antimicrobials
Social Assessment

Methods

<table>
<thead>
<tr>
<th>Colour</th>
<th>Risk scale level</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>☢️</td>
<td>High</td>
<td>High risk of negative social impact</td>
</tr>
<tr>
<td>☢️</td>
<td>Moderate</td>
<td>Moderate risk of negative social impact</td>
</tr>
<tr>
<td>🟢</td>
<td>Low</td>
<td>Low risk of negative social impact</td>
</tr>
<tr>
<td>🟠</td>
<td>Very Low</td>
<td>Very low risk of negative social impact</td>
</tr>
</tbody>
</table>

Survey

The S-LCA utilized 76 farm surveys to identify hotspots.

Desk Top Assessment

Survey results were further analyzed with a desk top assessment and regulatory review.
Assessment Stages

LIFE CYCLE STAGES

- CATTLE OPERATIONS
- PROCESSORS
- UPSTREAM VALUE CHAIN
- ASSOCIATIONS (of beef producers and processors)
- DOWNSTREAM VALUE CHAIN
- NATIONAL (legal and regulatory environment)

STAKEHOLDERS
- Workers
- Local Communities
- Value Chain Actors
- Society
- Consumers
Results Social Assessment

Areas where industry is performing well

Health & Safety
Training and policies in place to ensure health and safety within the workforce

Animal Care
Sickness and disease prevention, health assessment, handling practices, housing and feeding, transport

Working Conditions
Scope of benefits, overtime, unionization, work load

Socio-Economic Commitment
Commitment to sustainability issues (water, biodiversity), local community support, odor reduction, responsible procurement
Results Social Assessment

Four higher risks were identified across the value chain

- National
  - Rights of foreign workers

- Distribution
  - Median income

- Suppliers
  - Rate of fatal and non-fatal injuries

- Cattle operations
  - Work load
## Results: Animal Care

### Rating level for the animal health and welfare indicators examined in the S-LCA

<table>
<thead>
<tr>
<th>Rating Level</th>
<th>Life Cycle Stage</th>
<th>Indicator</th>
</tr>
</thead>
</table>
| Very low risk | Packers          | • Animal harvest method  
|               |                  | • Animal stunning method |
|               |                  | • Animal welfare audit |
|               |                  | • Technology and infrastructure to support animal welfare |
|               |                  | • Internal communication of animal welfare regulations |
|               |                  | • Transporters' certification |
|               | Farmers          | • Health prevention |
|               |                  | • Health assessment |
|               |                  | • Housing and feeding |
|               |                  | • Euthanasia method |
|               |                  | • Handling injuries |
|               |                  | • Handling training |
|               |                  | • Breeding injuries |
|               |                  | • Transport certification |
|               | Associations     | • Animal welfare promotion |
| Low risk      | Farmers          | • Housing condition |
|               |                  | • Castration |
|               |                  | • Weaning conditions |
|               |                  | • Disbudding and dehorning pain control |
|               |                  | • Handling issues |
|               |                  | • Code of Practice awareness and implementation |
| Moderate Risk | Farmers          | • Branding pain control |
| High Risk     | None             | • None |
ECONOMIC SUSTAINABILITY

Is the ability of a system to maintain productivity in the face of a major disturbance, as well as slow shifts in consumer preferences.
Declining Terms of Trade

Commodities tend to experience declining terms of trade. Declining terms of trade is when the price received for outputs declines relative to prices paid for inputs. This happens when productivity improvements result in supply increasing faster than demand, leading to declining deflated commodity prices.

Profitability

The entire beef supply chain (cow-calf, feedlot and packer) is rarely profitable all at the same time.

Cattle Cycle

The Canadian beef industry typically follows a 10-12 year cattle cycle from peak to peak or trough to trough. The cattle cycle is driven by the biological lag from when the producer receives the price signal to expand and when additional beef production is available to the consumer.
Economic Assessment Framework

Four indicators were chosen to benchmark the economic sustainability of the Canadian Beef industry:

- Producer Viability
  - Long Term Profitability
  - Long Term Cost of Production

- Consumer Resilience
  - Domestic Consumer Demand
  - International Consumer Demand
Data Sets Used for Producer Viability Analysis

**Agri Benchmark**

*Agri benchmark* is a global, non-profit network that provides a consistent methodology to compare production systems, cost of production and profitability around the world.

**Canfax**

As the *agri benchmark* data are only available to 2006, the historical analysis is based on models and data sets maintained by Canfax.

The Canfax monthly cattle TRENDS report supplied the data for the feedlot analysis.
Results: Producer Viability

Producer viability refers to producer’s financial ability and incentive to continue producing a product.

Cow – Calf Profit Margins: Data from agri benchmark’s typical farms in 2013, show cow/calf enterprises are covering short-term (i.e., cash costs) and medium-term (i.e., including depreciation) costs. Three of the four typical farms are also covering long-term costs (i.e., including opportunity costs). In this case, opportunity costs largely represent unpaid labour.

Feedlot: Data from agri benchmark’s typical farm in 2013 indicate feedlot enterprises were unable to cover even short-term (cash) costs when selling on the cash market.

$50 Per cow avg (1990-2014)
Results Producer Viability

**Long term cost of production**, 2013 baseline (deflated)
- Cow/calf $120/cwt, or $264/ckg
- Feedlot $106/cwt, or $235/ckg

**Long Term profitability**, 2013 baseline (deflated)
- Cow/calf $93/cow
- Feedlot -$0.09/cwt (cash), or -$0.20/ckg

There is great diversity in the beef sector with a wide range between the high cost and low cost producers. There is no single right way. You can be profitable with high cash cost, due to the environment one lives in, with corresponding high productivity resulting in low per unit cost of production. Also you may focus on reducing cash costs if you are in a low productivity environment.

There are times in the cattle cycle when margins are negative. Producers need access to risk management tools to navigate those years.
Results Producer Viability

Long term (1990-2014) average margins from a 200 head cow herd of $9,650 with paid labour of $7,909 provides a total annual income of $17,559.

Most of these operations are mixed with income from other commodities and therefore do not expect the beef enterprise to provide their entire income.

Using the most recent 10-year average (2005-2014), which includes record large profits, results in a total annual income of $27,468 (including paid labour).
Beef farm operations rely on off-farm income

Average % of off-farm Income on Beef Farms

Source: Statistics Canada
Equity as a percentage of total assets has been **steady around 82-85% from 2001 to 2013** which reflects the increase in liabilities taken on as land values have increased.

If land prices decline like they did between 1981 and 1988 (-25%), then equity levels would fall, creating financial pressure on operations.

This pressure would come from the **need to reduce debt** principle and as the same time impair the capacity of the operation to **raise working capital**.

![Value of Canadian Farmland](chart.png)

*Source: Statistics Canada*
Consumer Resilience Results

- Domestic Retail Demand
- International Demand

**DEMAND** is a consumer’s willingness to pay for a specific quantity and quality of product.

**TRENDS** are the result of fundamental changes in technology, society and the economy that play out over years or even generations.

**FADS** are driven by changes in current consumer inclinations; they come and go.

- Domestic Index 2000=100
  - Value: 104

- International Index 2000=100
  - Value: 82
Consumer Resilience Considerations

Long Term Trends

- Population growth
- Growing middle class with disposable income
- Consumer Demographics
  - Ethnic Diversity
  - Age Structure (baby boomers, millennials)

Medium Term Perceptions

- Food Safety
- Beef Quality
- Health Information
- Environmental Impact
- Animal Welfare

Short Term Market Impacts

- Price
- Competing Meat Prices
- Switching between proteins and cuts
Demand Index Domestic Retail

Canadian Retail Beef Demand Index
(Index 2000=100)

Source: CanFax Research
Demand Index International

International Beef Index
(2000=100)

Source: Cranfield 2012, CanFax Research Services
Continuous Improvement
Producer Viability & Consumer Resilience

Quality
Recognizing and Responding to Trends
Produce more of what consumers want (attributes) and less of what they don’t want

Productivity
Pounds weaner per cow exposed +1.87lbs/year (98-13)
Feed efficiency 10:1 in 1950 to 6:1 in 2010
Carcass weights up 7 lbs/year
Fewer cows needed today to produce more pounds of beef

Marketing
Differentiating quality (grid, formula, rail vs. live)
Traceability of specific attributes
Price discovery & transparency
Risk management
Product development
Thank you!

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