National Forage and Grassland Assessment

Report Prepared by:

Douglas Yungblut, Ph.D., P.Ag.
Yungblut & Associates Inc.

Final Report
June, 2012
Table of Contents

1. EXECUTIVE SUMMARY .................................................................................................................. 2

2. INTRODUCTION ............................................................................................................................ 3
   I. REASONS FOR THIS REPORT ................................................................................................. 3
   II. SCOPE OF REPORT .................................................................................................................. 3
   III. PREVIOUS PROVINCIAL REPORTS ..................................................................................... 4
       a. Ontario ................................................................................................................................. 4
       b. Quebec ................................................................................................................................. 4
       c. Saskatchewan ...................................................................................................................... 5
       d. Alberta ................................................................................................................................. 5
       e. Manitoba .............................................................................................................................. 6
       f. Summary of Provincial Reports .......................................................................................... 7

3. METHODOLOGY: HOW VALUES WERE DETERMINED ............................................................... 8

4. TRENDS OVER THE PAST 15 YEARS: MACRO NUMBERS OF ACRES AND LIVESTOCK FROM 4 CENSUSES .................................................................................................................. 11

5. DETAILED ANALYSIS OF ACRES AND LIVESTOCK FROM 2011 CENSUS .............................................................. 12

6. VALUE OF INDUSTRY FROM A COST OF PRODUCTION AND NUTRIENT VALUE STANDBOARD .......................................................................................................................... 14

7. VALUE OF INDUSTRY FROM A CONTRIBUTION TO THE VALUE OF THE BEEF AND DAIRY INDUSTRY STANDPOINT ........................................................................................................... 15

8. VALUE OF FORAGES AS A PROVIDER OF ECOLOGICAL GOODS AND SERVICES AND BIOMASS ................................................................................................................................. 17

9. FORAGE AND FORAGE SEED EXPORTS .................................................................................... 18

10. SUMMARY AND CONCLUSIONS ................................................................................................. 19

11. ACKNOWLEDGEMENTS ............................................................................................................... 19

12. REFERENCES ................................................................................................................................. 20

This report entitled “National Forage and Grassland Assessment” was produced by Yungblut & Associates Inc.. The review was commissioned for discussion purposes by Agriculture and Agri-Food Canada (AAFC). The content of this report does not necessarily reflect the opinions or interests of AAFC.
1. Executive Summary

The Canadian forage industry suffers from a lack of recognition for its contribution to the economy because it is diverse and difficult to measure. Everyone is familiar with scenes of livestock grazing or fields dotted with bales of hay, but these are not viewed from an economic viewpoint the way a field of corn, wheat or canola would be. This leads to a lack of support for this industry in both the public and private sectors.

Over the past five years each of the major forage producing provinces have examined the nature and scope of their forage industries. This lead to the determination of industry values ranging from $650M in Ontario to $1.5B in Alberta in direct economic contribution. There studies were, however done at different times using different study methodologies. There has never been a comprehensive review of the economic value of the Canadian forage industry.

The current study used acreage data from the 2011 census and economic values from 2011 whenever possible. A variety of sources were consulted to estimate dollar values of various aspects of the industry.

In terms of acreage, cultivated forages for pasture, feed and seed production accounted for 33.8 million acres or 39% of the land in Canada devoted to crop production. In comparison the next largest crop, wheat accounted for 20.4 million acres or 23% of crop land. In addition, over 36 million acres of land were devoted to native or unimproved pastures.

The economic value of the industry was $5.09 billion, making it the third largest crop after wheat and canola. The forage industry is the foundation of the dairy and beef industries which together contribute $11 billion in direct value to Canadian farmers and generate over $50 billion in economic activity.

These are the direct measurable benefits of the forage industry. Provincial studies in Alberta and Saskatchewan estimated the value of indirect benefits such as environmental enhancements and found that these could be worth as much again as the direct benefits.

There are exciting emerging opportunities for the forage industry. Interest in their use as renewable fuels and feedstock for biomaterials is in its infancy. There is also growing demand in areas such as China and the Middle East for high quality forages to feed growing livestock industries or to replace domestic production.
2. Introduction

i. Reasons for this Report

Canadian forages are produced across all agricultural regions of Canada. In total, almost 40% of Canada's total farm area is set aside for grazing and growing forage crops. The forage industry is not homogeneous with several distinct sectors based on the end use of the forage crop (turf species, soil conservation, forage seed production, grazing, and stored feed for ruminant livestock). The latter two categories represent the largest sector and utilize between 80-85% of the total forage produced.

Farm cash receipts, according to Statistics Canada, for forage and hay (including seed) reached $381.9 million in 2010 compared with $357 million the previous year. Farm cash receipts do not capture forage used on farms so this value greatly underestimates the value of forages in the agricultural industry.

Currently, over 70 million acres are used for livestock grazing, forage seed production and the growing of forage crops. Forage crops are grown for pasture, harvested as green-feed, stored as baled hay or silage, processed into pellets or cubes, or compressed for export markets. There are two aspects of the forage and grassland industry – the production of forage for feed, fibre, and seed and the value of forage and grassland from an environmental and biodiversity aspect.

There have been a number of provincial studies (Alberta, Saskatchewan, Ontario, Quebec, Manitoba) completed since 2008. This national assessment reviews and incorporates data from these sources and adds data from the other regions of Canada (British Columbia and Atlantic Canada) to estimate an overall value for the Canadian forage and grassland industry.

This national report builds a strong base of information from which government and industry can respond to domestic and global needs of the forage and grassland industry in Canada.

ii. Scope of Report

In this report the forage industry will be evaluated based on the acreages of the various forage types that make up the industry plus yield and value figures determined from various industry sources. Only those crops associated with feeding livestock or export as forages will be included in the value summary. Other uses of forages will be discussed for possible inclusion in future studies but not included in the value calculations in this report.
iii. Previous provincial reports

a. Ontario

In 2008 a forage study was carried out by J.W. Fisher, University of Guelph Kemptville campus, in an attempt to calculate the monetary value of forage in Ontario. A copy of this study, ‘Estimating the Value of Ontario’s Forage Industry’ may be obtained from the Ontario Forage Council (a).

A voluntary online survey was conducted that asked farmers to input their forage production data for the year 2007. The survey asked specific questions related to the production of forage, price, storage, and cost. The final number of pertinent records was 612. Results from the survey farms were then extrapolated to all Ontario farms producing forages.

Since most forage crops do not change ownership but are consumed on farm, the approach that was taken was to value the nutrients in forages as if they came from grains which have an established market value. The value of all forages (grasses and legumes) in Ontario during 2007, for agriculture purposes was estimated at $647.7M, making it the second largest crop produced in Ontario next to corn.

b. Quebec

A study published in 2010 examined the status of, and issues facing the forage industry in Quebec. The report is entitled ‘The Quebec Forage Industry: Status, Issues and Challenges’ (b). For this study a number of producers and industry stakeholders were consulted. They identified issues facing the Quebec forage industry as follows:

- Forage yields have actually declined from the early 1990’s to the early 2000’s. This is at least partly due to the shift of forage acres from higher to lower growing degree day areas as corn and soybeans have become more popular in the longer growing season areas.
- The number of dairy cows has declined and in many cases there is less forage used to feed those that remain. Other ingredients like by-products and cereals have replaced some forages.
- The environmental benefits of forages are not always recognized
- The potential role of perennial forages as a source of bio-products is unknown
- There is lack of support for the forage industry by government programs such as price supports.
- Some programs such as crop insurance do not provide adequate coverage for forages.

There was a comparison made of forage production and consumption by region and exports to the U.S. were noted, but there was no overall measure of the size of the Quebec industry.
c. Saskatchewan

The most comprehensive provincial study was conducted in Saskatchewan and reported in 2010 with the title ‘The Value of Saskatchewan’s Forage Industry’ (c). Through extensive research and stakeholder consultation, this report quantified that forages are an important resource in Saskatchewan both in economic and environmental terms. As determined in this report:

- Direct economic value generated by forages is in the range of $740.4 million annually, generated through economic activity associated with a wide variety of sectors.
- In addition, there is potential in a number of sectors to grow and create direct value for forages. For example, there is potentially $11.2 - $137 million of direct economic activity to be generated from forage land depending on the future direction of climate change policy.
- Indirect benefits include ecological goods and services such as erosion control, flood control, water quality, wildlife habitat, pollination services and carbon sequestration. This report determined that forages provide an indirect value of $894.5 million - $1.9 billion annually in Saskatchewan.
- Savings from government programs due to current forage acres were estimated at $401.6 million per year.
- This report estimated that the total direct and indirect value from forages equals $2 - $3 billion annually in Saskatchewan.

The report also identified issues and opportunities facing the advancement of the forage industry in Saskatchewan. A number of hurdles including reduced research and development funding, lack of a producer funded levy, transportation logistics and costs for the export industry, a depressed livestock industry, segmentation between forage sectors and a general lack of prominence as a crop in the agricultural matrix were discovered as challenges facing the industry. However a number of opportunities were identified as well. Strengthening links with the livestock industry, growth in organic livestock and crop production, carbon sequestration, agri-tourism, biofuels, new forage export markets and forage seed production were all identified as areas of potential for the forage industry to capitalize on.

d. Alberta

Following the publication of the extensive Saskatchewan report it was decided to conduct a similar study in Alberta in 2011. The resultant report is entitled ‘The Value of Alberta’s Forage Industry’ (d). Through a comprehensive valuation and analysis of each forage sector present in Alberta, this report concluded that forages make substantial contributions to the economic and environmental sustainability of the province. Major findings included:
• Direct estimated economic value generated by forages is in the range of $1.5 billion annually, based on the production and sale of numerous forage products including seed, processed forages, hay, and greenfeed.

• There is the potential for forage land to generate more economic value depending on future technological advancements and government policy. Approximately $14 million could be generated in the provincial carbon offset market, pending the approval of forage-related offset protocols. In addition, forages have the ability to be used as feedstock in the bio-fuel and bio-energy industries.

• Forages create indirect value through the ecological goods and services they provide. Forages contribute to control of erosion, wildlife habitat, water regulation, pollination, and carbon sequestration. Based on literature values, forages generate an estimated $390 million to $1.3 billion annually in relation to these goods and services.

• Forage land can also help reduce government program costs, such as crop insurance and income stabilization paid out for annual crops. Current forage acreage is estimated to save these programs $428 million annually.

• Taken together, the annual total estimated direct and indirect economic value of the forage industry in Alberta ranges from $2.3 to $3.3 billion.

e. Manitoba

In May, 2010 a report (e) was produced for the provincial forage industry entitled ‘The Manitoba Forage and Grassland Industry Strategic Plan’. This was the outcome of a strategic planning workshop for industry stakeholders and additional survey work by a consultant.

As an outcome of this report several strategic solutions were developed to capitalize on the opportunities and to mitigate the challenges that face the forage and grassland industry, under five broad initiative categories, including:

• Ensure that research addresses the Manitoba forage and grassland industry’s needs;
• Enhance extension services to improve forage and grassland producers’ agronomic and farm management/marketing practices;
• Enhance the capacity of the Manitoba forage and grassland industry to develop leadership and sustainability strategies;
• Improve market opportunities through improved logistics and infrastructure, particularly to move hay to export markets and to process livestock locally for niche markets; and
• Improve the image of agriculture in general and forage/grassland production in particular.

No attempt was made to put an overall value on the forage industry.
f. Summary of Provincial Reports

If there was any doubt about the necessity of the current report, the overwhelming message from the provincial reports is that while the forage sector is a major contributor to the provincial economies it is undervalued and underappreciated. Major points include:

- Forage yields have stayed stable or even declined while those of competitive crops like corn and canola have increased dramatically.
- Research into forage breeding and development has declined dramatically in the public sector.
- Extension support of forage programs has declined dramatically in some provinces.
- Crop support and risk management programs do not value forages as highly as other crops.
- Forages have a significant role to play in the Canadian environment beyond just supplying nutrients to livestock.
3. Methodology: How values were determined

A report of this nature requires many assumptions and use of data from a variety of sources. The 2011 census figures were newly available at the time the project was initiated. Values used in this report will, as much as possible reflect the most current numbers available.

Since the Saskatchewan and Alberta reports previously cited (c and d) contained values determined by in depth study, where applicable these values were used. Other data sources were as follows:

**Corn Silage yields:** There are not reliable provincial statistics available for all provinces. A corn breeding company with an extensive test plot program across Canada was contacted (f). The yields reflect their estimation based on plot results.

**Corn Silage value:** There is much discussion about how to value corn silage in relation to grain corn. The University of Wisconsin forage resource center suggests using the value of 8 bushels of grain corn (g). Based on OMAFRA values (h) the average value of a bushel of corn in 2010 was $5.25. The value used for corn silage was thus ($5.25 X 8) $42/tonne.

**Hay Yields:** Yields for 2011 for Alberta and Saskatchewan were taken from the extension websites. The Alberta value was used for British Columbia in the absence of other data. For Manitoba, Ontario and Quebec values were taken from extension service websites. The Quebec value was also used for the Maritimes. Values are reported on a hay equivalent basis of 90% dry matter. Hay yields were not broken down by type so the acreage of alfalfa and alfalfa mixes was combined with other hay and fodder to calculate hay production.

**Hay value:** At the time of writing this report the only provincially reported hay value for 2011 was $53/tonne for Saskatchewan. For 2010 values reported for Saskatchewan, Alberta and Ontario were $56, 102 and 126, respectively. This produces a ratio of 2011/2010 for Saskatchewan of 95%. This ratio was then applied to the 2010 numbers for Alberta and Ontario to derive values for 2011 of $97 and $120 respectively. In the absence of other data the Alberta number was used for B.C., the Saskatchewan one for Manitoba and the Ontario one for Quebec and the Maritimes.

**Value of Nitrogen contribution:** The level of N contribution is taken from the Ontario (h) website for one half or more legume. The N only has real value when a legume crop is taken out of production and followed by an N requiring crop like corn or canola. The assumption was made that 20% of alfalfa would be taken out of production each year so the value was applied to those acres. The current value of N (2011) according to the Ontario site is $0.78/lb.
Value of pasture: For Saskatchewan and Alberta the values for animal unit months (AUM) per acre from the previously cited reports were used. For B.C. the Alberta values were used and for Manitoba the Saskatchewan values were used. For Ontario the provincial grazing specialist (j) was consulted to determine appropriate values. Due to the similarity of agronomic practices and climate these same values were used for Quebec and the Maritimes. The value of an AUM was taken from the Saskatchewan study. This was calculated using a figure of $0.75/day as the cost of grazing for a cow calf pair.

Value of forage seed production: Forage seed value per acre from the Alberta report was $126 and for Saskatchewan was $129. An average value of $127.50 was used for this report. There is no way of separating whether production was for domestic or export. Export values were not added since this could involve double counting.

Dehydrated alfalfa: The actual question on the 2011 census regarding alfalfa and alfalfa mixtures specifically includes dehydrated alfalfa. The assumption is made that these acres are included in the “alfalfa and alfalfa mixtures” section.

Cereals (other than corn) for silage: There is a possibility that some of the acreage in the next 2 categories is already counted in the “other hay and fodder” category. The question related to this on the 2011 census was “other crops for fodder including sorghum, etc.”. In some cases cereals that were planned to be harvested for grains end up being harvested as silage or greenfeed due to unfavourable weather or growing conditions. Since the Alberta and Saskatchewan reports included these as separate categories they will be included in this report. In Alberta this acreage is tracked as part of regular statistical reporting so the values for Alberta are quite robust. The values for 2010 are used in this report. In the Saskatchewan report acreage was calculated based on expected forage consumption for dairy and beef cattle. Their value included corn silage so this acreage was backed out since it had already been accounted for. There are no reliable statistics for the other provinces. Since beef cows would be the major consumers of cereal silage in B.C. and Manitoba values for these provinces were calculated using the percentage of Alberta cows in B.C. (13.6%) and of Saskatchewan cows in Manitoba (45%). Corn is the preferred silage crop in eastern Canada and cereal silage is only grown where climatic or soil conditions do not permit the growing of corn. The acreage of cereals for silage is estimated for the eastern region. The value used for this silage was that reported for 2010 in the Alberta report.

Cereals for greenfeed and swath grazing: This refers to cereals that are harvested and baled while still green or swathed and left in the field for grazing. Alberta also tracks this acreage. Again since beef cows would be the major consumers of this feed, for the other western provinces an acreage estimate was made based on the percentage of cows that each province has of Alberta (B.C. 13.6%, Saskatchewan 71% and Manitoba 32%). Due to the climatic conditions in eastern Canada this type of forage production is not practised there. The value used for this silage was that reported for 2010 in the Alberta report.

Crops not included: The Saskatchewan and Alberta studies included sod and straw in the assessment of forage value. The decision was made that these crops did not qualify as forages and so they were not included.
Exports: Exports of forages and seeds were included in the Alberta and Saskatchewan studies. Since it is impossible to differentiate which acres are designated for export and which for domestic use, adding the export values to the totals could lead to double counting. Forage and seed exports would generate extra income beyond the farm gate but this premium would be negligible in relation to the overall size of the industry. For this reason exports are not included in this analysis. The value of, and issues facing the export industry will be discussed more fully in section 9.
4. Trends over the past 15 years: Macro numbers of acres and livestock from 4 censuses

As shown in Table 1 forage acres decreased during this time period, especially in the interval from 2006 to 2011.

Table 1: Forage acreage and livestock numbers 1996 – 2011*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn for silage (000 acres)</td>
<td>473</td>
<td>583</td>
<td>687</td>
<td>675</td>
<td>98</td>
</tr>
<tr>
<td>Tame hay (000 acres)</td>
<td>15,347</td>
<td>18,074</td>
<td>19,962</td>
<td>16,943</td>
<td>85</td>
</tr>
<tr>
<td>Tame or seeded pasture (000 acres)</td>
<td>10,746</td>
<td>11,872</td>
<td>14,071</td>
<td>13,671</td>
<td>97</td>
</tr>
<tr>
<td>Forage seed (000 acres)</td>
<td>NA</td>
<td>799</td>
<td>662</td>
<td>326</td>
<td>49</td>
</tr>
<tr>
<td>Total beef cows (000 head)</td>
<td>4,680</td>
<td>4,802</td>
<td>5,082</td>
<td>3,849</td>
<td>75</td>
</tr>
<tr>
<td>Total dairy cows (000 head)</td>
<td>1,227</td>
<td>1,060</td>
<td>996</td>
<td>963</td>
<td>97</td>
</tr>
<tr>
<td>Total sheep and lambs (000 head)</td>
<td>864</td>
<td>1,262</td>
<td>1,143</td>
<td>1,108</td>
<td>97</td>
</tr>
</tbody>
</table>

*Statistics Canada (j)

Corn silage and tame pasture numbers have remained fairly constant since the 2006 census but hay and forage seed acres have seen a dramatic decline. Dairy cow numbers have declined steadily in recent years due to the increased productivity of dairy cows and the upper limit on total milk production due to the quota system. Beef cow numbers have decreased dramatically since the 2006 census. The 2006 beef cow number was somewhat inflated in the aftermath of the 2003 BSE crisis. The dramatic decline since 2006 reflects poor returns to the beef industry in that time period.
5. Detailed analysis of acres and livestock from 2011 census

Table 2: Crop acreages, yields and value assignments

<table>
<thead>
<tr>
<th>(000 acres)</th>
<th>Can</th>
<th>BC</th>
<th>Alb</th>
<th>Sask</th>
<th>Man</th>
<th>Ont</th>
<th>Que</th>
<th>Total</th>
<th>Mar*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural pasture acres</td>
<td>36,316</td>
<td>3,423</td>
<td>15,903</td>
<td>11,902</td>
<td>3,625</td>
<td>984</td>
<td>331</td>
<td>148</td>
<td></td>
</tr>
<tr>
<td>AUMs** per acre</td>
<td>0.45</td>
<td>0.45</td>
<td>0.37</td>
<td>0.37</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>AUM Value $</td>
<td>22.5</td>
<td>22.5</td>
<td>22.5</td>
<td>22.5</td>
<td>22.5</td>
<td>22.5</td>
<td>22.5</td>
<td>22.5</td>
<td></td>
</tr>
<tr>
<td>Tame, seeded pasture acres</td>
<td>13,699</td>
<td>559</td>
<td>5920</td>
<td>5085</td>
<td>1026</td>
<td>649</td>
<td>312</td>
<td>148</td>
<td>25.8</td>
</tr>
<tr>
<td>AUMs per acre</td>
<td>1.35</td>
<td>1.35</td>
<td>1.41</td>
<td>1.41</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>3</td>
</tr>
<tr>
<td>AUM Value $</td>
<td>22.5</td>
<td>22.5</td>
<td>22.5</td>
<td>22.5</td>
<td>22.5</td>
<td>22.5</td>
<td>22.5</td>
<td>22.5</td>
<td></td>
</tr>
<tr>
<td>Corn for silage acres</td>
<td>675</td>
<td>34</td>
<td>96</td>
<td>27</td>
<td>79</td>
<td>271</td>
<td>142</td>
<td>25.8</td>
<td></td>
</tr>
<tr>
<td>Yield tonnes/acre</td>
<td>20</td>
<td>17.1</td>
<td>16</td>
<td>16</td>
<td>26</td>
<td>25</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value/ tonne $</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td>42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alfalfa &amp; alfalfa mixtures acres</td>
<td>11,233</td>
<td>538</td>
<td>3657</td>
<td>3586</td>
<td>1319</td>
<td>1346</td>
<td>675</td>
<td>112</td>
<td></td>
</tr>
<tr>
<td>N contribution (lb/acre)</td>
<td>97</td>
<td>97</td>
<td>97</td>
<td>97</td>
<td>97</td>
<td>97</td>
<td>97</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N value ($/lb)</td>
<td>0.78</td>
<td>0.78</td>
<td>0.78</td>
<td>0.78</td>
<td>0.78</td>
<td>0.78</td>
<td>0.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other tame hay and fodder acres</td>
<td>5,711</td>
<td>411</td>
<td>1467</td>
<td>1001</td>
<td>509</td>
<td>731</td>
<td>1219</td>
<td>373</td>
<td></td>
</tr>
<tr>
<td>Yield tonnes/acre</td>
<td>1.8</td>
<td>1.8</td>
<td>1.97</td>
<td>1.5</td>
<td>2.4</td>
<td>2.3</td>
<td>2.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value/ tonne $</td>
<td>97</td>
<td>97</td>
<td>53</td>
<td>53</td>
<td>114</td>
<td>114</td>
<td>114</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forage seed acres</td>
<td>326</td>
<td>42</td>
<td>132</td>
<td>73</td>
<td>68</td>
<td>7.5</td>
<td>2.9</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>Value/acre $</td>
<td>127.5</td>
<td>127.5</td>
<td>127.5</td>
<td>127.5</td>
<td>127.5</td>
<td>127.5</td>
<td>127.5</td>
<td>127.5</td>
<td></td>
</tr>
<tr>
<td>Cereals for silage acres***</td>
<td>860</td>
<td>78</td>
<td>570</td>
<td>132</td>
<td>60</td>
<td>5</td>
<td>10</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Yield tonnes/acre</td>
<td>6.91</td>
<td>6.91</td>
<td>6</td>
<td>6</td>
<td>6.91</td>
<td>6.91</td>
<td>6.91</td>
<td>6.91</td>
<td></td>
</tr>
<tr>
<td>Value/ tonne $</td>
<td>35.8</td>
<td>35.8</td>
<td>35.8</td>
<td>35.8</td>
<td>35.8</td>
<td>35.8</td>
<td>35.8</td>
<td>35.8</td>
<td></td>
</tr>
<tr>
<td>Cereals for Greenfeed acres***</td>
<td>1,245</td>
<td>78.2</td>
<td>575</td>
<td>408</td>
<td>184</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Yield tonnes/acre</td>
<td>3.02</td>
<td>3.02</td>
<td>3.02</td>
<td>3.02</td>
<td>3.02</td>
<td>3.02</td>
<td>3.02</td>
<td>3.02</td>
<td></td>
</tr>
<tr>
<td>Value/ tonne $</td>
<td>77.18</td>
<td>77.18</td>
<td>77.18</td>
<td>77.18</td>
<td>77.18</td>
<td>77.18</td>
<td>77.18</td>
<td>77.18</td>
<td></td>
</tr>
<tr>
<td>Total 000 acres</td>
<td>70,065</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Acreages, Statistics Canada (j), other values see section 3 *Total 4 Maritime provinces ** AUM = Animal unit months *** acreages estimated from provincial forage reports
It is obvious from the data presented in Table 2 that forages are a major contributor to Canadian agriculture in terms of area. To put these numbers in perspective, the total reported acreage in crops in 2011 was reported as 87.3 million acres. The area in tame pasture and forage and seed production was 33.8 million acres (39% of total crop land) as compared to the next greatest crop which was wheat at 20.4 million acres (23%). It is now important to calculate a dollar value for this vital industry.
6. Value of industry from a cost of production and nutrient value standpoint

Table 3: Value of different forage sectors ($ 000)*

<table>
<thead>
<tr>
<th></th>
<th>Canada</th>
<th>B.C.</th>
<th>Alberta</th>
<th>Sask.</th>
<th>Manitoba</th>
<th>Ont.</th>
<th>Que.</th>
<th>Mar.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pasture</td>
<td>810,908</td>
<td>51,638</td>
<td>340,838</td>
<td>260,406</td>
<td>62,728</td>
<td>58,646</td>
<td>24,998</td>
<td>11,655</td>
</tr>
<tr>
<td>Corn Silage</td>
<td>634,360</td>
<td>28,560</td>
<td>68,947</td>
<td>18,144</td>
<td>53,088</td>
<td>295,932</td>
<td>149,100</td>
<td>20,588</td>
</tr>
<tr>
<td>N contribution from legumes</td>
<td>169,982</td>
<td>8,141</td>
<td>55,338</td>
<td>54,263</td>
<td>19,959</td>
<td>20,368</td>
<td>10,214</td>
<td>1,699</td>
</tr>
<tr>
<td>Hay - alfalfa and all other tame</td>
<td>2,939,463</td>
<td>165,695</td>
<td>894,650</td>
<td>478,929</td>
<td>145,326</td>
<td>598,176</td>
<td>522,744</td>
<td>133,943</td>
</tr>
<tr>
<td>Forage Seed</td>
<td>41,578</td>
<td>5,355</td>
<td>16,830</td>
<td>9,308</td>
<td>8,670</td>
<td>956</td>
<td>370</td>
<td>89</td>
</tr>
<tr>
<td>Cereal silage, greenfeed, swath grazing</td>
<td>496,726</td>
<td>37,523</td>
<td>275,029</td>
<td>123,452</td>
<td>55,775</td>
<td>1,237</td>
<td>2,474</td>
<td>1,237</td>
</tr>
<tr>
<td><strong>Total value</strong></td>
<td>5,093,017</td>
<td>296,912</td>
<td>1,651,632</td>
<td>944,501</td>
<td>345,546</td>
<td>975,315</td>
<td>709,899</td>
<td>169,212</td>
</tr>
</tbody>
</table>

* For value determinations see section 3 **All Maritimes

The data shown in Table 3 demonstrate that forages are a major contributor to the Canadian agricultural sector. In contrast to some other crops like wheat or canola, the majority of the value of forages is captured within Canada, on the farm where it is produced. In 2011 wheat growers in Canada realized net farm income of $5.2 B while canola producers realized $ 7.3 B (Stats Canada, (j)). This would make forages with a value of $ 5.09B the third largest crop in Canada in terms of value generated at the farm level.

The numbers shown in Table 3 compare favourably with those generated by the provincial studies reported earlier. The estimate of the value of the Ontario industry in 2007 was $ 648M. The Alberta study using data from 2006 to 2010 estimated the direct value of the forage industry at $ 1.5B while the Saskatchewan determined a value of $ 740M using data from 2006 - 2009. The present study uses the most recent data when prices for forages have increased and well as giving value to the nitrogen contribution of forages, which was not included in the other studies.

As will be shown in section 9, exports of forages and forage seeds are a small part (4%) of the industry value. However as shown in section 7 they do make a major contribution to the value of the beef industry which exports a major portion of its production. In that sense a significant fraction of forage value is exported via beef exports.
7. Value of industry from a contribution to the value of the beef and dairy industry standpoint

Value of dairy and beef industries to the Canadian economy

Dairy
Milk production on farms supports $30 billion in economic activity in Canada (k). This is generated through sales and manufacturing of milk, and by jobs and economic activity created in the industries that provide goods and services to dairy farmers and processors.

- The dairy industry adds a net $9.7 billion to the Canadian Gross Domestic Product.
- Milk sales from Canadian farms are valued at $5.3 (2008) billion dollars.
- The sale of processed dairy products is valued at $13.1 billion.

Beef
In 2010 farm cash receipts for cattle and calves were $6.15 billion (l). It is estimated that the cattle industry contributes $20 billion to the Canadian economy and is the largest single contributor of cash income to Canadian farmers (m).

ii. Contribution of forages
In OMAFRA livestock enterprise budgets it is estimated that in 2010 forages contribute approximately 59% of the cost of keeping a beef cow calf pair for a year and 15% of the cost of raising a beef calf to slaughter weight (n).

In the same source, for dairy cows, forages are estimated to contribute 41% of the feed cost or 16% of the total cost of keeping a cow for one year (n).

Figure 1: Depiction of forage industry value to farm sector and Canadian economy
It undervalues the contribution of forages to these industries to just look at it from a cost standpoint. It would be virtually impossible for these industries, which contribute over $11 billion at the farm gate level to the economy, to exist from a cost, animal health or environmental standpoint without forages. In section (6) a value for the Canadian forage industry was estimated to be $5.09 billion. When this industry serves as the underpinning of industries which contribute $11 billion at the farm level and $50 billion at the GDP level to the Canadian economy, as shown in Figure 1, this number is clearly too low.

The horse, sheep and goat, bison and exotic livestock industries also depend heavily on forages for their existence and add further to the contribution of forages to the Canadian economy.
8. Value of forages as a provider of ecological goods and services and biomass

From the previously cited Saskatchewan study, indirect benefits include ecological goods and services such as erosion control, flood control, improved surface water quality, wildlife habitat, pollination services and carbon sequestration. This report determined that forages provide an indirect value of $894.5 million - $1.9 billion annually. In the Alberta report this value was estimated to be in the range of $390 million to $1.3 billion annually.

Further discussion of the increased sequestration of carbon by forages is outlined in the following quotation from Meyer-Aurich et al (o):

“Integration of alfalfa into a corn rotation can mitigate more than 2000 kg CO2 eq ha⁻¹ per year. Even though legumes contribute considerably to the emissions of GHG by fixing nitrogen in the soil, these emissions are more than offset by reduced emissions from less fertilizer use, the reduced induced emissions from manufacturing the fertilizer and increased carbon sequestration in the soil. This cropping practice seems to be a win–win situation since it provides benefits for the farmer and the environment”.

Alberta is the only province to have an active carbon sequestration payment program to date. Approximately $14 million could be generated in the provincial carbon offset market, approval of forage-related offset protocols.

In addition, forages have the ability to be used as biomass feedstock in the bio-fuel and biomaterials industries. Ontario, for example, has established a provincial steering committee to guide the process of biomass development for combustion (p). There is an existing domestic market for biomass pellets for burning as well as a market in the EU. Researchers at the University of Guelph (q) are leading an effort to incorporate biomass into plastics that would have a variety of applications in the consumer and automotive industries. The value of these industries will evolve over the next decade.
9. Forage and Forage Seed Exports

Canada is currently a significant participant in both the export forage and forage seed markets. As shown in Tables 4 and 5 a variety of crops and seeds are exported.

Table 4: Canada's Top Varieties of Exported Forages, Hay & Clover ($ million)

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Timothy Hay</td>
<td>104.8</td>
<td>123.4</td>
<td>77.4</td>
<td>75.1</td>
<td>53.6</td>
<td>48.8</td>
</tr>
<tr>
<td>2 Dehydrated Alfalfa Meal &amp; Pellets</td>
<td>22.4</td>
<td>29.5</td>
<td>23.3</td>
<td>18.7</td>
<td>13.3</td>
<td>13.7</td>
</tr>
<tr>
<td>3 Dehydrated Alfalfa in Cubes</td>
<td>15.3</td>
<td>17.2</td>
<td>17.2</td>
<td>11.7</td>
<td>5.5</td>
<td>7.3</td>
</tr>
<tr>
<td>4 Other Hay</td>
<td>7.4</td>
<td>9.4</td>
<td>13.1</td>
<td>9.9</td>
<td>4.9</td>
<td>9.0</td>
</tr>
<tr>
<td>5 Other Alfalfa, Loose or in Bales</td>
<td>6.0</td>
<td>7.7</td>
<td>10.8</td>
<td>7.2</td>
<td>2.6</td>
<td>17.7</td>
</tr>
<tr>
<td>Other</td>
<td>10.9</td>
<td>6.2</td>
<td>5.8</td>
<td>2.7</td>
<td>2.3</td>
<td>4</td>
</tr>
<tr>
<td><strong>TOTAL VALUE</strong></td>
<td>166.8</td>
<td>193.4</td>
<td>147.6</td>
<td>125.3</td>
<td>82.2</td>
<td>100.5</td>
</tr>
</tbody>
</table>


The value of Canadian exports has declined in recent years but this is not a reflection of reduced international demand. The U.S. and Japan are currently the largest purchasers of Canadian forage and seed exports.

After discussions with several exporting companies the following trends are apparent:

- Japan and Korea will likely continue at approximately the same level of imports.
- China and the Middle East (especially Saudi Arabia) will grow substantially as importers of forages. China has much more stringent standards for imported forages than other countries. China faces a shortage of quality forage to support its rapidly growing dairy sector and the Middle Eastern countries have decided to reduce forage production as a water conservation measure.

The first export of Canadian forage to China occurred in early 2012. These export values were not added to the value of the Canadian industry since it is impossible to differentiate production numbers between exports and domestic usage.
10. **Summary and Conclusions**

Forage industry appraisals from each of the major forage producing provinces were reviewed in the preparation of this report. They highlighted both the importance of forages in different parts of Canada and some similar issues facing this industry sector in each province. These issues include level or declining yields, lack of public sector support for the industry and declining emphasis on public sector forage breeding.

Due to the complex and diverse nature of the forage industry a number of sources were consulted to develop an evaluation system that was as transparent and rigorous as possible. The result is a valuation of the industry that allows a fair comparison to other segments of the agricultural industry.

No matter what measuring system is used the forage industry is an important contributor to the value of Canadian agriculture. The direct measurable value as a provider of nutrients to livestock and of nitrogen to other crops is over $ 5 billion using values from 2011. This makes forages the third largest crop in terms of income generated at the farm level. The industry also serves as the underpinning of the dairy and beef sectors that generate over $ 11 billion in income at the farm level and $50 billion of economic activity in the Canadian economy.

There are exciting new emerging opportunities for forages as a source of biomass fuel and biomaterials. The quest to reduce our dependence on fossil fuels in an environmentally sustainable manner has led to interest in the development of perennial crops for these applications. This interest will continue to grow as new technology emerges to make these applications more economically viable.

Forages also contribute to the improvement of the environment and to public enjoyment of the rural landscape. Attempts at putting a monetary value on these services in Alberta and Saskatchewan indicate that they could at least double the value of $ 5.09 billion.

There are dynamic new international opportunities for the Canadian forage industry. The burgeoning dairy industry in China and the increased demand for forages from Middle Eastern countries determined to conserve their precious water resources have created two new and growing markets.

11. **Acknowledgements**

A report of this nature would not be possible without the support and encouragement of a steering committee. The committee provided input and guidance throughout the process from project conception to final report. The members of the steering committee include: Justin Sugawara and George Adnam: Agriculture & Agri-Food Canada, Jack Kyle: Ontario Ministry of Agriculture, Food, and Rural Affairs.
12. References


b. http://fourrages.ca/concours/cqpf/


d. http://www.albertaforages.ca/site/news__events


f. Welbanks, T., Agronomist, Maizex Seeds, personal communication

g. University of Wisconsin forage resource website
   http://www.uwex.edu/ces/crops/uwforage/BuyingSellingCS.pdf


i. Kyle, J., Ontario Provincial grazing specialist, personal communication

j. www5.statcan.gc.ca/


q. http://www.uoguelph.ca/research/learn-about-research/environment

This report entitled “National Forage and Grassland Assessment” was produced by Yungblut & Associates Inc.. The review was commissioned for discussion purposes by Agriculture and Agri-Food Canada (AAFC). The content of this report does not necessarily reflect the opinions or interests of AAFC.