Accounting for Agricultural Natural Wealth

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"Land, Water and Society"
Alberta Land Institute Conference
May 30, 2018

InnoTech ALBERTA

Sponsored by the Alberta Land Institute

Acknowledgements

- Rob Smith, Midsummer Analytics
- Erin Sawyer, Alberta Land Institute
- Alberta Land Institute
- Participants in ALI Agricultural Natural Capital Project

EDITORIALS

Should we sprawl on farmland?

It's no small irony that some of the continent's richest farmland is situated in or near our largest urban centres. Of course, there is perfectly understandable historical rationale behind that seeming contradiction today. Not surprisingly, pioneers gravitated to the best prope... wherever they found it, and that almost ali... ded agricultural potential. There is ba... rhood extant in Edmonton today... ctive farmland.

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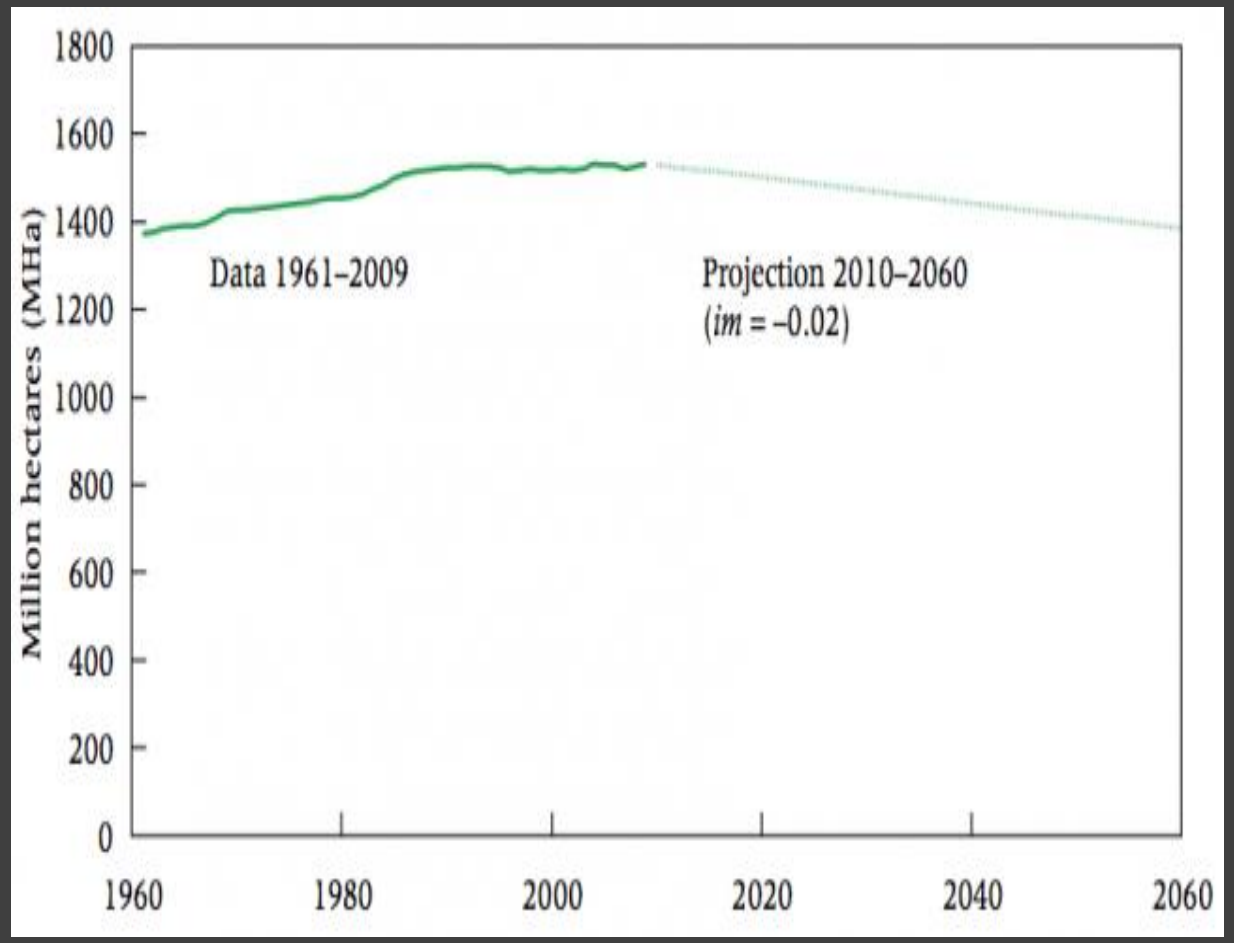
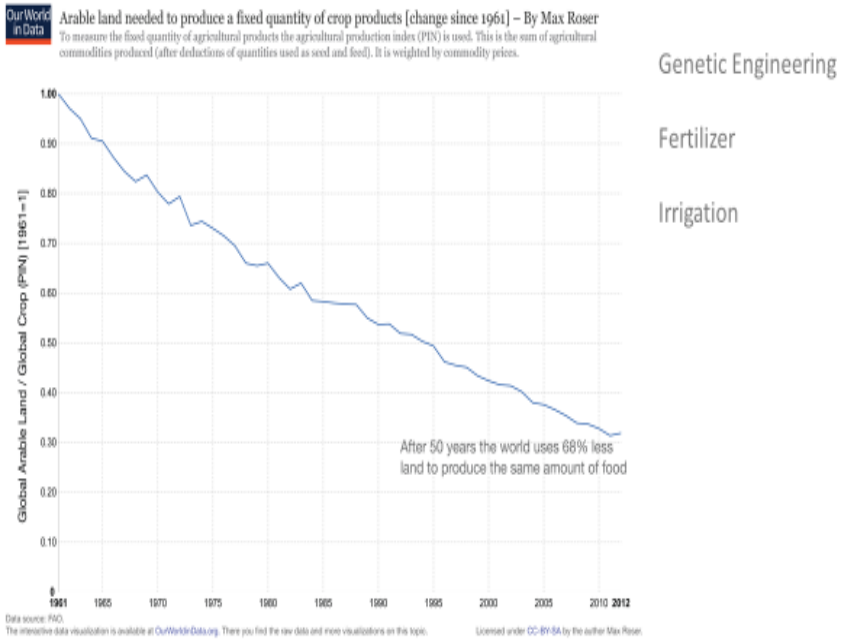
ed pressu...

Farming in Bremner is on the line as one of the reasons a petition was started against council's decision for a new hamlet to be built in the rural area July 12, 2017 Fort Saskatchewan Record

Landowners resist rich farmland being earmarked for new Strathcona County city of Bremner **David Staples, Edmonton Journal, 01/03/17**



The 20th Century Agricultural Revolution



Genetic Engineering

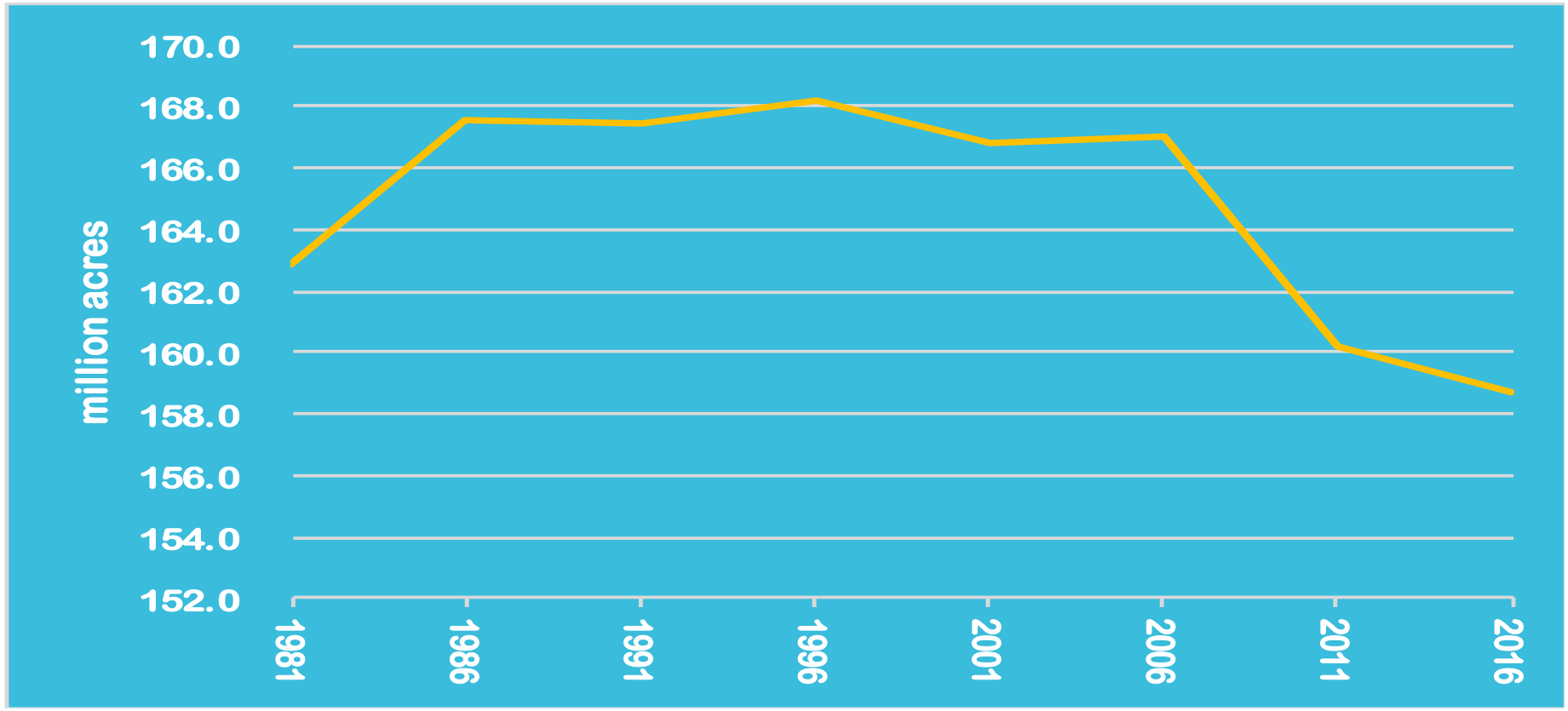
Fertilizer

Irrigation

Max Roser (2016)– 'Land Use in Agriculture'. Published online at OurWorldInData.org

Peak Farm

Farm area, Canada, 1981-2016



Source: Statistics Canada, Census of Agriculture

Note: Farm area includes: cropland, summerfallow, improved and unimproved pasture, woodlands and wetlands and other land (including idle land and land on which farm buildings are located).

TABLE 1. Agricultural Land Conversion by Land Suitability Rating for the White zone of Alberta from 2000 to 2012

Land Suitability Class	Converted (ha)	Percent of Total Conversion	Total Provincial Area (ha)	Percent Conversion per Class
2	42,841	34.58%	3,897,805	1.10%
3	41,700	33.66%	6,224,750	0.70%
4	12,150	9.81%	2,818,550	0.40%
5	3,586	2.89%	992,954	0.40%
6	3,444	2.78%	694,014	0.50%
7	1,827	1.48%	296,715	0.60%
9	18,353	14.81%	71,452	25.70%
Total	123,902	100%	14,996,239	0.83%

Harsma et al. 2014

TABLE 2. Agricultural Land Conversion by Land Suitability Rating for the Capital Region from 2000 to 2012

Land Suitability Class	Converted (ha)	Percent of Total Conversion	Total Capital Region Area (ha)	Percent Conversion per Class
2	19,282	50%	591,183	3.3%
3	4,230	11%	173,980	2.4%
4	1,398	4%	55,663	2.5%
5	255	1%	20,066	1.3%
6	442	1%	11,225	3.9%
7	156	0%	13,288	1.2%
9*	12,493	33%	30,445	41.0%
Total	38,257	100%	895,851	4.3%

Harsma et al. 2014

Agricultural Land Conversion in Alberta 2000-2012

21st Century Challenges for Agricultural Assets

- Sustainably improve agricultural productivity to meet increasing demand
  - The Advisory Council on Economic Growth goal to increase annual agri-food exports by $30B over next 10 years – become one of the top 3 exporters.
  - Ensure a sustainable agricultural asset base while maintaining high quality water supplies
  - Address climate change mitigation and adaptation; and intensification of natural hazards
- Can consistent accounting techniques for measuring and monitoring agricultural wealth inform
  - Land use planning decisions;
  - Sustainability of agriculture and agricultural productivity

How does agriculture contribute to wealth?

- Wealth is the ***cumulative value*** of all physical and intangible assets owned by a person, community, company or country after subtracting all debts.
- Agricultural assets
  - Produced assets such as machinery, buildings, equipment
  - Human assets such as education and collective knowledge, health
  - Ecological assets such as soils, natural vegetation, and water
  - Social assets such as neighbors and social supports
- The ***value*** of these assets include…
  - Commodities produced (alfalfa, beef, canola) (measured by GDP)
  - Non-tangible benefits – open space, water storage, nutrient cycling, health & well-being

Canada's System of National Accounts

- Current accounts – expenditures and transactions
  - Production Accounts – value of all inputs and outputs (GDP)
  - Capital Accounts – Lending and borrowing
- Balance Sheet – assets and liabilities
  - Produced and Financial Capital
  - Land – residential housing, value of agricultural land
  - Depreciation
- Feasibility of incorporating non-monetary values?
  - Soil capability
  - Water quality
  - Natural space and habitat

Environmental Accounting

UN System of Environmental Economic Accounting (2012)

- Emissions, restoration and mitigation activities, changes in the value of natural resource stocks
- Agriculture, Water, Forestry manuals

UN Experimental Ecosystem Accounts

- Include ecosystem services
- Include ecosystem degradation

Statistics Canada – Human Activity and the Environment

- 2013 – Measuring Ecosystem Goods and Services
- 2014 – Agriculture and the Environment
- 2015/16 – Freshwater
- 2016 – Census Metropolitan Areas - Ecosystems

Agricultural Land Change Matrix 1990-2010

	To		Total loss/gain	Loss/gain as a share of 1990 area
	Settlements and roads	Cropland		
From	km2			percent
Cropland	385	n/a	**4935**	3.8%
Managed grassland	52	2745	**-2797**	-5.9%
Forest and trees	769	2250	**-3019**	-1.0%
Wetlands*	348	326	**-673**	-0.5%
Total loss/gain	**1554**	**4935**		

*Defined as open wetland, forest wetland, treed wetland, herb wetland and shrub wetland

Change in agricultural land by region, 1990-2010

Region and agricultural land type	Total area (km2)			
	1990	2010	Difference 1990–2010	% change 1990–2010
Calgary-Edmonton corridor* – Cropland	24,230	25,028	799	3.3
Calgary-Edmonton corridor – Grassland/Managed	1,379	1,126	-253	-18.4
Calgary-Edmonton corridor – Total Agland	***25,609***	***26,154***	***545***	***2.1***
Non-corridor – Cropland	107,270	111,406	4,136	3.9
Non-corridor – Grassland/Managed	46,415	43,872	-2,543	-5.5
Non-corridor – Total Agland	***153,686***	***155,278***	***1,593***	***1.0***
Alberta – Cropland	131,500	136,435	4,934	3.8
Alberta – Grassland/Managed	47,794	44,998	-2,797	-5.9
Alberta – Total Agland	***179,294***	***181,432***	***2,138***	***1.2***

*Defined as: Sturgeon County, Strathcona County, Edmonton, Parkland County, Leduc County, Brazeau M.D., Wetaskawin County, Ponoka County, Lacombe County, Red Deer County, Mountain View County, Rocky View

Cropland quality change account, Alberta, 1990-2010

		Cropland Losses		Cropland Gains					
		To settlements and roads		From forest and trees		From managed grassland		From wetlands	
CLI Class*	CLI Description	(area km^2)	As percent of total cropland area lost	(area km^2)	As percent of total cropland area	(area km^2)	As percent of total cropland area	(area km^2)	As percent of total cropland area
Class 1	No significant limitations in use for crops	50	13	42	1	23	0	5	0
Class 2	Moderate limitations that restrict the range of crops or require moderate conservation practices	109	28	294	6	490	9	36	1
Class 3	Moderately severe limitations that restrict the range of crops or require special conservation practices	103	27	618	12	677	13	56	1
Dependable land total		**263**	**68**	**954**	**18**	**1190**	**22**	**96**	**2**
Land with limiations (Class 4 and below) total		**123**	**32**	**1296**	**24**	**1555**	**29**	**230**	**4**

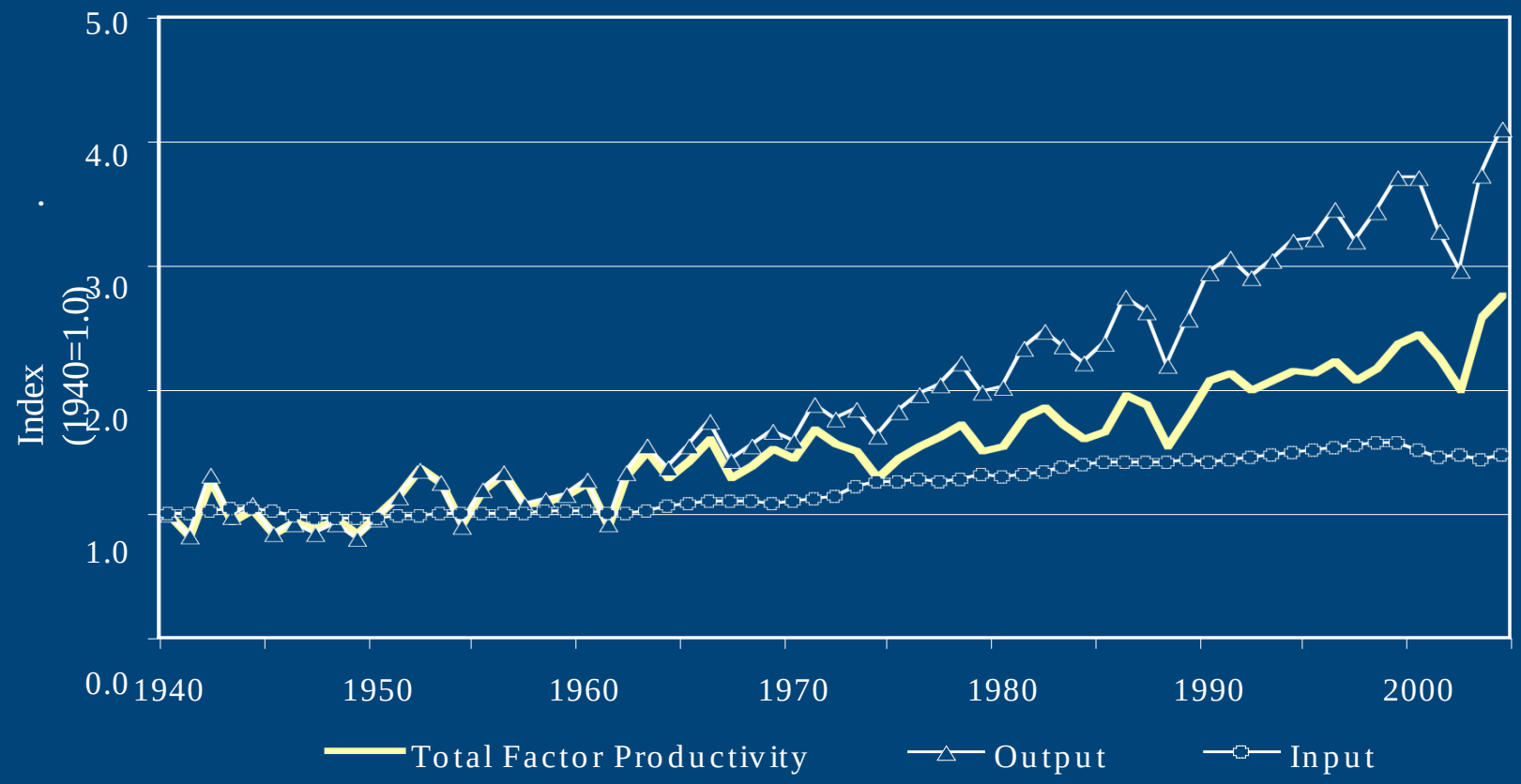
*CLI = Canada Land Inventory Soil Capability Classification for Agriculture

Overall, the trend from 1990 to 2010 was to a poorer mix of cropland in Alberta

- The majority of cropland *lost* from 1990 to 2010 (68%) was *dependable* (CLI classes 1-3)
- The majority of cropland *gained* (58%) had *severe to very severe limitations* for agriculture (CLI classes 4 and below)

Prairie Aggregate Agriculture Input,

Output and Productivity: 1940-2004



Canadian and Prairie Agricultural Productivity: Measurement, Causes, and Policy Implications, Terry Veeman, Jim Unterschultz, and Bryce Stewart, CAES Conference, Saskatoon, Saskatchewan, Canada June 4-6, 2007

Alberta Crop Input Quantity Index (1970=100)

Year	Capital	Land	Labour	Materials
1995	181.31	115.96	93.47	254.80
1996	185.27	113.86	89.81	270.12
1997	186.13	113.83	84.06	280.27
1998	189.63	113.78	86.52	295.12
1999	194.77	114.00	78.02	312.22
2000	180.11	116.04	60.27	301.81
2001	175.83	113.28	49.07	275.63
2002	180.00	113.02	46.81	288.93
2003	164.91	112.07	60.57	284.09
2004	163.27	111.94	63.41	304.23

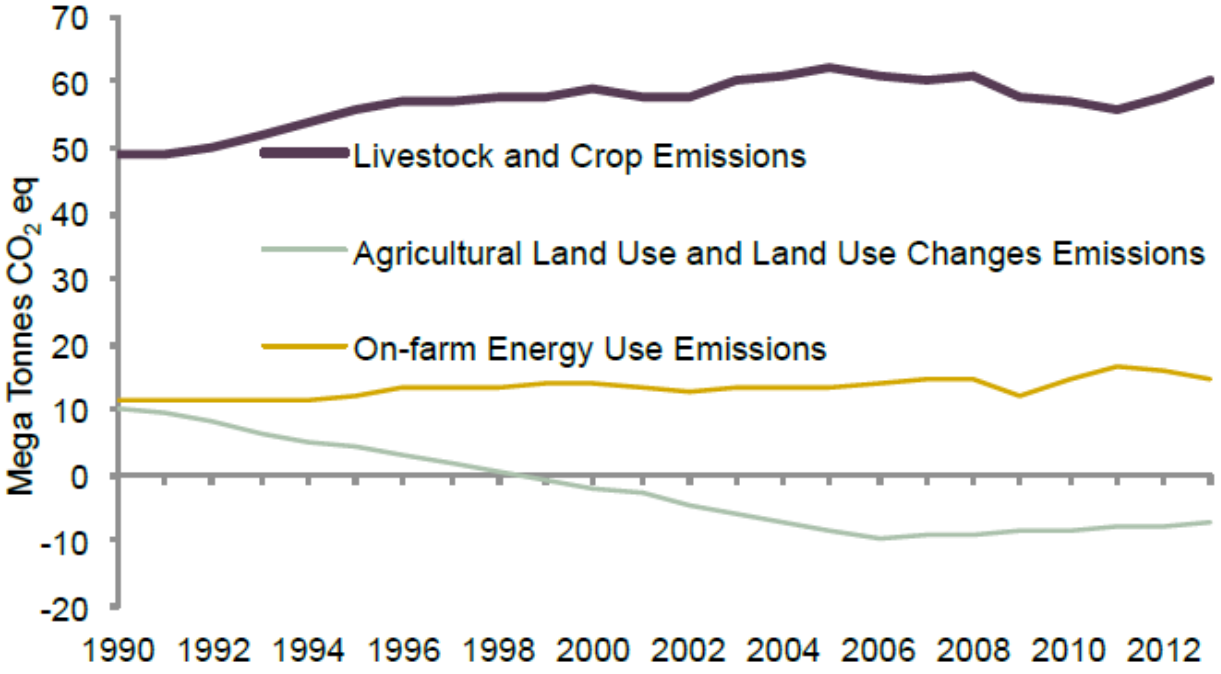
Canadian and Prairie Agricultural Productivity: Measurement, Causes, and Policy Implications, Terry Veeman, Jim Unterschultz, and Bryce Stewart, CAES Conference, Saskatoon, Saskatchewan, Canada June 4-6, 2007

Environmentally Adjusted Productivity Growth

- Actual (net) productivity is lower when there is pollution
- Actual (net) productivity is higher when pollution damages are mitigated
  - Ball (1994) productivity growth in US Agriculture should be 12-28% lower due to negative effects from excess nutrients
  - Repetto (1996) – agricultural productivity should be higher due to improved soil quality and air emissions
  - Hurbovcak et al. (2000) – Annual US costs of agriculture in 1992 > 4.3B
  - Fenichel et al (2016): annual costs of groundwater depletion $110M
    - “This annual loss in wealth is approximately equal to the state’s 2005 budget surplus, and is substantially more than investments in schools over this period.”

The sector has accomplished significant improvements in land and water use

Emission Trends by Category, 1990-2013



Source: Environment Canada, National Inventory Report 2015 and Natural Resources Canada, National Energy Database, 1990-2012..

- The value of total agricultural production has increased from $7.5 B in 1981 to $16.2 B in 2011 (in constant 2007 prices).
- During this period, GHG emissions from agricultural activity remained fairly stable resulting in a decline in GHG emission intensity of the agricultural production
- producers use 65 percent less water and 90 percent less land to produce 1 litre of milk than they did 70 years ago.

CAPI ICPA

Efficiency in Agricultural Production

Table 4: Efficiency levels and ranking, Geometric means in 1992 - 2003

Country	Technical Efficiency	Allocative Efficiency	Material Efficiency	Ranking (TE)	Ranking (AME)	Ranking (ME)
Australia	0.7267	0.1509	0.1096	22	31	32
Austria	0.7739	0.5581	0.4320	20	17	13
Belgium-Luxembourg	1.0000	0.3355	0.3355	1	25	21
Canada	0.8190	0.3800	0.3113	16	23	23
Czech Republic	0.8081	0.6739	0.5445	17	9	7
Denmark	1.0000	0.4173	0.4173	1	22	14
Estonia	0.7357	0.6937	0.5103	21	7	8
Finland	0.8947	0.7182	0.6427	13	5	4

Traditional and Environmental Agricultural Total Factor Productivity in OECD Countries, Viet-Ngu Hoang 2015

Agricultural Accounting Opportunities

Policy Issue	Accounting	Key Indicators
Sustainability of agricultural productivity	Agricultural Asset Depreciation	Soil capability, land fragmentation, material inputs, environmentally adjusted productivity
Water use and water quality	Water Asset Depreciation	Water stocks and flows, Changes in wetland area and function; water quality, water productivity, water use efficiency, wetland
Contribution of agricultural assets to municipalities	Ecosystem Services	Local food production, recreation, water protection and storm water management; amenity values;

Conclusions

- Productivity is imperative to remain competitive which should take into account the state of natural capital.
- Require good and regionally/nationally/internationally comparable measures.
  - Environmental subsidies and Trade
- Research needs -
  - Standardized and comparable measures for ecosystem service assets / values
  - Understand substitutability between soils and material inputs and impact on ecosystem services and agricultural productivity
- Agricultural land accounting needs a home in Alberta

Thank you!

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