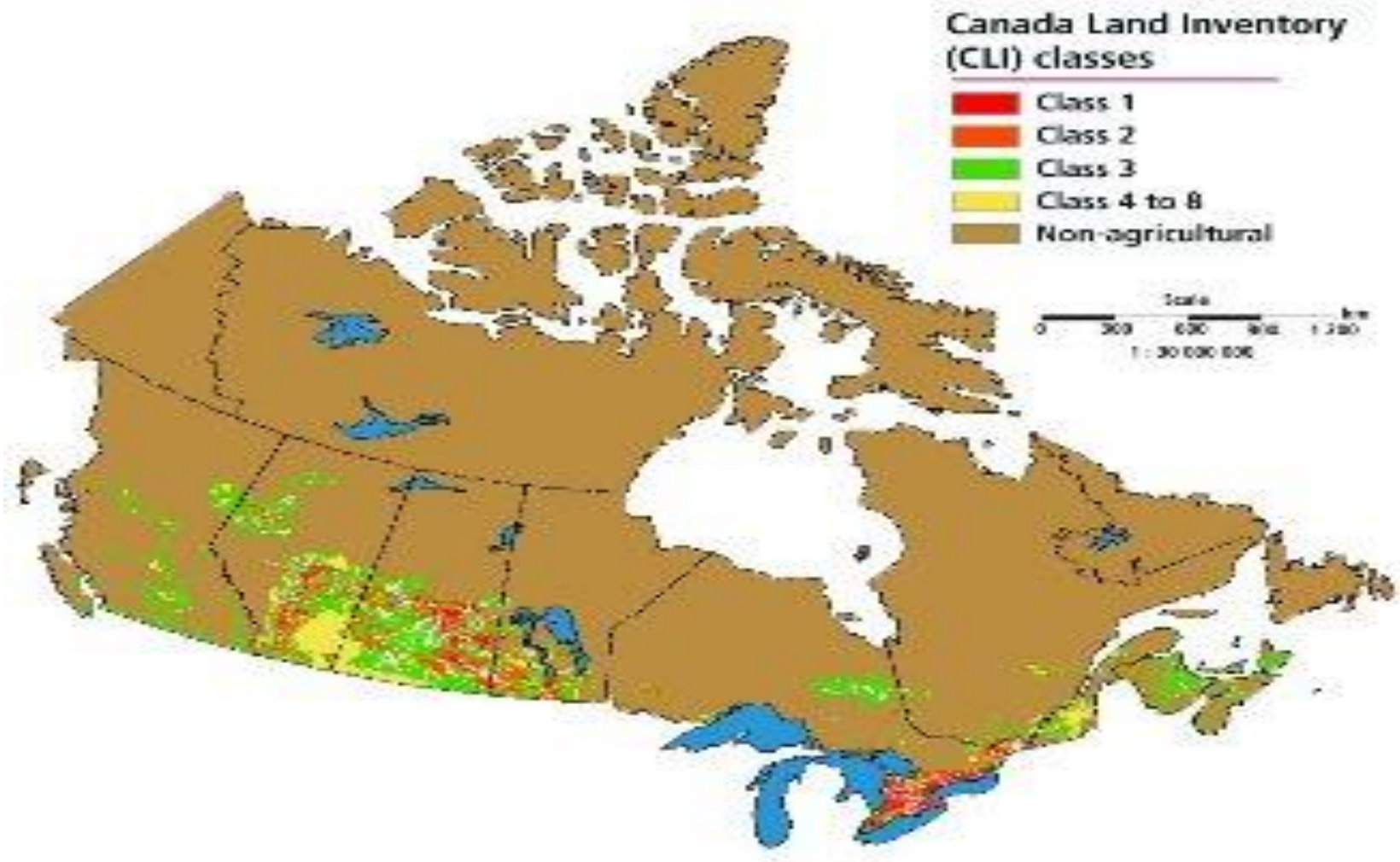
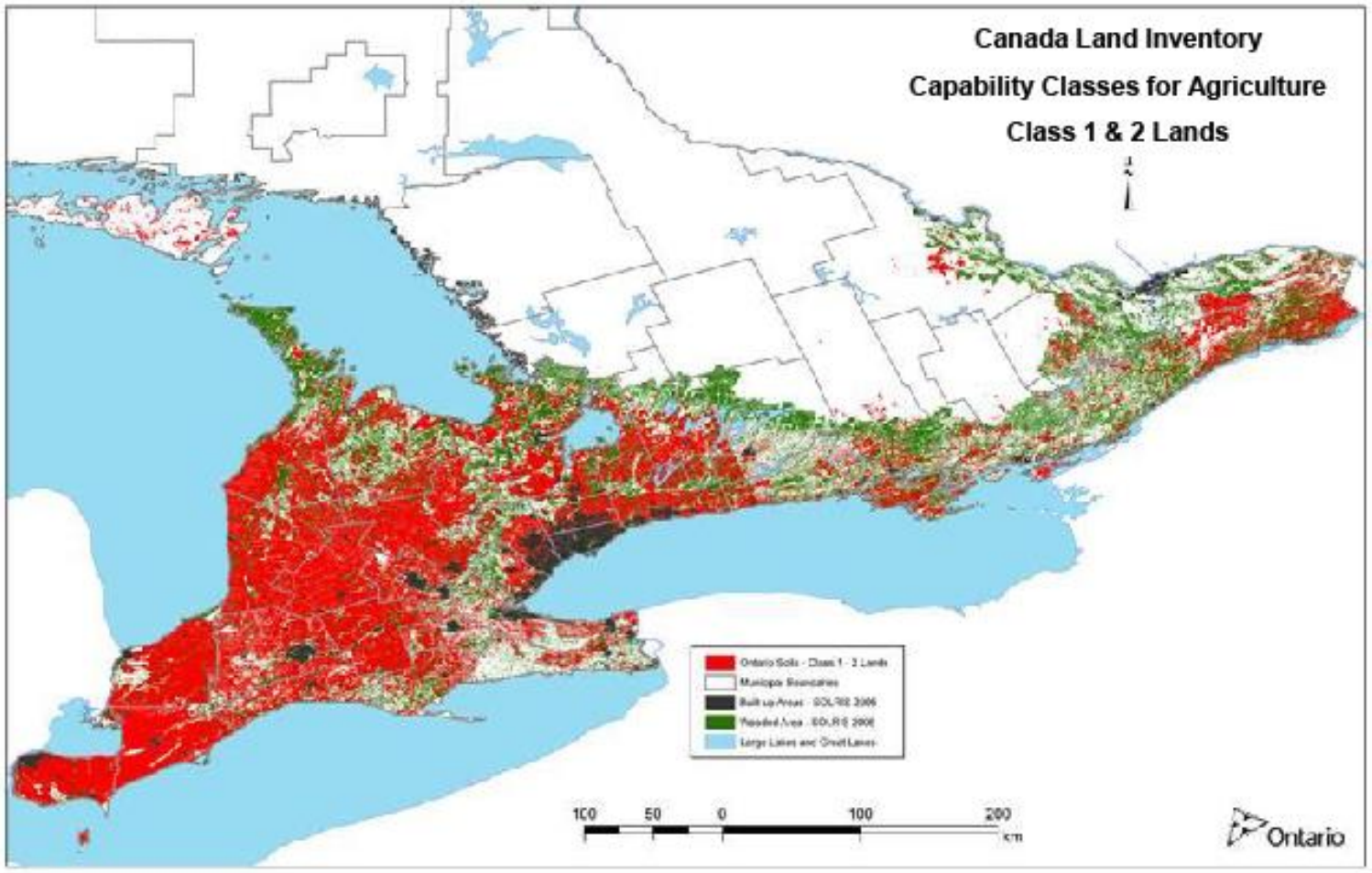
Feed the People
Feed the Soil
Feed the Bioeconomy

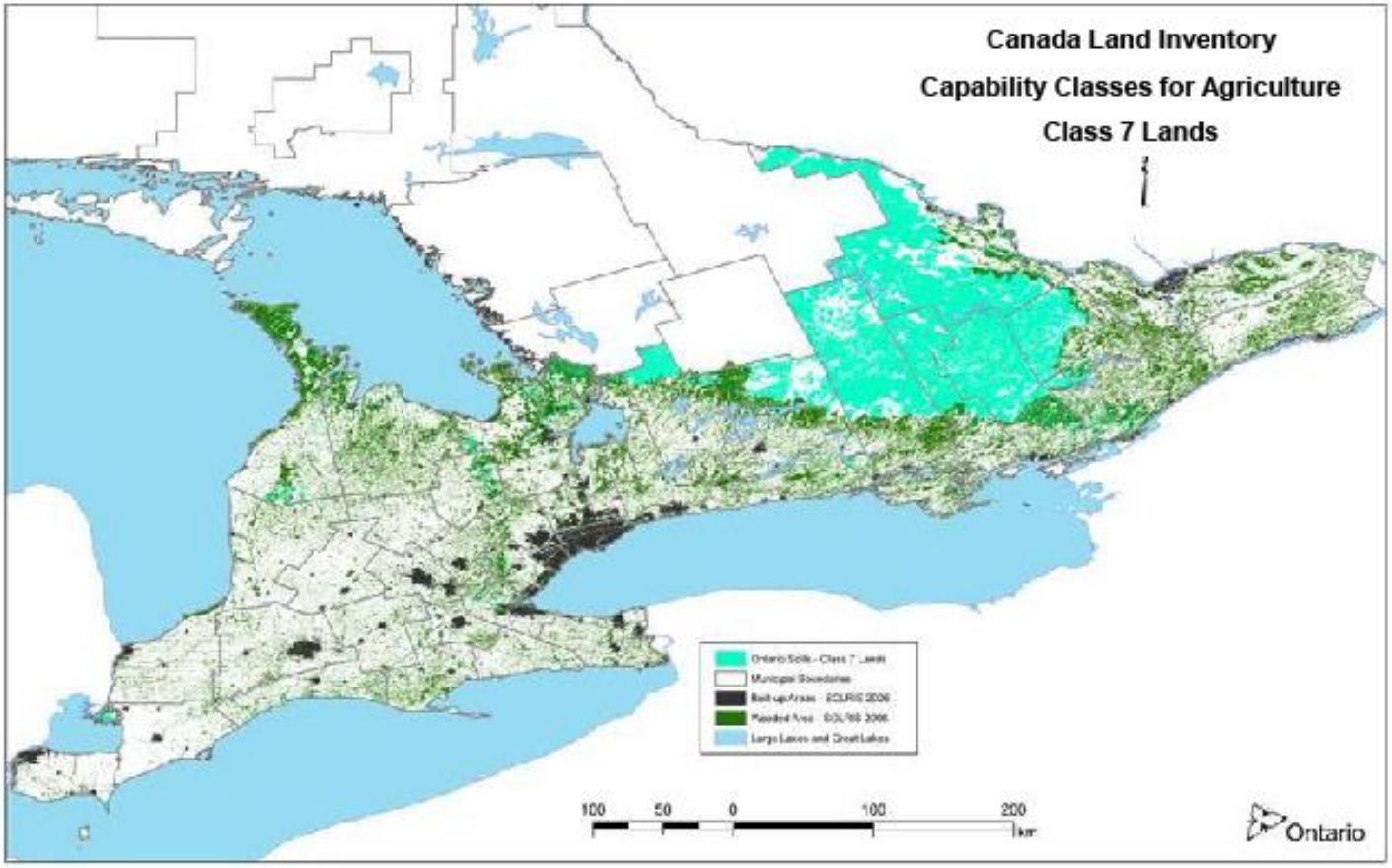
Don McCabe
Ontario Federation of Agriculture
November 15, 2016
Scaling Up Conference
Ottawa

Dependable Agricultural Land



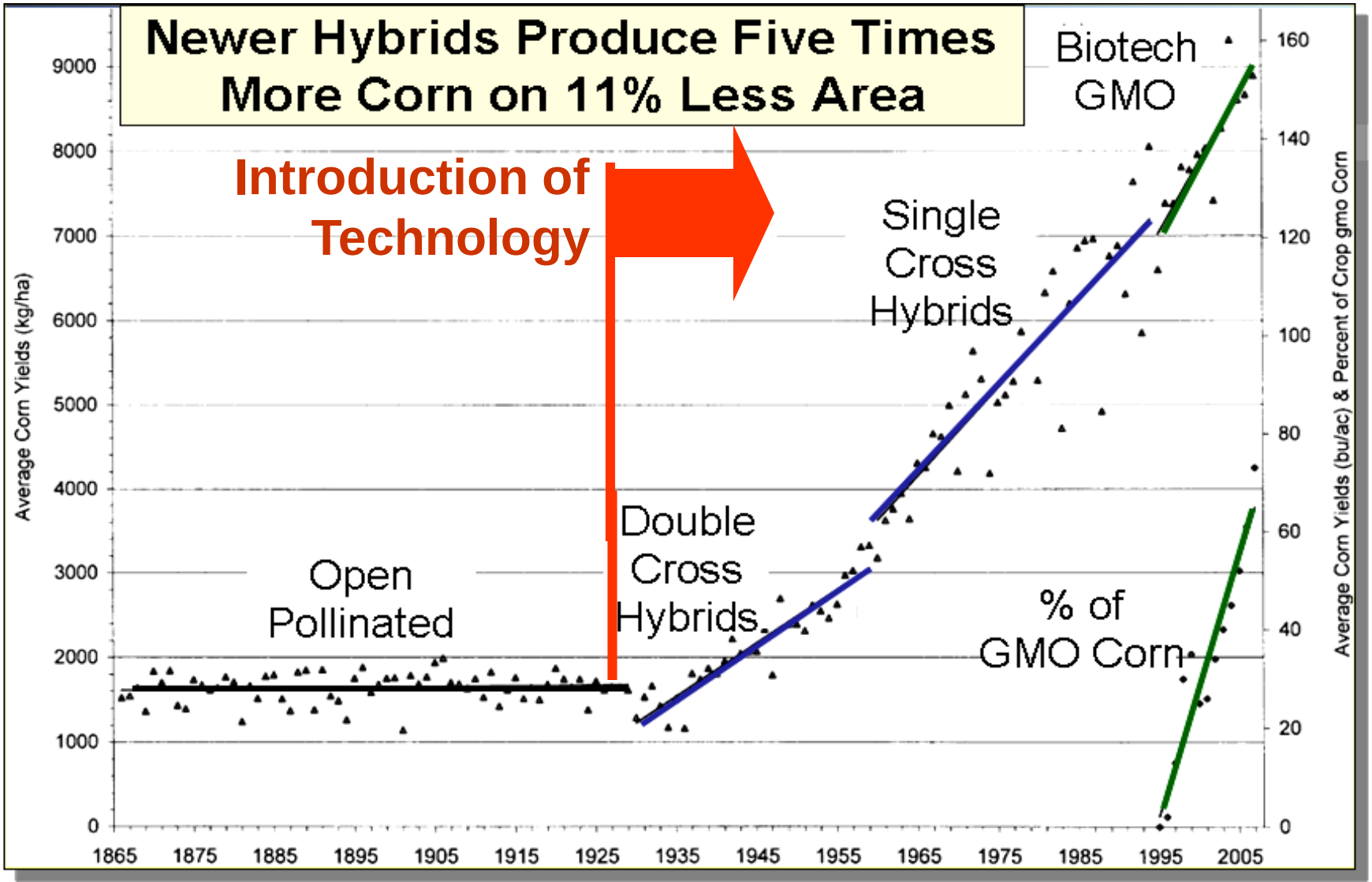
Source: Environment Canada 1982, Lands Directorate, CGIS Database
Statistics Canada 1999, Environment Accounts and Statistics Division, Environmental Information System (EIS) Database


Canada Land Inventory
Capability Classes for Agriculture
Class 1 & 2 Lands
N
Ontario Soils - Class 1 - 3 Lands
Municipal Boundaries
Built-up Areas - SOLRIS 2006
Flooded Area - SOLRIS 2006
Large Lakes and Great Lakes
100
50
0
100
200
km
Ontario


Canada Land Inventory
Capability Classes for Agriculture
Class 7 Lands
100
50
0
100
200
km
Ontario

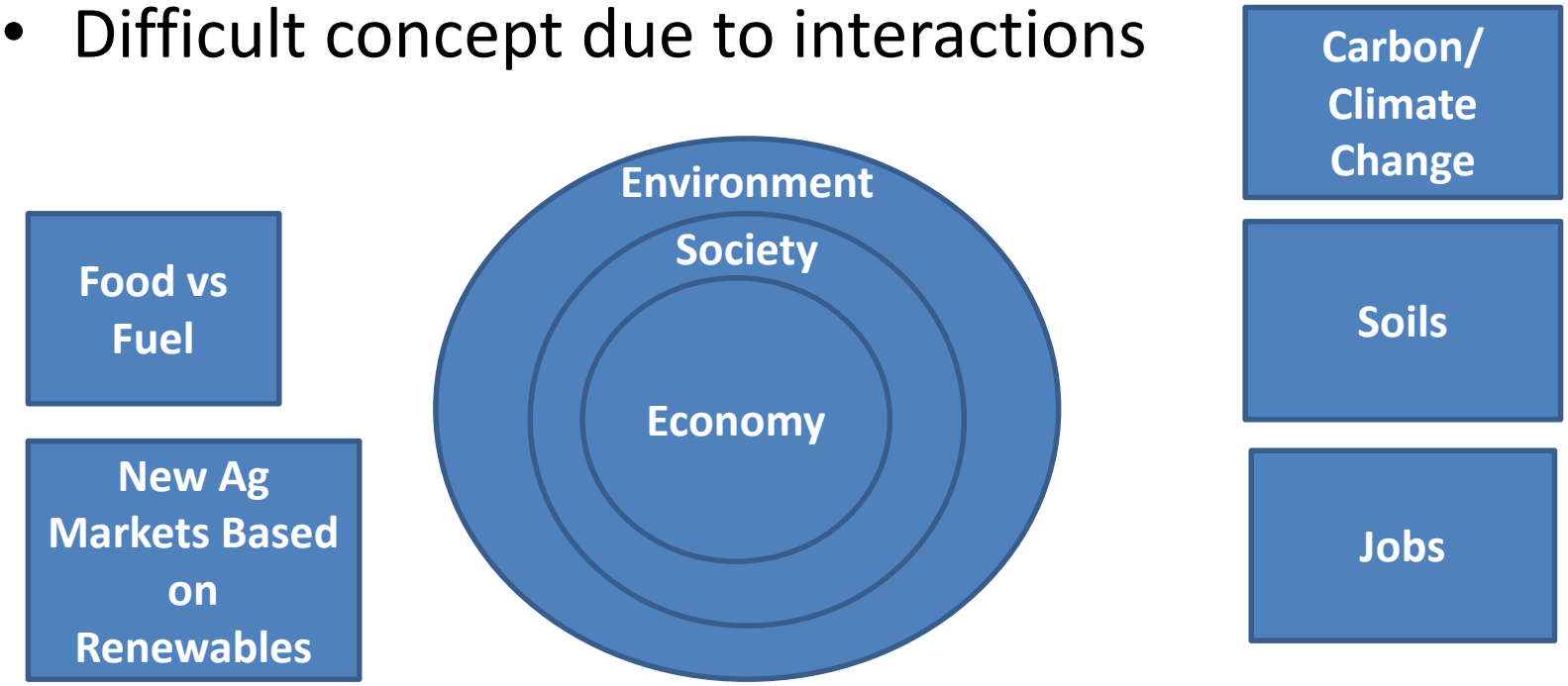

Everything in this slide has a price point to market
Combine and Head (AGCO)
Corn (CBOT)
Stalks and Cobs (Value chain cooperative or commodity pricing?)

What Saved Mankind?

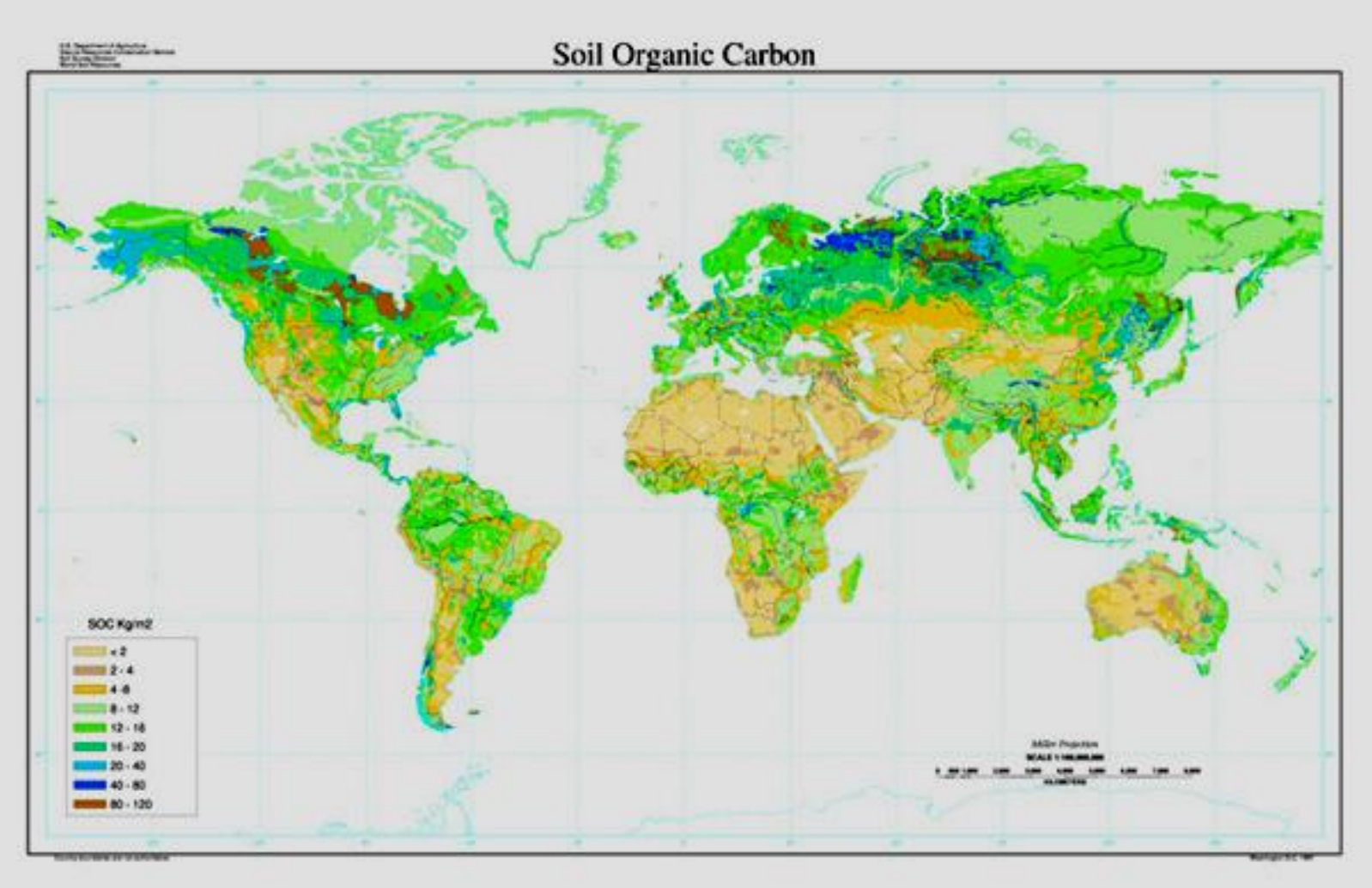


Sustainability

- Brundtland Commission of the United Nations on March 20, 1987: “sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
- Difficult concept due to interactions



Environmental Concern



What Does Sustainability Look Like On My Farm?

November 2008

2008 soybeans, 2009 winter wheat, 2007 corn cobs

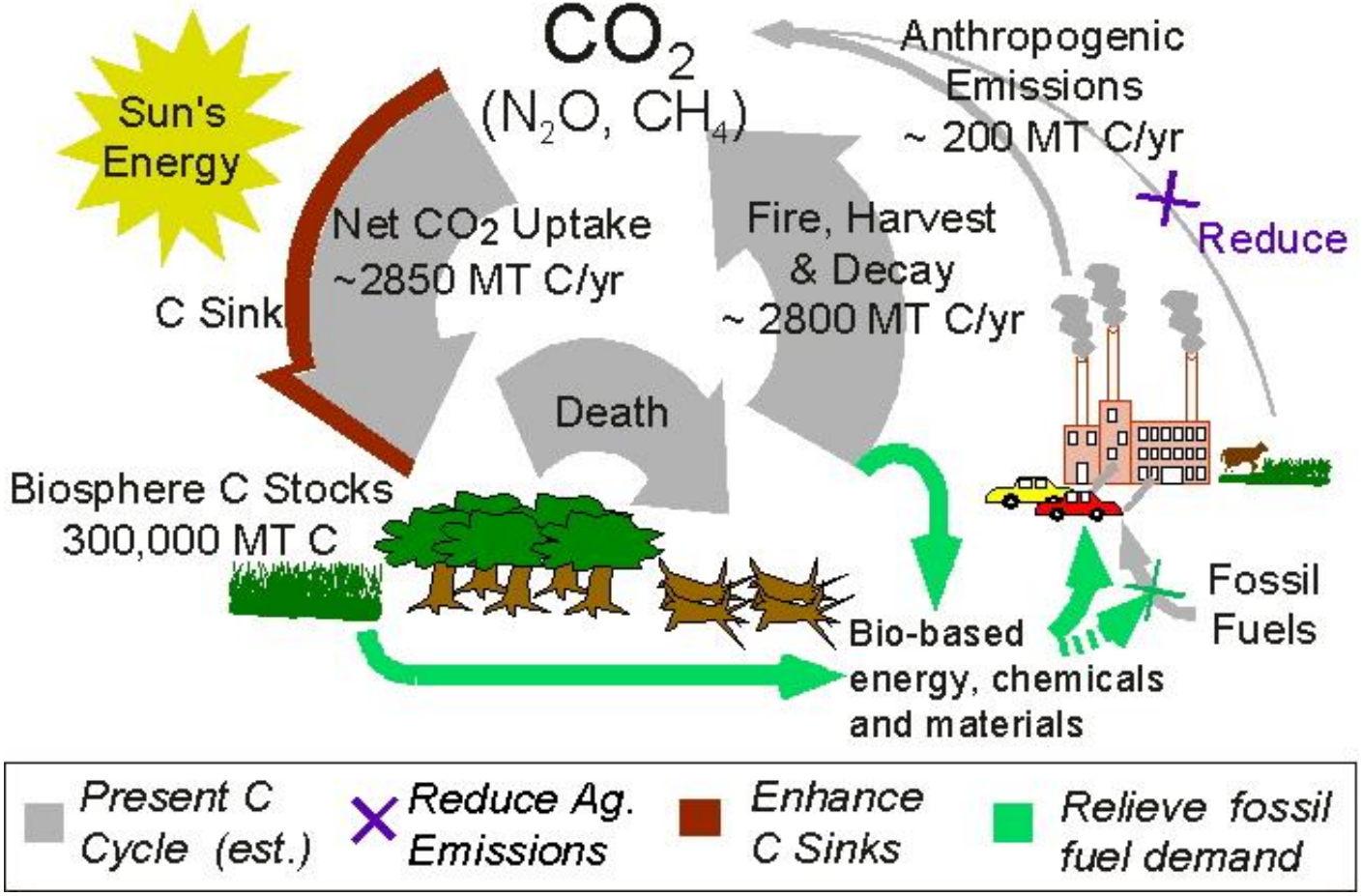
Definition of a Farmer

- Cash crop
- Corn, soybeans, wheat farmer
- Beef farmer
- Fruit and vegetable producer
- Egg producer
- Pineapple plantation
- Or……..

Definition of a Farmer

- Manager of carbon and nitrogen cycles with input from the water cycle to produce starch, oil, protein, fuel, fiber and energy for world wide consumers at the highest quality.

The Canadian Biosphere

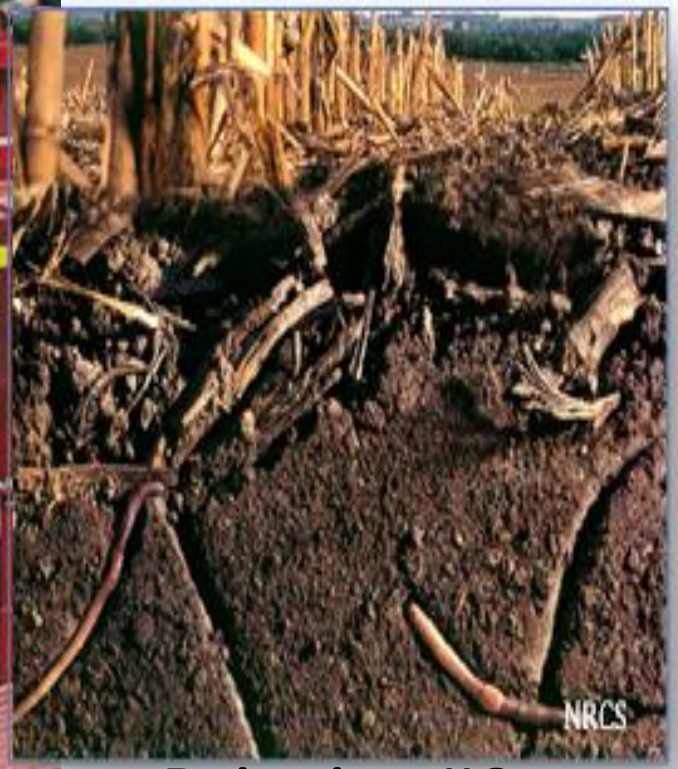


Canadian agriculture is regional crop rotation with proper stewardship to maximize the sun's input to make starch , oil and fiber.

Prioritizing or Meeting Markets?

Priority #1

- Feed markets that feed, clothe, power and build the world.
- Logistics and markets exist.
- Global competition means constant improvement to meet price points.



Priority #2

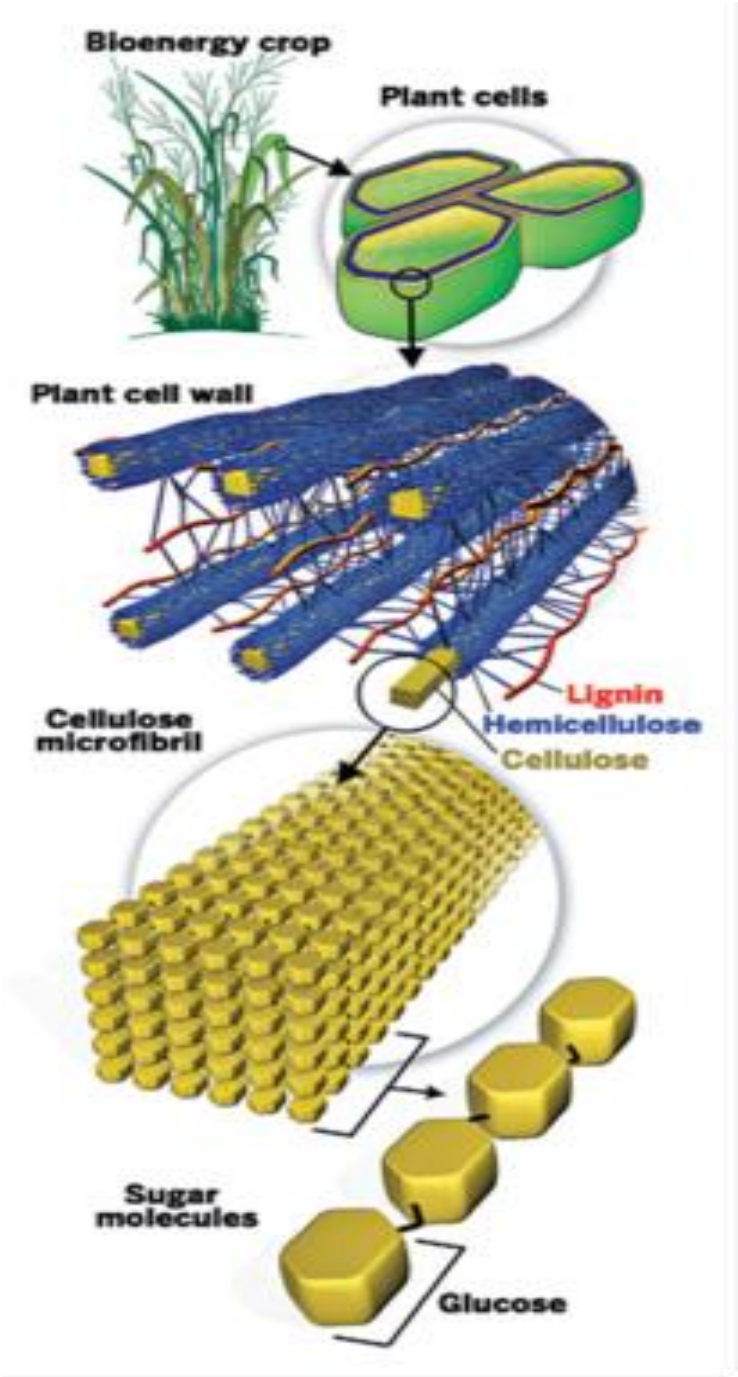
- Feed the soil life
- The engines of the C & N cycles.
- Soil quality is the result

Soil Equation to Soil System

- Jenny's Equation for soil formation
  - Soil=f(cl,pm,r,o,t)
  - Soil is a function of climate, parent material, topography, biota and time
- Farmers are managers of the carbon and nitrogen cycles.
- Biota and time are the factors that can be managed here.

Priority #3

SUSTAINABLE ag residue removal for composites, chemicals, fuels and energy
IF THE PRICE IS RIGHT!



http://www.biobased-society.eu/2013/02/respectful-treatment-of-the-complexity-of-biomass/

Biomass is Biomass

- Availability of wheat straw, soybean straw and corn stover
- County by county assessment
- Required to develop a supply chain
- Sustainability requirements addressed

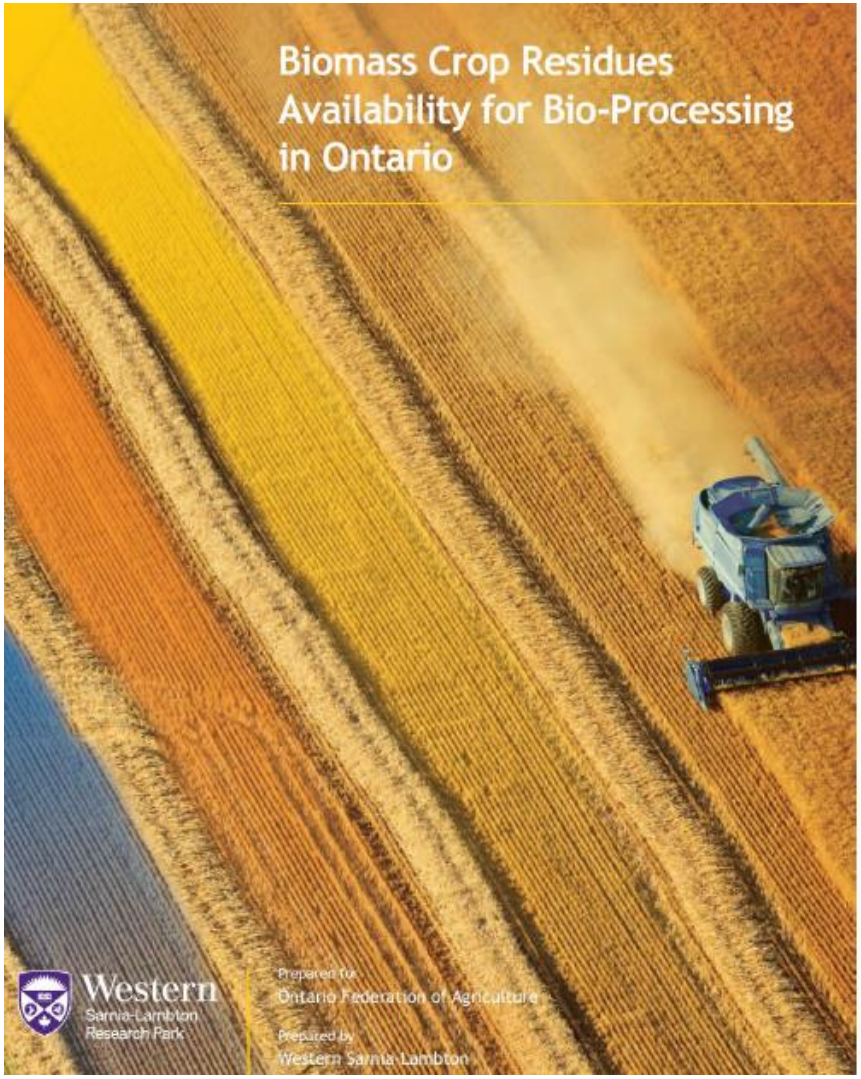


Table 3.2 Summary of Sustainably Harvestable Crop Residues in Ontario

No.	County	Total Harvestable Residues in the County ('000 tonne)	Total Harvestable Residues in the County and Neighbouring Counties ('000 tonne)*	Names of Neighbouring Counties (sharing borders)
1	Algoma	12.8	28.1	Cochrane,Thunder Bay
2	Brant	42.0	362.2	Haldimand, Hamilton, Norfolk, Oxford, Waterloo
3	Bruce	178.4	756.7	Grey, Huron, Wellington
4	Chatham-Kent	189.3	636.8	Elgin, Essex, Lambton, Middlesex
5	Cochrane	7.0	35.7	Algoma, Thunder Bay, Timiskaming
6	Dufferin	36.7	423.0	Grey, Peel, Simcoe, Wellington
7	Durham	102.4	382.2	Kawartha Lakes, Northumberland, Peterborough, Simcoe, York
8	Elgin	140.4	855.4	Chatham-Kent, Middlesex, Norfolk, Oxford
9	Essex	-45.7	143.6	Chatham-Kent
10	Frontenac	20.8	221.0	Lanark, Leeds & Grenville, Lnrx & Addgton, Renfrew
11	Grey	115.6	589.3	Bruce, Dufferin, Simcoe, Wellington
12	Haldimand	-43.4	-10.3	Brant, Hamilton, Niagara, Norfolk
13	Halton	10.4	201.4	Hamilton, Peel, Wellington
14	Hamilton	9.3	244.6	Brant, Haldimand, Halton, Niagara, Waterloo, Wellington
15	Hastings	53.6	239.9	Lnrx & Addgton, Northumberland, Peterborough, Prince Edward
16	Huron	293.1	1240.4	Bruce, Lambton, Middlesex, Perth, Wellington
17	Kawartha Lakes	54.4	196.2	Durham, Peterborough
18	Lambton	77.4	835.1	Chatham-Kent, Huron, Middlesex
19	Lanark	25.6	246.6	Frontenac, Leeds & Grenville, Ottawa, Renfrew
20	Leeds & Grenville	43.3	331.5	Frontenac, Lanark, Ottawa, Stor, Dun & Glen'y
21	Lennox & Addington	34.5	151.5	Frontenac, Hastings, Prince Edward
22	Middlesex	275.3	1443.5	Chatham-Kent, Elgin, Huron, Lambton, Oxford, Perth
23	Niagara	-47.3	-81.4	Haldimand, Hamilton
24	Norfolk	29.0	389.3	Brant, Elgin, Haldimand, Oxford
25	Northumberland	69.9	307.9	Durham, Hastings, Peterborough, Prince Edward
26	Ottawa	60.0	498.5	Lanark, Leeds & Grenville, Prescott & Russel, Renfrew, Stor, Dun & Glen'y
27	Oxford	221.3	1058.7	Brant, Elgin, Middlesex, Norfolk, Perth, Waterloo
28	Peel	12.1	344.8	Dufferin, Halton, Simcoe, Wellington, York
29	Perth	246.6	1309.9	Huron, Middlesex, Oxford, Waterloo, Wellington
30	Peterborough	39.4	319.8	Durham, Hastings, Kawartha Lakes, Northumberland
31	Prescott & Russel	91.0	332.8	Ottawa, Stor, Dun & Glen'y
32	Prince Edward	42.5	200.6	Hastings, Lnrx & Addgton, Northumberland
33	Rainy River	41.0	49.3	Thunder Bay
34	Renfrew	96.8	203.3	Frontenac, Lanark, Ottawa
35	Simcoe	88.9	382.9	Dufferin, Durham, Grey, Peel, York
36	Stormont, Dundas & Glengarry	181.7	376.1	Leeds & Grenville, Ottawa, Prescott & Russel
37	Thunder Bay	8.2	69.1	Algoma, Cochrane, Rainy River
38	Timiskaming	7.6	14.6	Cochrane
39	Waterloo	104.0	792.9	Brant, Hamilton, Oxford, Perth, Wellington
40	Wellington	169.6	1175.9	Bruce, Dufferin, Grey, Halton, Hamilton, Huron, Peel, Perth, Waterloo
41	York	27.1	230.6	Durham, Peel, Simcoe
Sub-total (Southern Ontario)		847.7		
Sub-total (Western Ontario)		1,255.5		
Sub-total (Central Ontario)		389.3		
Sub-total (Eastern Ontario)		553.9		
Sub-total (Northern Ontario)		76.7		
	Grand Total	**3,123.1**		

*Mostly in less than 100 km radius

Table 3.2 Summary of Sustainably Harvestable Crop Residues in Ontario

No.	County	Total Harvestable Residues in the County ('000 tonne)	Total Harvestable Residues in the County and Neighbouring Counties ('000 tonne)*	Names of Neighbouring Counties (sharing borders)
1	Algoma	12.8	28.1	Cochrane, Thunder Bay
2	Brant	42.0	362.2	Haldimand, Hamilton, Norfolk, Oxford, Waterloo
3	Bruce	178.4	756.7	Grey, Huron, Wellington
4	Chatham-Kent	189.3	636.8	Elgin, Essex, Lambton, Middlesex
5	Cochrane	7.0	35.7	Algoma, Thunder Bay, Timiskaming
6	Dufferin	36.7	423.0	Grey, Peel, Simcoe, Wellington
7	Durham	102.4	382.2	Kawartha Lakes, Northumberland, Peterborough, Simcoe, York
8	Elgin	140.4	855.4	Chatham-Kent, Middlesex, Norfolk, Oxford
9	Essex	-45.7	143.6	Chatham-Kent
10	Frontenac	20.8	221.0	Lanark, Leeds & Grenville, Lnrx & Addgton, Renfrew
11	Grey	115.6	589.3	Bruce, Dufferin, Simcoe, Wellington
12	Haldimand	-43.4	-10.3	Brant, Hamilton, Niagara, Norfolk
13	Halton	10.4	201.4	Hamilton, Peel, Wellington
14	Hamilton	9.3	244.6	Brant, Haldimand, Halton, Niagara, Waterloo, Wellington
15	Hastings	53.6	239.9	Lnrx & Addgton, Northumberland, Peterborough, Prince Edward
16	Huron	293.1	1240.4	Bruce, Lambton, Middlesex, Perth, Wellington
17	Kawartha Lakes	54.4	196.2	Durham, Peterborough
18	Lambton	77.4	835.1	Chatham-Kent, Huron, Middlesex
19	Lanark	25.6	246.6	Frontenac, Leeds & Grenville, Ottawa, Renfrew
20	Leeds & Grenville	43.3	331.5	Frontenac, Lanark, Ottawa, Stor, Dun & Glen'y
21	Lennox & Addington	34.5	151.5	Frontenac, Hastings, Prince Edward
22	Middlesex	275.3	1443.5	Chatham-Kent, Elgin, Huron, Lambton, Oxford, Perth
23	Niagara	-47.3	-81.4	Haldimand, Hamilton
24	Norfolk	29.0	389.3	Brant, Elgin, Haldimand, Oxford
25	Northumberland	69.9	307.9	Durham, Hastings, Peterborough, Prince Edward
26	Ottawa	60.0	498.5	Lanark, Leeds & Grenville, Prescott & Russel, Renfrew, Stor, Dun & Glen'y
27	Oxford	221.3	1058.7	Brant, Elgin, Middlesex, Norfolk, Perth, Waterloo
28	Peel	12.1	344.8	Dufferin, Halton, Simcoe, Wellington, York
29	Perth	246.6	1309.9	Huron, Middlesex, Oxford, Waterloo, Wellington
30	Peterborough	39.4	319.8	Durham, Hastings, Kawartha Lakes, Northumberland
31	Prescott & Russel	91.0	332.8	Ottawa, Stor, Dun & Glen'y
32	Prince Edward	42.5	200.6	Hastings, Lnrx & Addgton, Northumberland
33	Rainy River	41.0	49.3	Thunder Bay
34	Renfrew	96.8	203.3	Frontenac, Lanark, Ottawa
35	Simcoe	88.9	382.9	Dufferin, Durham, Grey, Peel, York
36	Stormont, Dundas & Glengarry	181.7	376.1	Leeds & Grenville, Ottawa, Prescott & Russel
37	Thunder Bay	8.2	69.1	Algoma, Cochrane, Rainy River
38	Timiskaming	7.6	14.6	Cochrane
39	Waterloo	104.0	792.9	Brant, Hamilton, Oxford, Perth, Wellington
40	Wellington	169.6	1175.9	Bruce, Dufferin, Grey, Halton, Hamilton, Huron, Peel, Perth, Waterloo
41	York	27.1	230.6	Durham, Peel, Simcoe
	Sub-total (Southern Ontario)	847.7		
	Sub-total (Western Ontario)	1,255.5		
	Sub-total (Central Ontario)	389.3		
	Sub-total (Eastern Ontario)	553.8		
	Sub-total (Northern Ontario)	76.7		
	Grand Total	**3,123.1**		

*Mostly in less than 100 km radius

Sub-total (Southern Ontario)	847.7
Sub-total (Western Ontario)	1,255.5
Sub-total (Central Ontario)	389.3
Sub-total (Eastern Ontario)	553.8
Sub-total (Northern Ontario)	76.7
Grand Total	3,123.1

Table 3.3 Ontario Counties with Over 500,000 tonne/year of Crop Residues Supply#

No.	County	Total Harvestable Residues in the County ('000 tonne)	Total Harvestable Residues in the County and Neighbouring Counties ('000 tonne)"	Names of Neighbouring Counties (sharing borders)
1	Bruce	178.4	756.7	Grey, Huron, Wellington
2	Chatham-Kent	189.3	636.8	Elgin, Essex, Lambton, Middlesex
3	Elgin	140.4	855.4	Chatham-Kent, Middlesex, Norfolk, Oxford
4	Grey	115.6	589.3	Bruce, Dufferin, Simcoe, Wellington
5	Huron	293.1	1240.4	Bruce, Lambton, Middlesex, Perth, Wellington
6	Lambton	77.4	835.1	Chatham-Kent, Huron, Middlesex
7	Middlesex	275.3	1443.5	Chatham-Kent, Elgin, Huron, Lambton, Oxford, Perth
8	Oxford	221.3	1068.7	Brant, Elgin, Middlesex, Norfolk, Perth, Waterloo
9	Perth	246.6	1309.9	Huron, Middlesex, Oxford, Waterloo, Wellington
10	Waterloo	104.0	792.9	Brant, Hamilton, Oxford, Perth, Wellington
11	Wellington	169.6	1175.9	Bruce, Dufferin, Grey, Halton, Hamilton, Huron, Peel, Perth, Waterloo

"Mostly in less than 100 km radius
Southern Ontario, Western Ontario
#Total supply includes crop residues from neighbouring counties

Agronomic Practices

- Best biomass source
  - Myscanthus, switchgrass, native grass vs popular or willow
- What grows best
- Best yield
- Best attributes for fuel
- Best practices
- How much land

Table 5.3. Mean energy crops yield estimates for land capability classes (tDM/ha)

Land Classes	1	2	3	4	5
Crops	*High Valued lands*			*Marginal lands*	
Miscanthus	12	12	11	8	7
Switchgrass	7	7	6.3	5.6	5.6
Reed canarygrass	9.5	9.5	8	7	6
High biomass Sorghum	11	11	10	8	7
Hybrid Poplar	16	16	9	9	7

Potential Biomass Production from the Selected Energy crops in Ontario

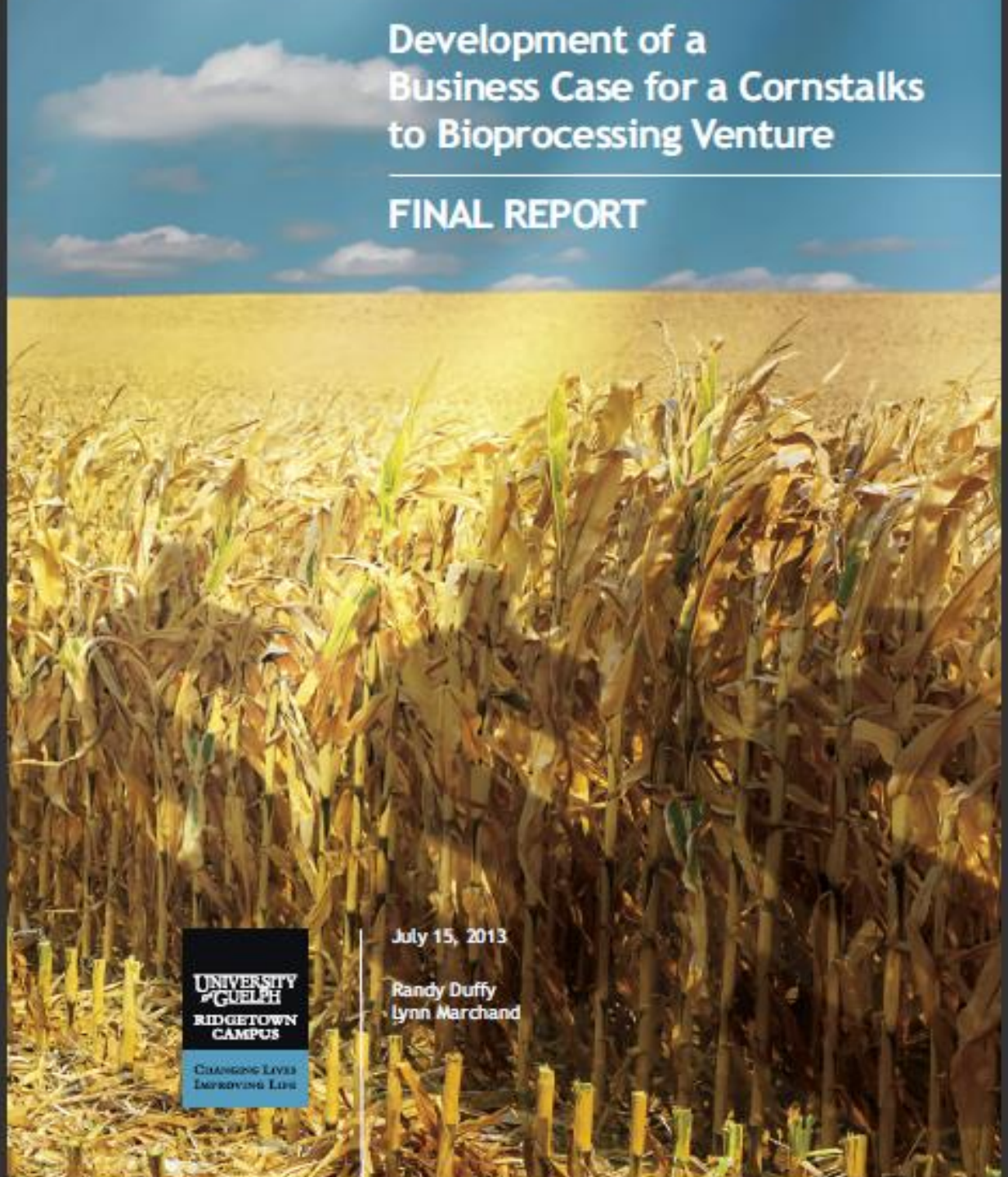
Scenario 1: For each energy crop source, 5%, 10%, 25%, 60% and 100% land use with their corresponding biomass yields determines biomass production/supply.

Table 5.4. Potential Biomass Production from Energy crops in Ontario (tDM/yr)

	5%	10%	25%	60%	100%
Miscanthus	2,520,144	5,040,289	12,600,743	30,241,651	51,730,896
Switchgrass	1,507,268	3,014,534	7536348	18,087,152	31,074,954
Reed canarygrass	1,977,012	3,954,022	9,885,072	23,724,065	40,702,233
High-biomass sorghum	2,328,435	4,656,869	11,642,192	27,941,137	47,896,705
Hybrid Poplar	2,977,177	5,954,361	14,885,920	35,726,055	61,037,584

Development of a Business Case for a Cornstalks to Bioprocessing Venture

FINAL REPORT



University of Guelph
Ridgetown Campus
Changing Lives Improving Lives

July 15, 2013

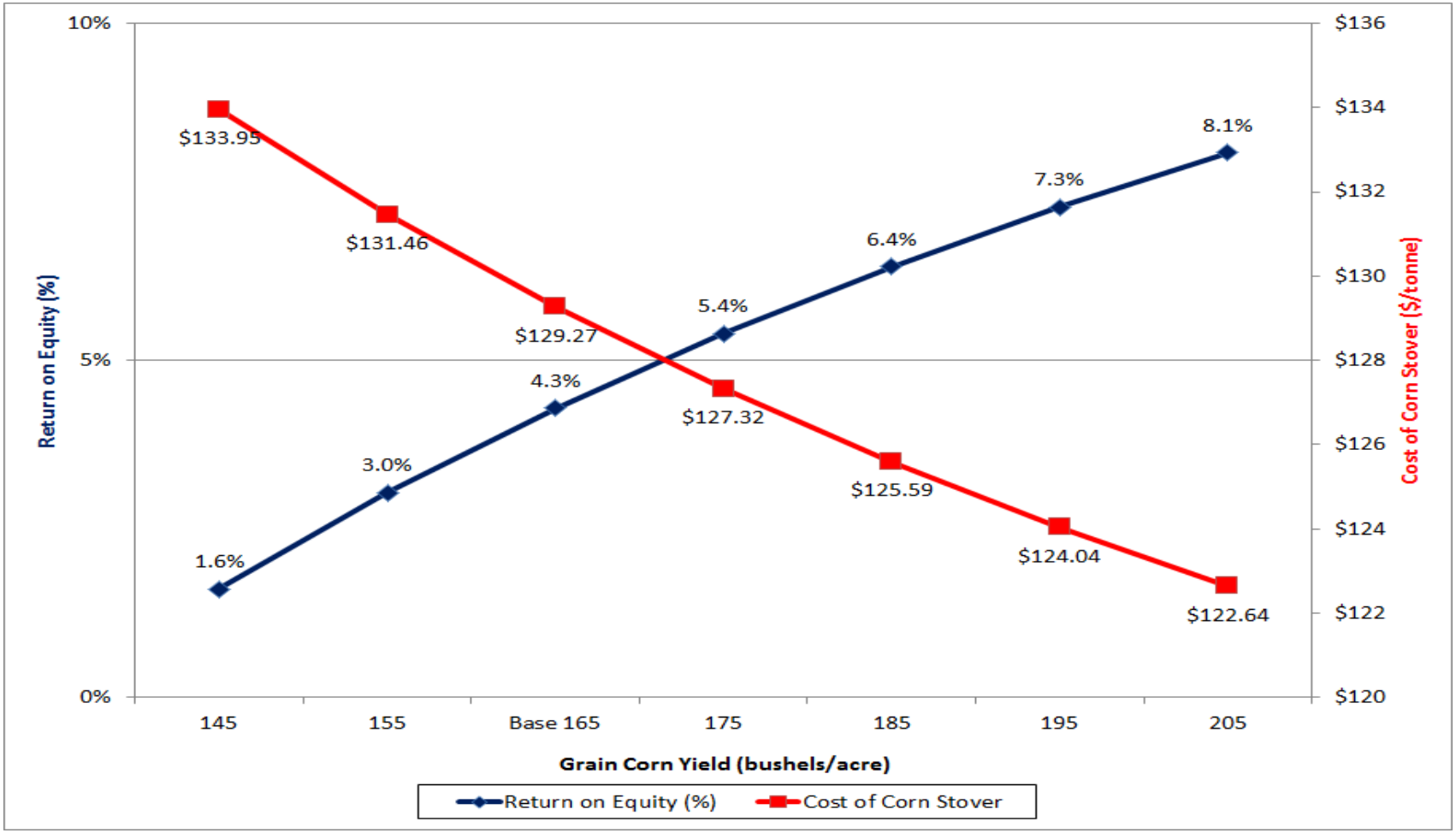
Randy Duffy
Lynn Marchand

Development of a Business Case for a Cornstalks to Bioprocessing Venture

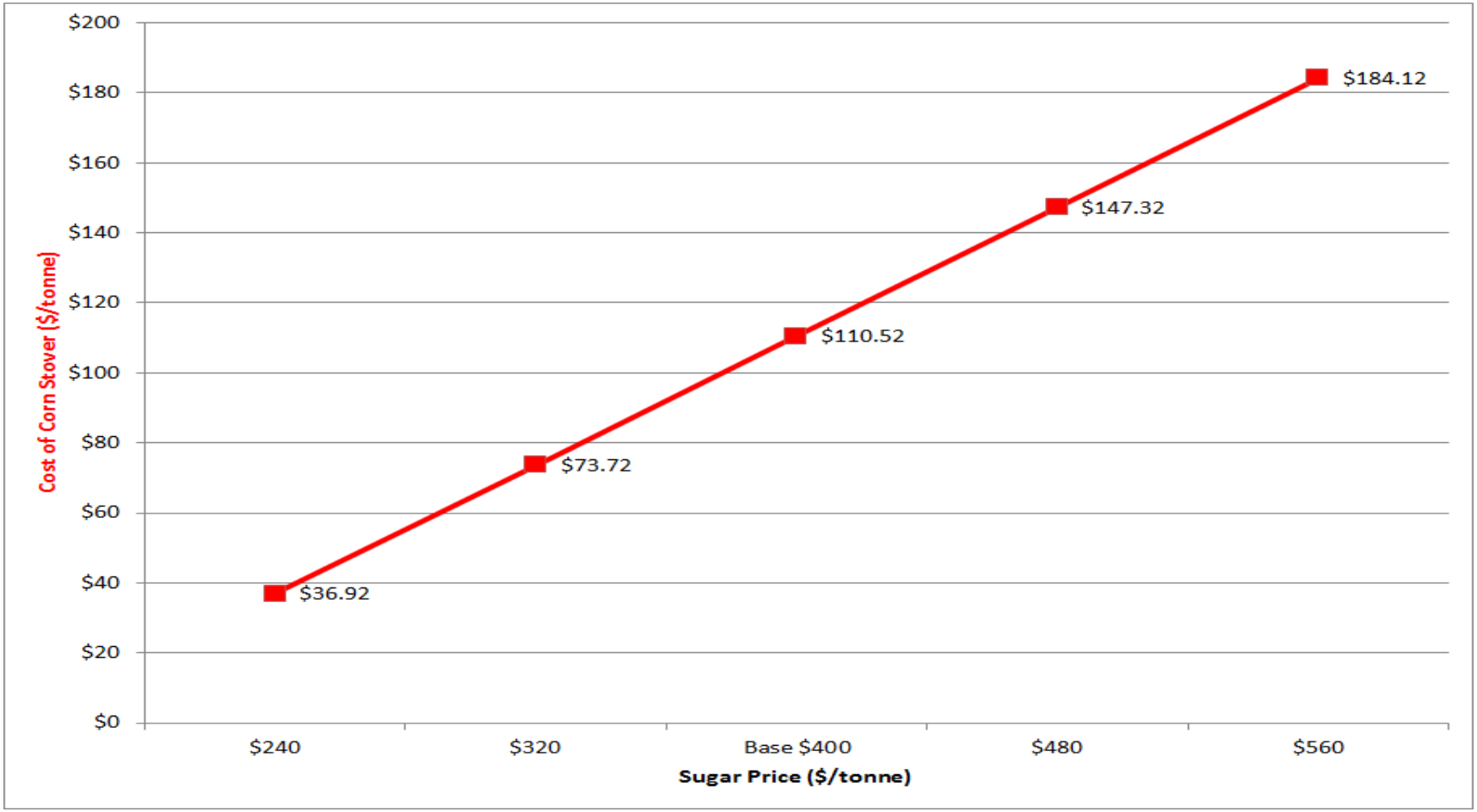
- Agronomic benefits possible with corn stover removal
- Model of bioprocessing co-op helps to derisk project
- Need for a cellulosic sugar mill

http://www.ofa.on.ca/uploads/userfiles/files/cornstalkreport-final.pdf

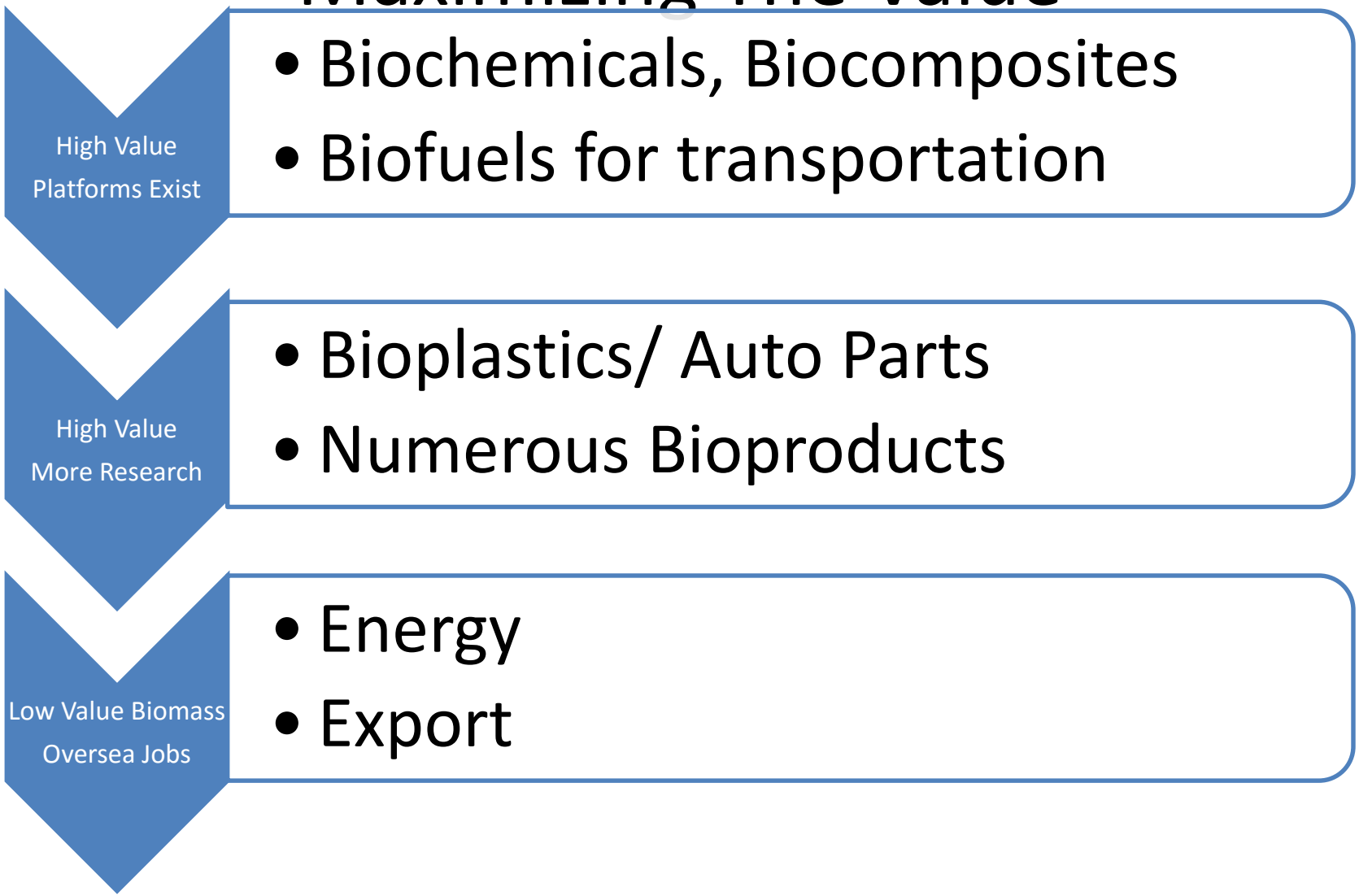
Effect of Grain Corn Yield on ROE and Cost of Stover in a Supply Co-op



Effect of Sugar Price on Cost of Stover in a Bioprocessing Co-op



Cascading End Uses for Biomass - Maximizing The Value



TECHNOLOGIES TO CONNECT YOUR ENTIRE ENTERPRISE.

Precision ag tools exist

Soil data to support this technology is coming in Ontario

LIDAR

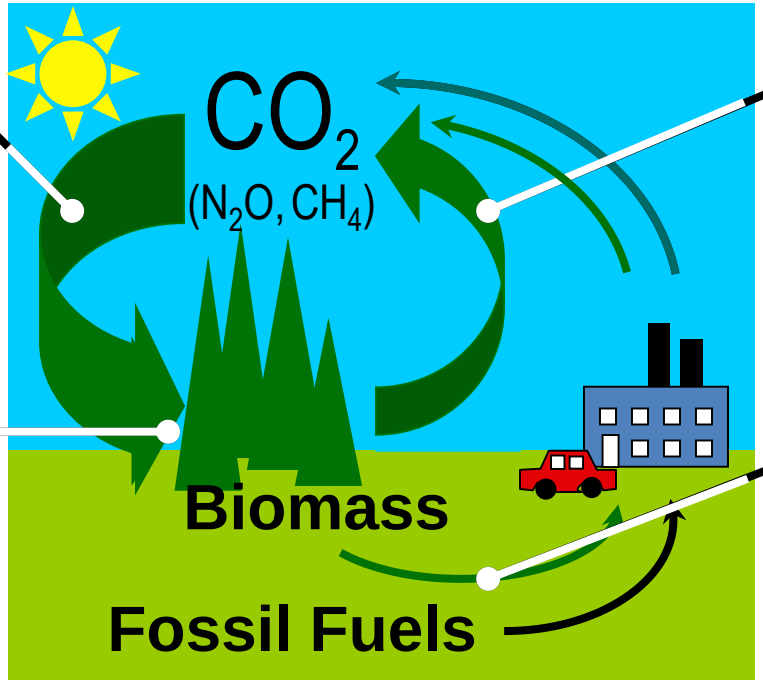

CLAAS

Capturing Canada's Green Advantage: Biosphere Solutions

… the improved management and use of our biological cycles to provide environmental values, energy, chemicals and materials ***(the Bioeconomy)*** *in addition to food, feed and fibre.*

SEQUESTER Atmospheric C & solar energy into biomass.

ADAPT biosphere to changing climate & atmosphere

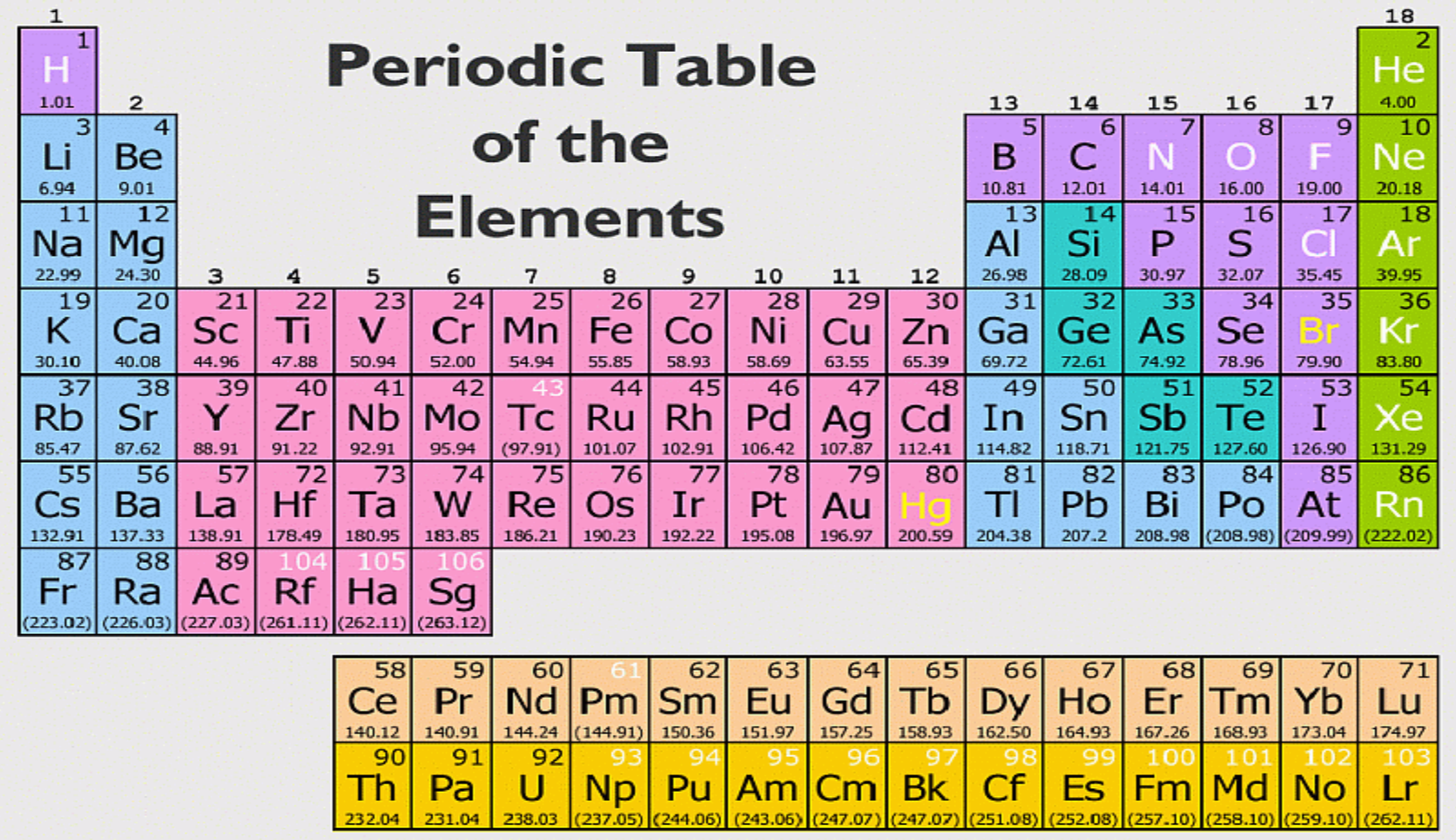


REDUCE CH_4 & N_2O associated with biosphere management

COMPLEMENT fossil energy (& chemicals, materials) with biomass

…

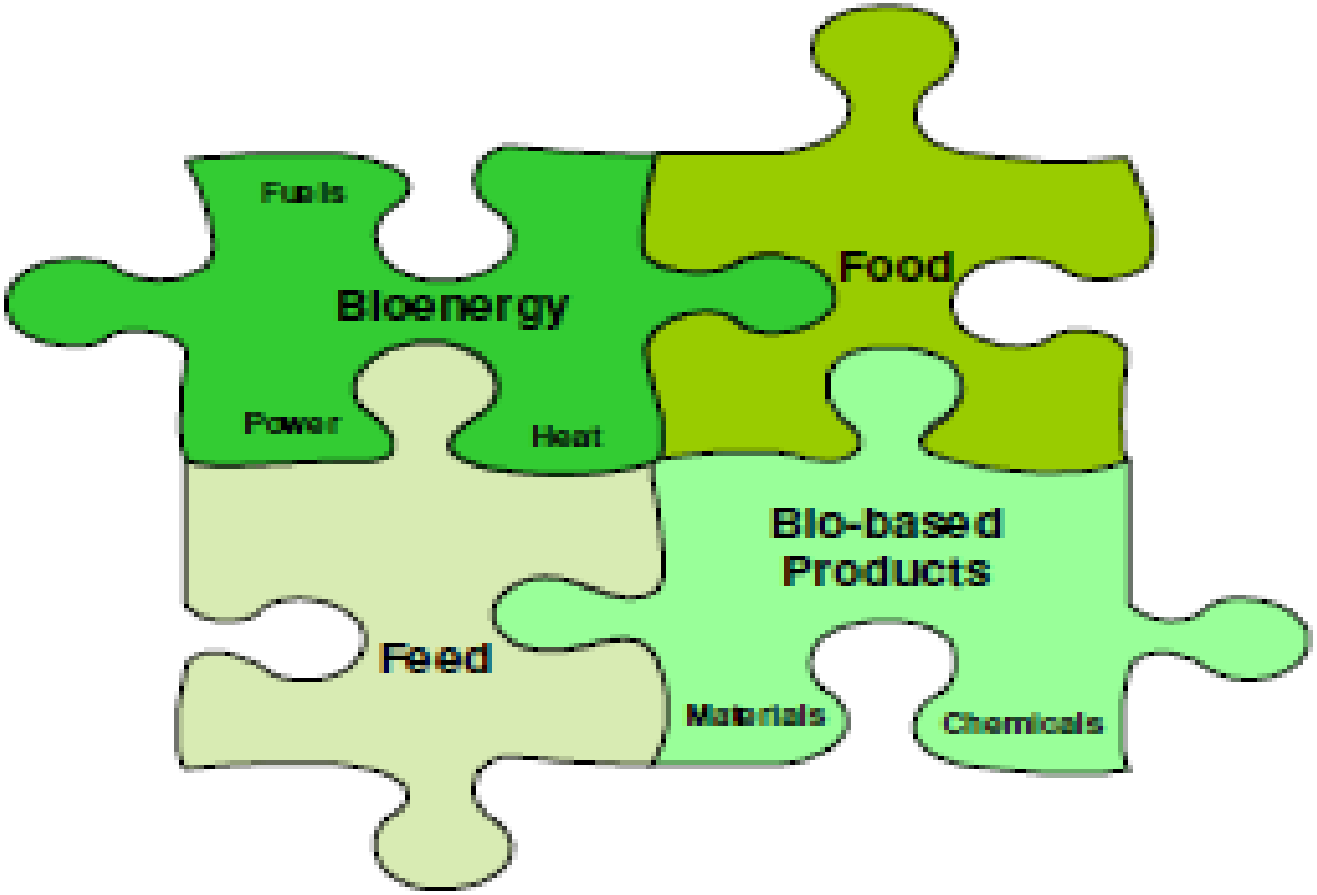
Only Farmers, Forester's and Ranchers Can Do It ALL!



Doing it all!

Ontario farmers manage the natural resources.

Let's harness knowledge, policy and commitment



Graphic from http://www.iea-bioenergy.task42-biorefineries.com/

THANK YOU!

http://biofuels.dupont.com/uploads/pics/feedstock-square2.jpg