Farm-Level Metrics

The role of non-traditional metrics in risk modelling & management

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Bob Burden
June 24, 2014

1. Define and discuss “non-traditional” metrics
2. What’s changed – the operating reality
3. How to take advantage – so what?

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Goals

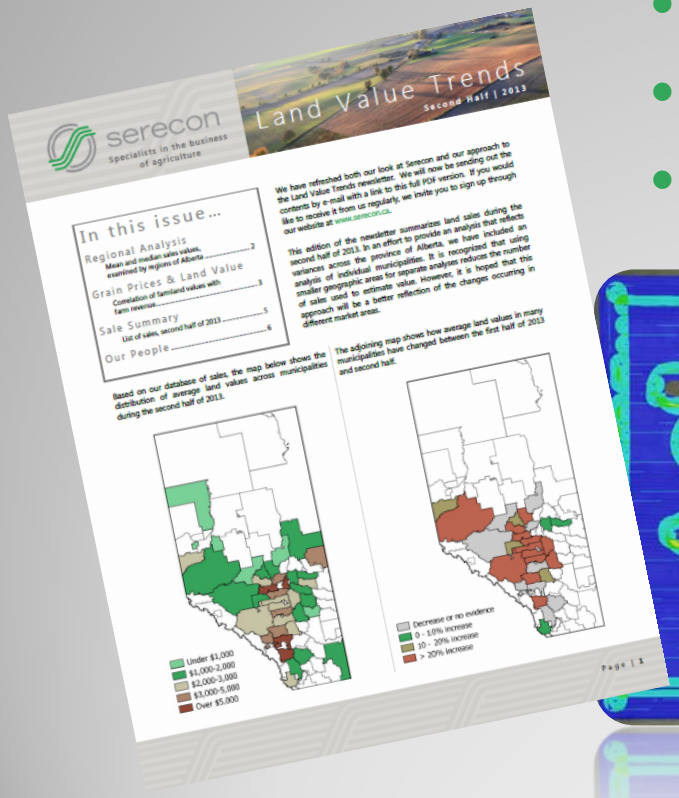
- Fact is that NTM are needed for farmers to measure economic **and now** environmental sustainability and compliance
- Not just costs – they will facilitate assessment of economic and environmental risks / impacts
- Most important – leads to comparison of economic and environmental impact & risks, based on **changes** in management practices

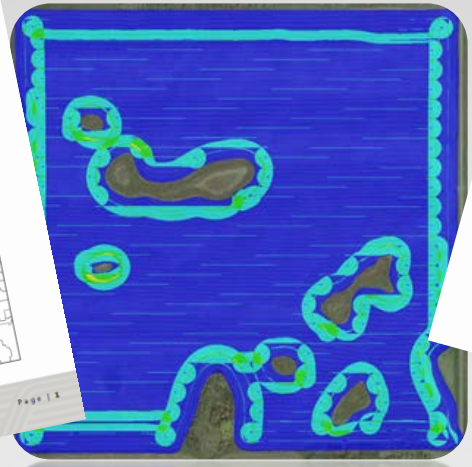
Measurement motivates appropriate behaviour

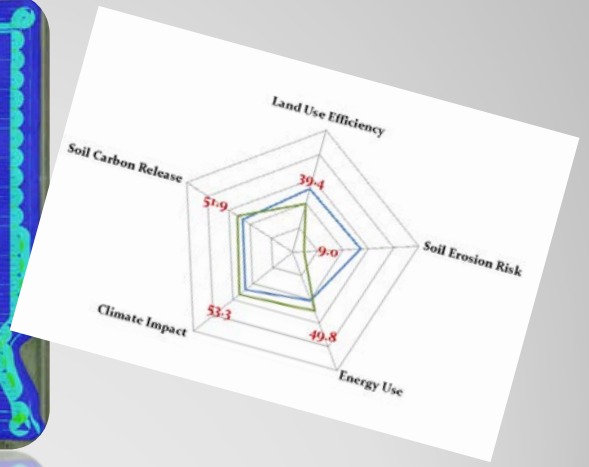
- What Serecon does (traditional metrics people):
  - Valuations & Appraisals
  - Farm Asset Management – JV with FNC
  - Management Consulting
- Our background in business valuation helps us quantify and qualify agriculture in ways that are meaningful to stakeholders
  - Policy decisions; litigation; institutions
- Life got messy – FMD; HPAI; CWD…..

Examples of unique approaches (NTM's):

- "Farms Our Size" Financial Benchmarking
- Obstruction Mapper
- Sustainability calculator
- NADSM - livestock







“non-traditional metrics”

- **Different quantity**
- Different quality
- Different types

- Benchmarks historically created using macro level data:
  - not comparable – correlation vs causation
  - primary focus on average net income, **not actual distribution** of results or probability/risk
  - comparators based on political boundaries, **not primarily on agricultural production capacity**
  - regional or national average income values always **ignore operational scale**

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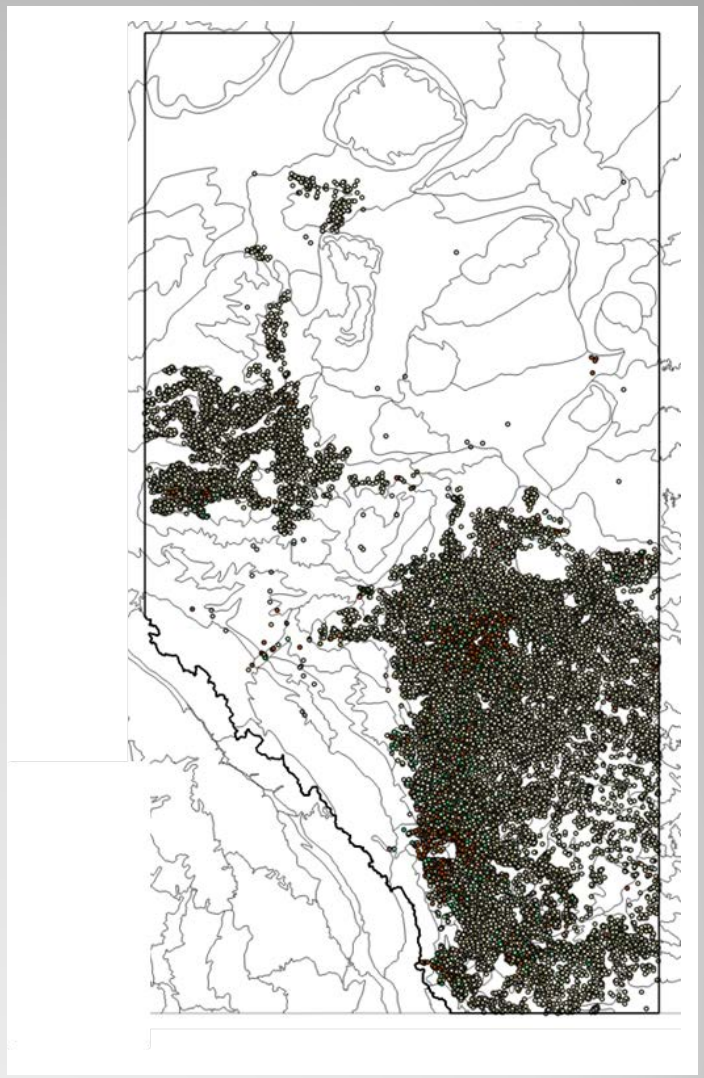
"Farms Our Size"

Historically, benchmarks based on geo-political boundaries.

Benchmarks much more meaningful when based on agronomic potential: soils & climate.



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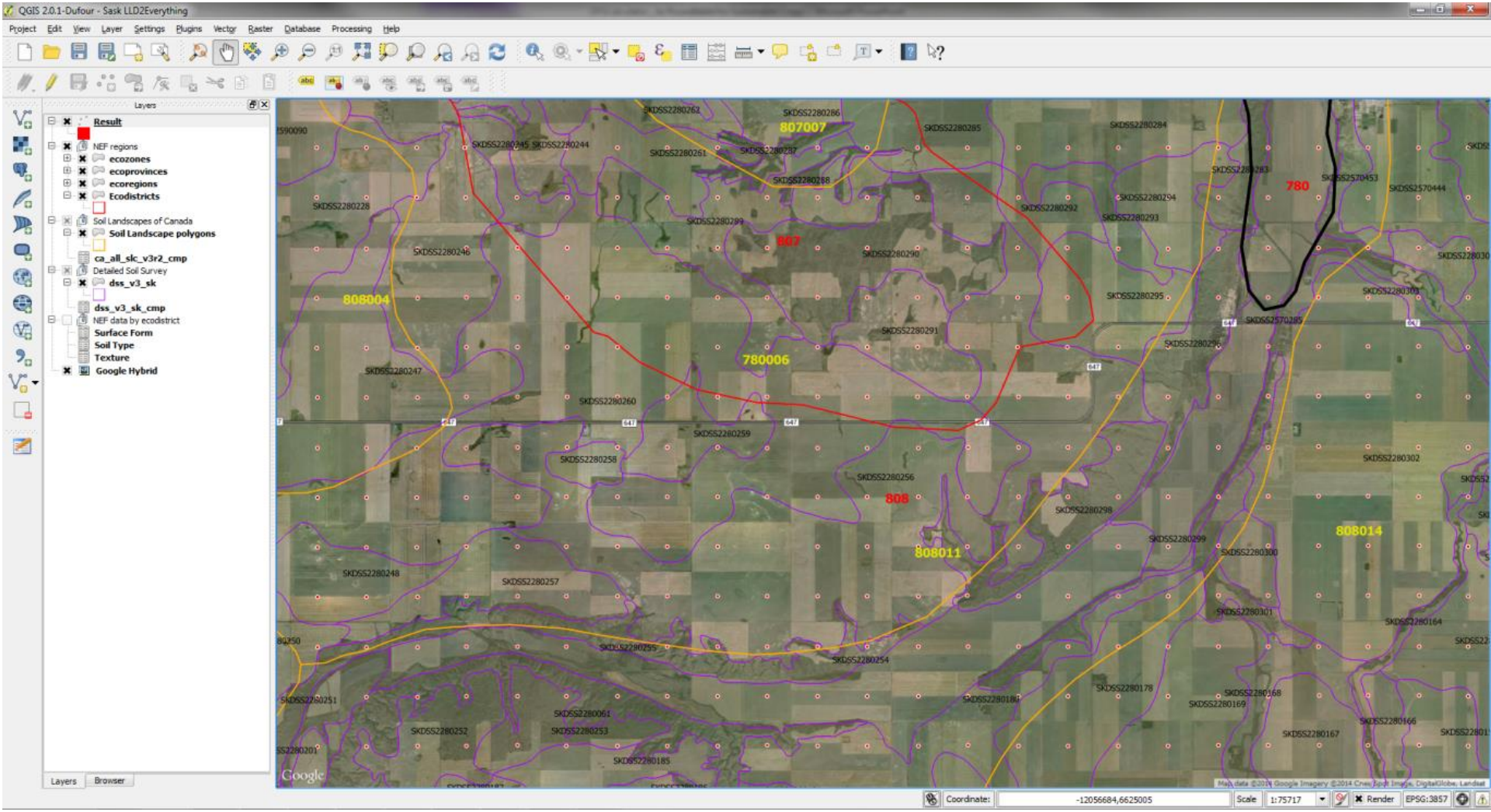
Land Value Trends & GIS



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Soil & Climate Data Refinement

- Regions based on **agricultural capacity**, which in turn is based on soil & climate
- **Distribution** of values for costs, not just the average value *(allows assessment of economic risk, rather than just average return)*
- **Scale** of operations reflected ("Farms our Size")
- Designed for **farm-level decision-making**

The landowner is not necessarily the farmer! – still interested in:

1. Income generated by farming
2. **Dividend generated by land ownership**
3. Capital appreciation of land

Both the farmer and investor would benefit from measurement of economic & environmental risk & sustainability!

- Producers – serious data fatigue:
  improve operational performance/stability,
  refine management of operations & production
  reduce risk of environmental impacts
- Investors – serious data requirements:
  better investment & lease decisions
  measure potential environmental liabilities
  reduce risk of environmental liability **& knowledge about the management/depreciation of the fundamental asset base**

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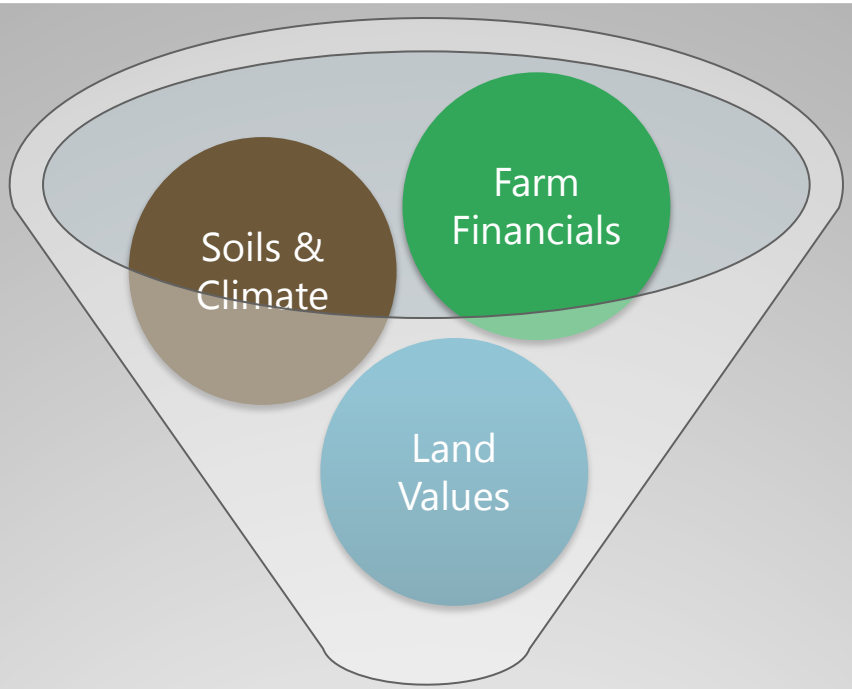
Must be a Win for All



Capital Appreciation

Income from Land

Income from Farm Operations

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The Concept: Ag ROI Metrics

- Data quality high
  Data less likely to have bias because not specifically created for the purpose of cost of production benchmarks
- Data quantity high
  Allows for protection of privacy while improving regional fidelity
- Cost-effective data collection method - *Has to be facilitated and **not** survey based*
- Can model production data (e.g. crop insurance), but need accurate financial inputs/results at scale
- "big data" – **computational economics** using a **collaborative network approach**

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Why Accounting Data?

“non-traditional metrics”

- Different quantity
- **Different quality – the obstruction mapper**
- Different types

- Obstruction Mapper created to assess economic impact of forced changes to field path
- Wellsites & above-ground powerline structures
- Measures missed areas, travel overlap, and input overlap

BUT it also has unintended uses

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Serecon Obstruction Mapper

Obstruction Mapper Demo

Traditional Uses:

- Impact of roads, wellsites or other structures impeding optimum field patterns
- Optimization of field efficiencies (including equipment selection and pathing options)
- Field efficiencies in turn affect travel time, input use, energy use, economics

Non-Traditional Uses:

- **Modelling of energy use and climate impact for different management practices**
- **Estimation of the cost of environmental protection measures, such as leaving wetlands or wildlife habitat intact**
- **An assessment of the depreciation of the environmental asset base – leading to more refined risk assessments – soil loss; production efficiency & water quality**

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Obstruction Mapper Uses

Example #1:

- Installation of new powerline structures
- Calculating the tangible economic costs of working around an obstruction

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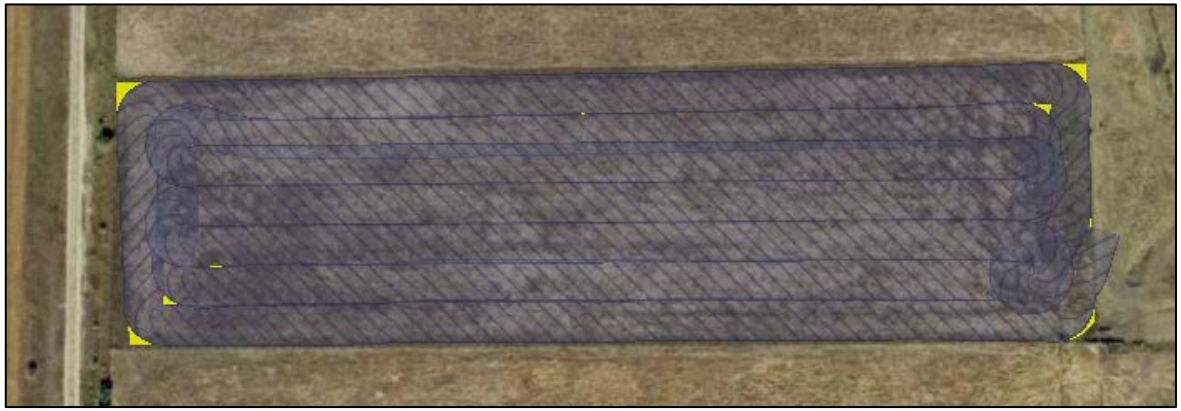
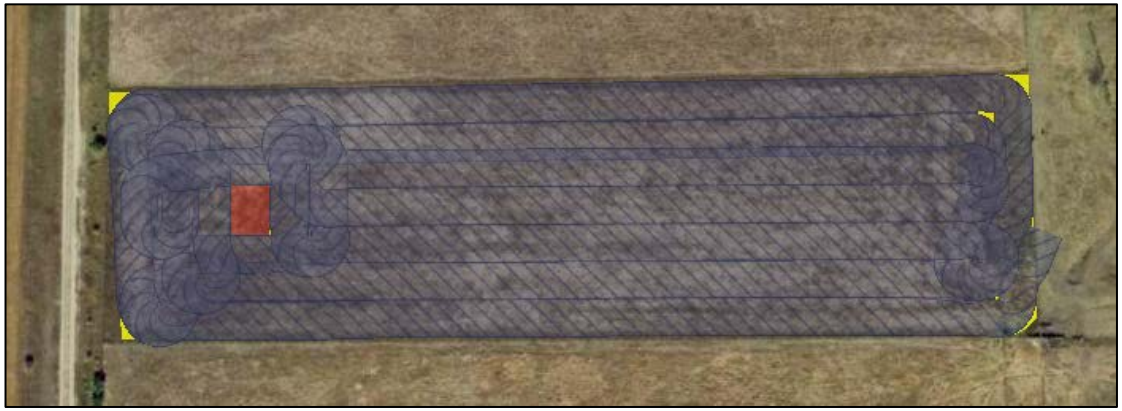
Example #1: Obstructions

Path Modelling



Current Pattern

Pattern around obstruction



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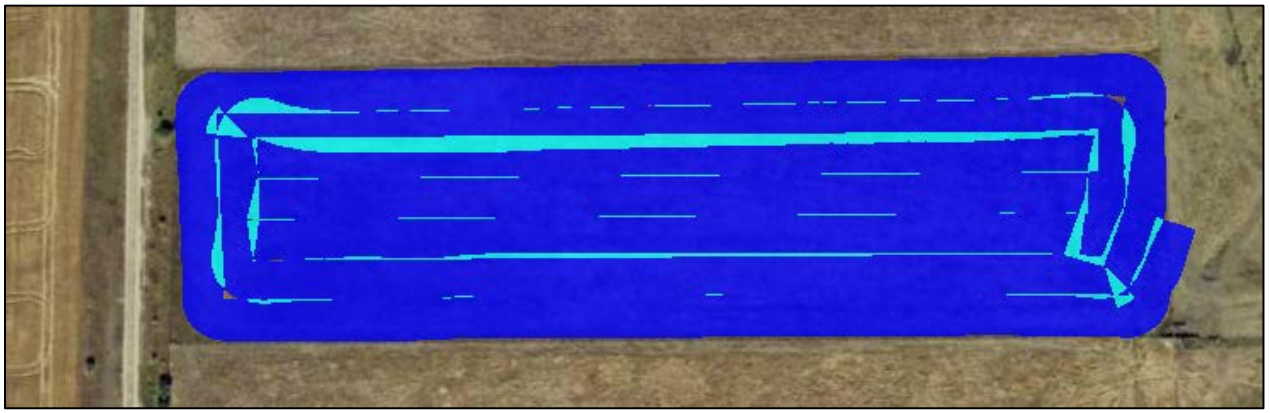
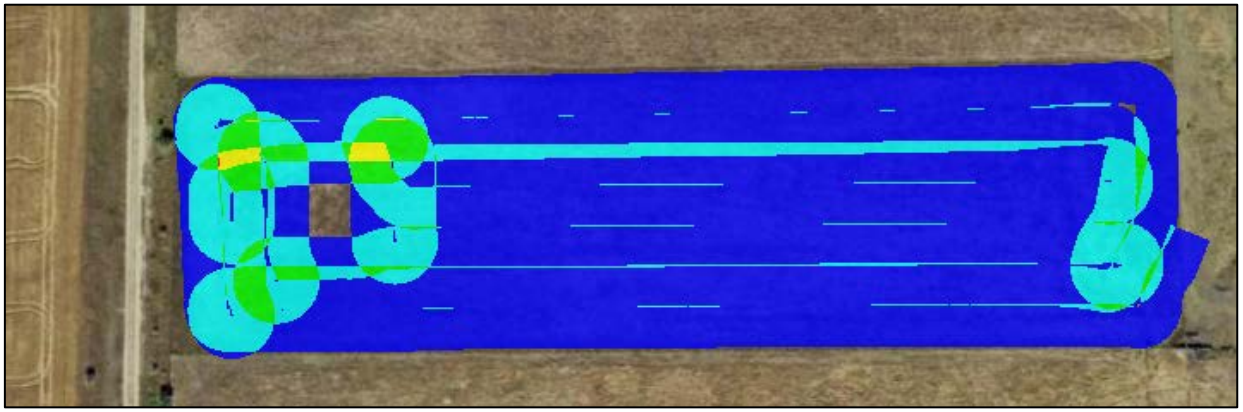
Example #1

Overlap Modelling



Current **Pattern**

Overlap after obstruction



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Example #1

Estimated Differential

	Area of Overlaps (acres)	Tangible Adverse Effects ($)
Additional Equipment Operating Cost		
Equipment Operating Cost Due to Overlaps	1.24	$83.83
Crop Loss		
Missed Area Not Seeded	0.07	$24.65
Crop/Revenue Loss		
One Overlap	0.55	$32.64
Two Overlaps	0.27	$40.53
Three Overlaps	0.05	$13.61
Additional Input Costs		
One Input Overlap	0.14	$28.54
Two Input Overlaps	0.01	$1.24

Total Additional Annual Costs & Losses	**$225.04**

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Example #1

Example #2:

- Field with numerous small wetlands
- Draining and seeding wetlands would reduce field operation time and increase acreage
- Quantify the cost of leaving wetlands in place

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Example #2: Conservation Costs

Path Modelling

60’ seeder with wetlands

60’ seeder after draining

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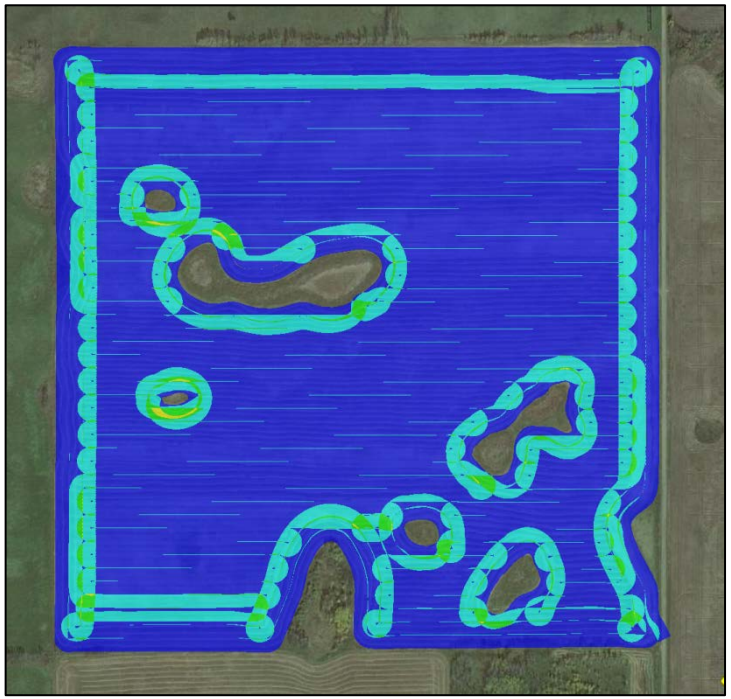
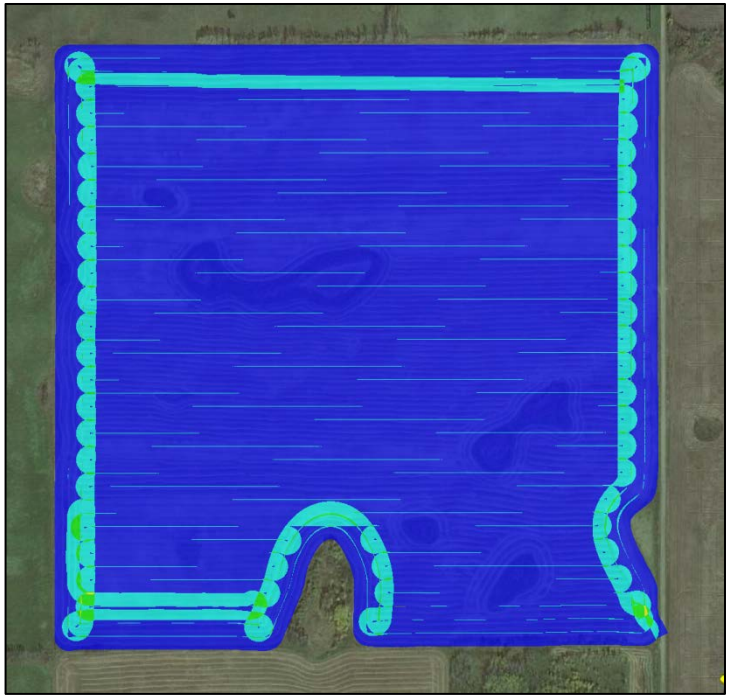
Example #2

Overlap Modelling



60’ seeder with wetlands

60’ seeder after draining



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Example #2

	Before Taking		After Taking		Area Affected (ac)	Total Overlap (ac)	Impact Value (per acre)	Total Impact Estimate
	(m^2)	(ac)	(m^2)	(ac)				
Missed Area (ac)					**-6.65**		$ 500.00	**-$ 3,325.12**
Missed Area (ac)	185.77	0.05	163.11	0.04	-0.01			
Footprint of Obstruction (ac)	26,889.90	6.64	0.00	0.00	-6.64			
Travel Overlaps (ac)					**-14.35**	**-17.10**	$ 62.00	**-$ 1,060.10**
One Overlap (ac)	121,713.00	30.08	74,041.20	18.30	-11.78	-11.78		
Two Overlaps (ac)	14,307.00	3.54	4,572.40	1.13	-2.41	-4.81		
Three Overlaps (ac)	778.55	0.19	92.88	0.02	-0.17	-0.51		
Four Overlaps (ac)	0.00	0.00	0.76	0.00	0.00	0.00		
Input Overlaps (ac)					**-3.67**	**-3.71**	$ 125.00	**-$ 463.14**
One Overlap (ac)	40,724.10	10.06	26,017.70	6.43	-3.63	-3.63		
Two Overlaps (ac)	222.01	0.05	77.02	0.02	-0.04	-0.07		
Three Overlaps (ac)	0.00	0.00	0.76	0.00	0.00	0.00		
Four Overlaps (ac)	0.00	0.00	0.00	0.00	0.00	0.00		
						serecon	**Total**	**-$ 4,848.36**

Assumptions

Missed area impact = Alberta Canola Commission price ($10.25 per bushel x 50 bushel) http://canola.ab.ca/canola_prices.aspx

Input overlap = ARD cost of production for black soil zone http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/inf14269

Travel overlap = custom rate costs ($25 seeding, $12.50 swath, $24.50 combine) http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/inf14269

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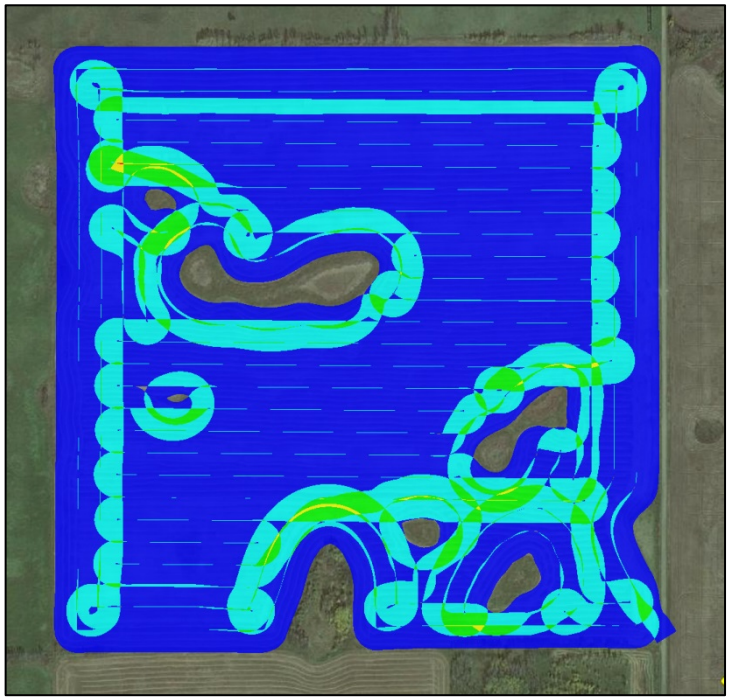
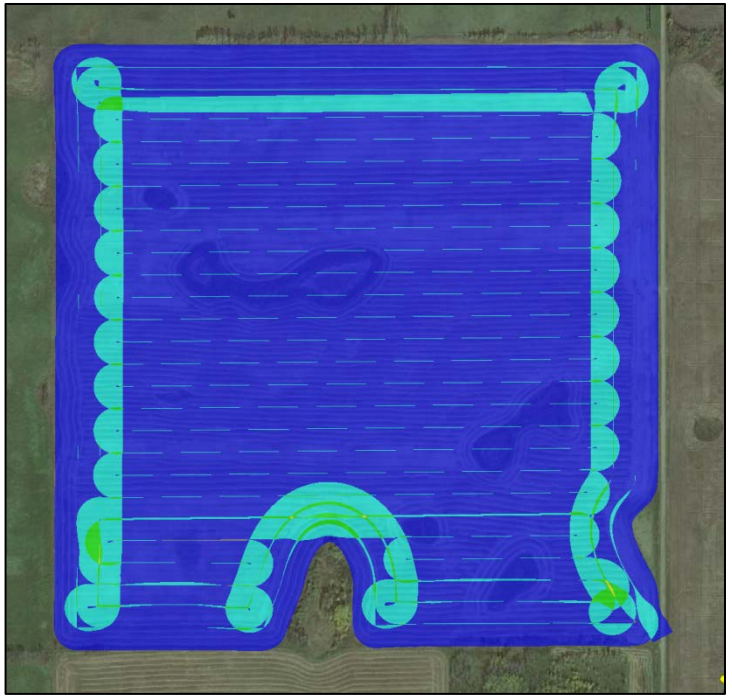
Ex#2 Details: Seeding

Overlap - Sprayer



90’ sprayer with wetlands

90’ sprayer after draining



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Example #2

Estimated Differential

	Seeding & Harvest	Spraying	Total Impact Estimate
Missed Area ***(Lost Revenue)***	$ 3,325.12		$ 3,325.12
Travel Overlaps ***(Additional Operation Expense)***	1060.10	364.42	$ 1,424.53
Input Overlaps ***(Unnecessary Expenditure)***	463.14	206.73	$ 669.88
	$ 4,848.36	$ 571.16	**$ 5,419.52**

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Example #2

“non-traditional metrics”

- Different quantity
- Different quality
- **Different types – environmental metrics**

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"Our ultimate goal is to sustainably source the raw materials we use in our products."

"Our current focus is on increasing the sustainability of the 10 priority agricultural raw materials ….. represent more than 50 percent of our annual purchases."

"We partner with industry groups to advance sustainable sourcing frameworks across our supply chain."

Source: General Mills, Global Responsibility 2013

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The End of Agriculture?

The End of Agriculture?
Not A Chance!

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A Focus on Measuring Sustainability is

A focus on non-traditional depreciation!

Different things to different people **BUT**

- Objectivity
- Look to established, recognized, validated opinions
- Environmental – Economic - Social
- General Mills:
  "Just do something real and be able to validate it"

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What is Sustainability?

1. **Demonstrate progress in western Canadian cropping systems over 20 years** - environmental performance
2. **Establish a baseline** - monitor future improvements
3. **Create enabling conditions** – stakeholder discussion and development of commercial sustainability indicators in the food industry

- US - Keystone & “Field to Market”
- Not-for-profit with 50 member organizations
- Grower groups, conservation organizations, agribusinesses, food, restaurant and retail companies, academia and research org’s
- Cool Farm Tool
- BASF etc..

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Field to Market U.S. – we’re not alone

- On-Farm Sustainability Initiative is an industry-led consortium

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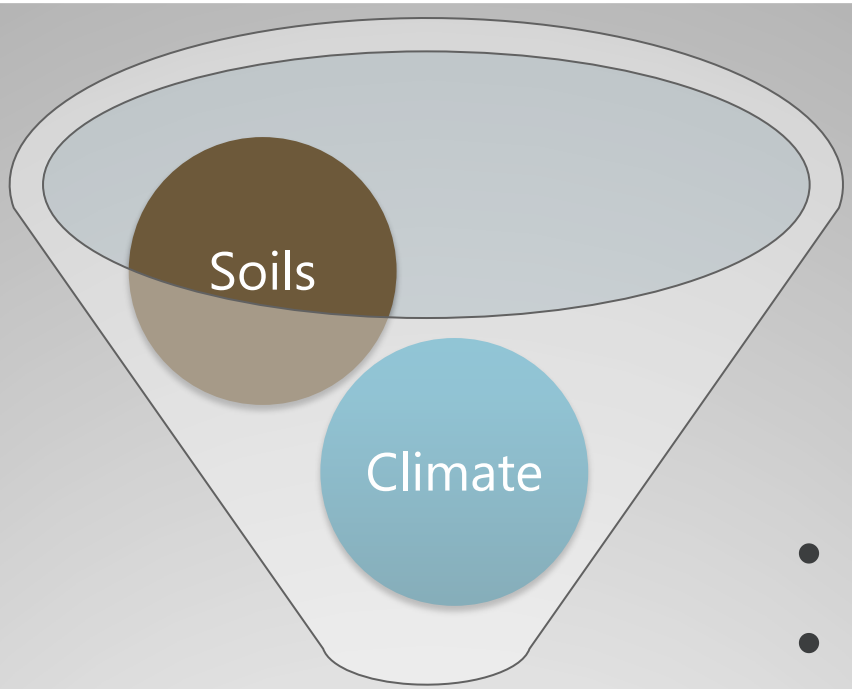
Canadian Field Print Initiative



- Reactive
- High level

Energy Use

Climate Impact

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Other Approaches - LCA

- A **farm level** tool
- Starting point to assess the **environmental** and **economic** impacts of change
- Allows for **assessment of relative impacts** of management changes against baseline

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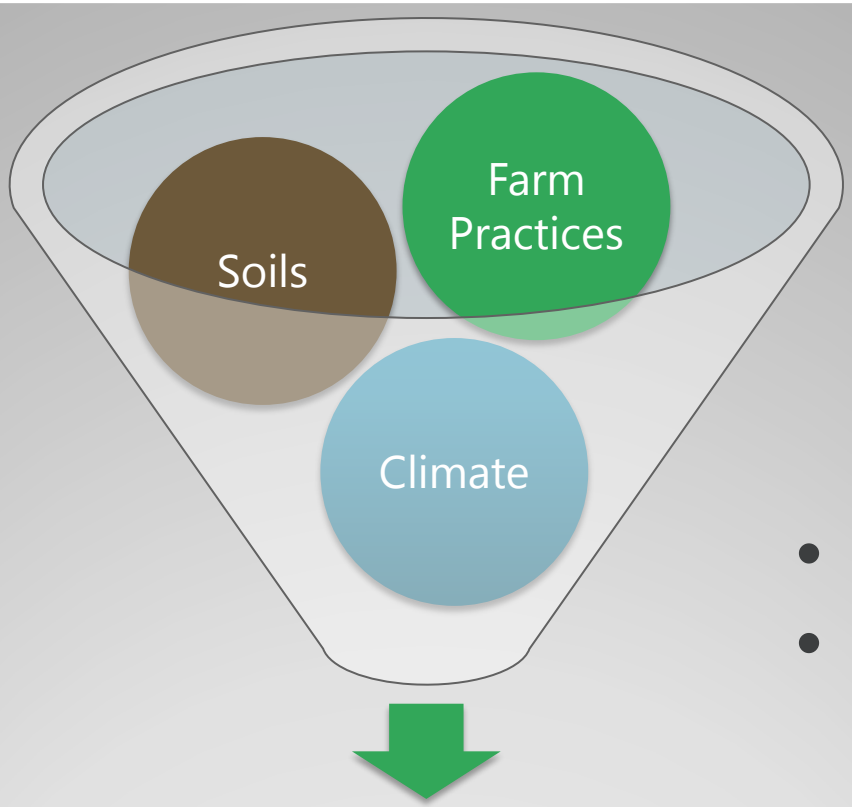
Deal with the operating reality



- Proactive
- Meaningful to Producer

Land Use Efficiency	Soil Erosion Risk	Energy Use	Climate Impact	Soil Carbon Release

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Our Calculator – producer focused

- Easy to use
- Easy to understand
- Easy to work with
- Easy to transfer & expand

- Non-proprietary
- Ability to develop industry-wide commitment

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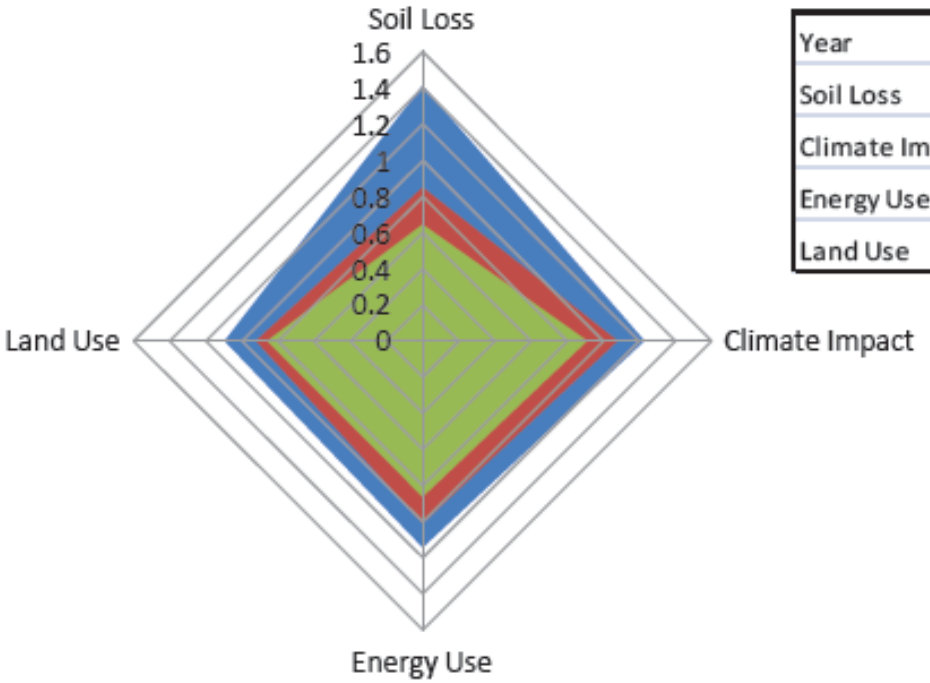
Calculator Principles

- Improvement in:
  - every indicator
  - every crop
  - from 1986 to 2006
- Improvements (the so what) driven by:
  - Higher yield
  - **Reduced tillage**
  - **Improved nutrient management**
  - **Changes in crop rotations**

53% ↓ in soil loss **22% ↓ in energy use**

27% ↓ in greenhouse gases **16% ↓ in land use**



Year	2001	Unit
Soil Loss	0.87	T soil/T output
Climate Impact	0.41	T CO_2e/tonne
Energy Use	2.65	GJ/tonne
Land Use	0.52	ha/tonne

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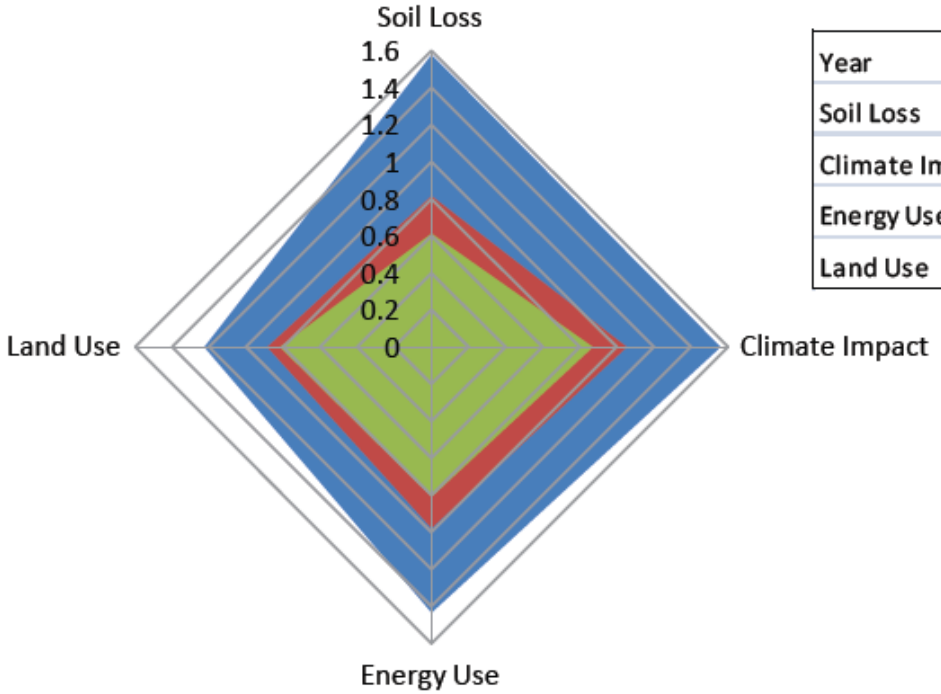
Sustainability of Canadian Peas

61% ↓ in soil loss **44% ↓ in energy use**

44% ↓ in greenhouse gases **33% ↓ in land use**



Year	2001	Unit
Soil Loss	1.51	Tsoil/Toutput
Climate Impact	0.45	TCO_2e/tonne
Energy Use	3.91	GJ/tonne
Land Use	0.90	ha/tonne

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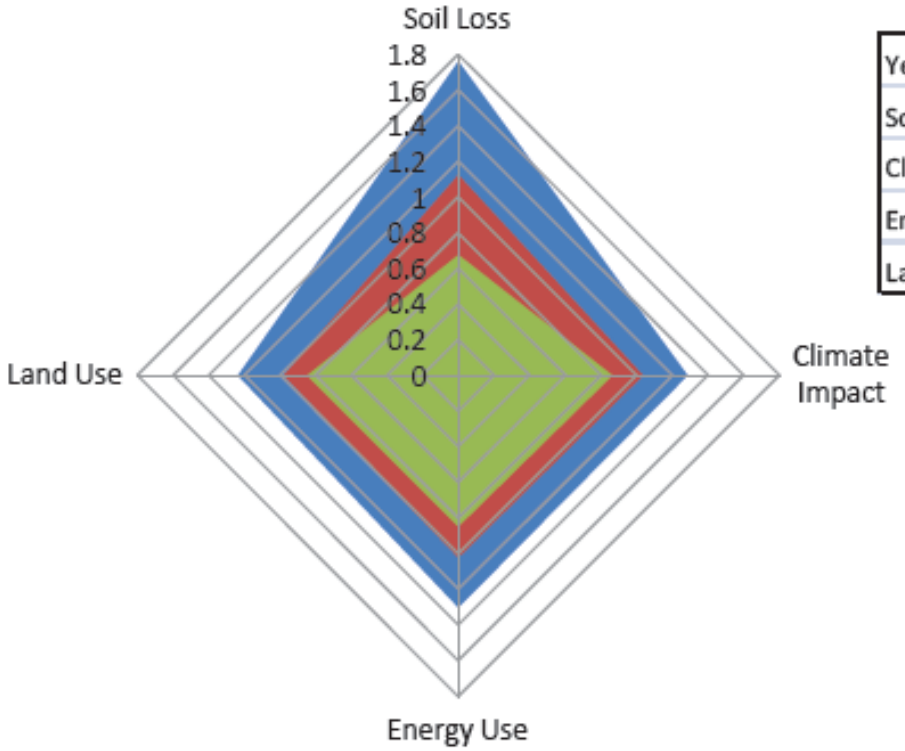
Sustainability of Canadian Lentils

62% ↓ in soil loss **30% ↓ in energy use**

32% ↓ in greenhouse gases **26% ↓ in land use**



Year	2001	Unit
Soil Loss	1.07	Tsoil/Toutput
Climate Impact	0.41	TCO_2e/tonne
Energy Use	3.33	GJ/tonne
Land Use	0.46	ha/tonne

1986
1996
2006

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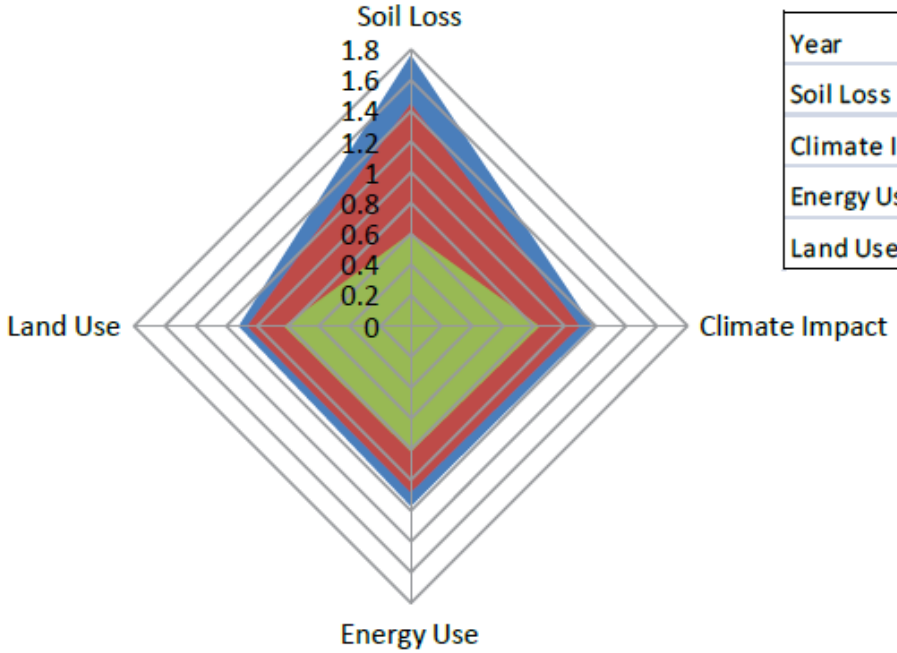
Sustainability of Canadian Wheat

66% ↓ in soil loss **30% ↓ in energy use**

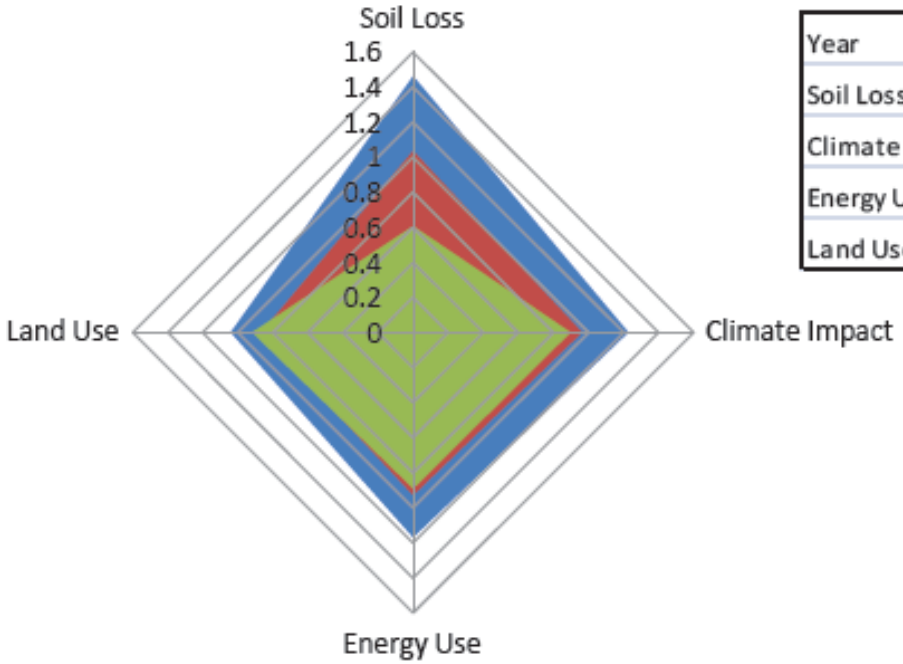
29% ↓ in greenhouse gases **26% ↓ in land use**



Year	2001	Unit
Soil Loss	0.74	T soil/T output
Climate Impact	0.87	T CO_2e/tonne
Energy Use	6.96	GJ/tonne
Land Use	0.71	ha/tonne

55% ↓ in soil loss **29% ↓ in energy use**

34% ↓ in greenhouse gases **12% ↓ in land use**



Year	2001	Unit
Soil Loss	1.22	T soil/T output
Climate Impact	0.75	T CO_2e/tonne
Energy Use	6.26	GJ/tonne
Land Use	0.88	ha/tonne

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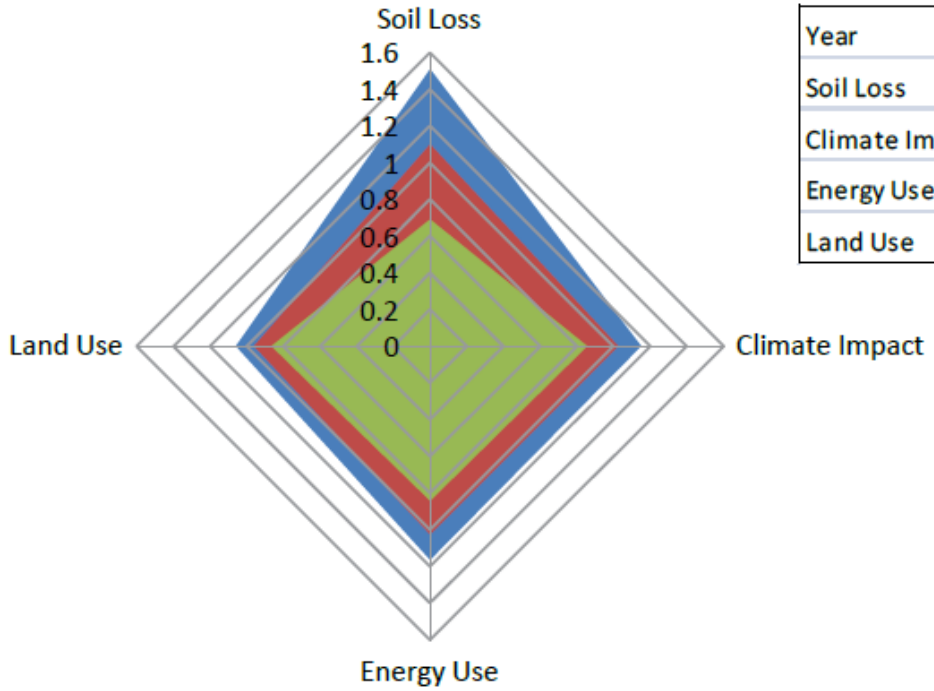
Sustainability of Canadian Flax

54% ↓ in soil loss
26% ↓ in greenhouse gases
28% ↓ in energy use
18% ↓ in land use



Year	2001	Unit
Soil Loss	0.99	T soil/T output
Climate Impact	0.40	T CO_2e/tonne
Energy Use	3.17	GJ/tonne
Land Use	0.43	ha/tonne

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Sustainability of Canadian Oats

- Indicators useful as part of management and investment decisions – **"appropriate"**
- Ability to reconcile improvements in sustainability with the financial impact of sustainable farming – **"behaviour"**
- Consumers and food industry increasingly **demanding quantification of sustainability**
  - Bonnefield, CPP, FNC – **standards of care**
- Measurement **motivates appropriate behaviour**
- Computational economics using a collaborative network approach **(again)**

Expanding the non-traditional metric Toolkit

SO WHAT??

Integrating metrics (Indicators)

into other models & analysis – collaborative networks

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Non-traditional metrics can be integrated into other analysis & decision-making tools

- Example: Serecon's farm path simulation software used to map obstructions
- Can be used to model field efficiencies
- Field efficiencies in turn affect travel time, input use, energy use, climate impact, economics

Example #3:

- Small field with 33′ seeder (16″ overlap)
- Considering replacing with 49′ seeder with GPS navigation (9″ overlap)

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Example #3: Field Efficiencies

Path Modelling

33’ with 16” overlap

49’ with 9” overlap

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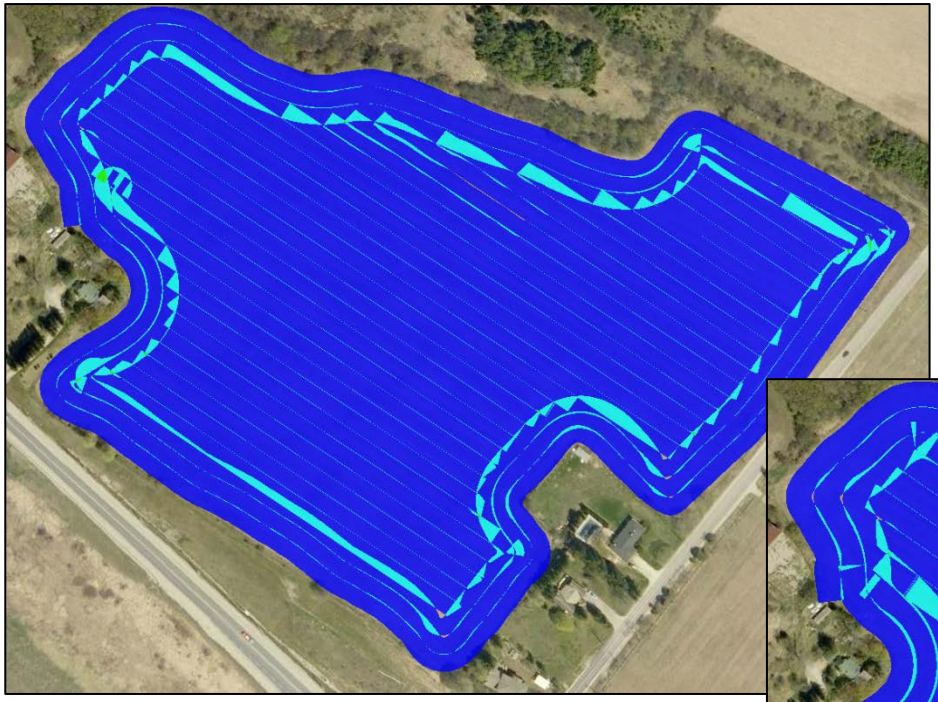
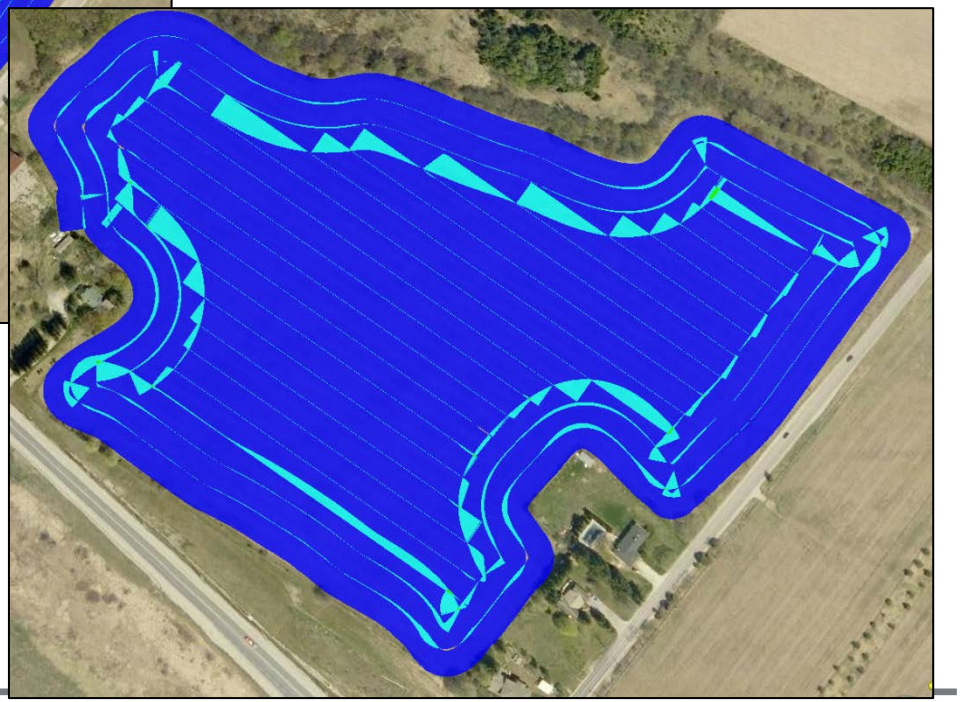
Example #3

Input Modelling



33’ with 16” overlap

49’ with 9” overlap



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Example #3

Estimated Differential

	Travel distance	Missed Area	Input Overlap
Old (33' @ 16" overlap)	13,807 m	41 m^2	10,687 m^2
New (49' @ 9" overlap)	9,302 m	68 m^2	9,858 m^2
Difference	-32.6%	17 m^2	-7.8%

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Example #3

Estimated Differential

- 32.6% less travel distance/time = less fuel used
  = lower GHG emissions
- 7.8% less input overlap = less fertilizer used
  = lower GHG emissions
  = lower climate impact
- Alignment of economics and reduced environmental impact
- In other cases (drainage of wetlands, for example), environmental benefits and financial results may not align, but measurement allows for informed decisions & policies

But we now have a way to define "appropriate behaviour" & a way to motivate it

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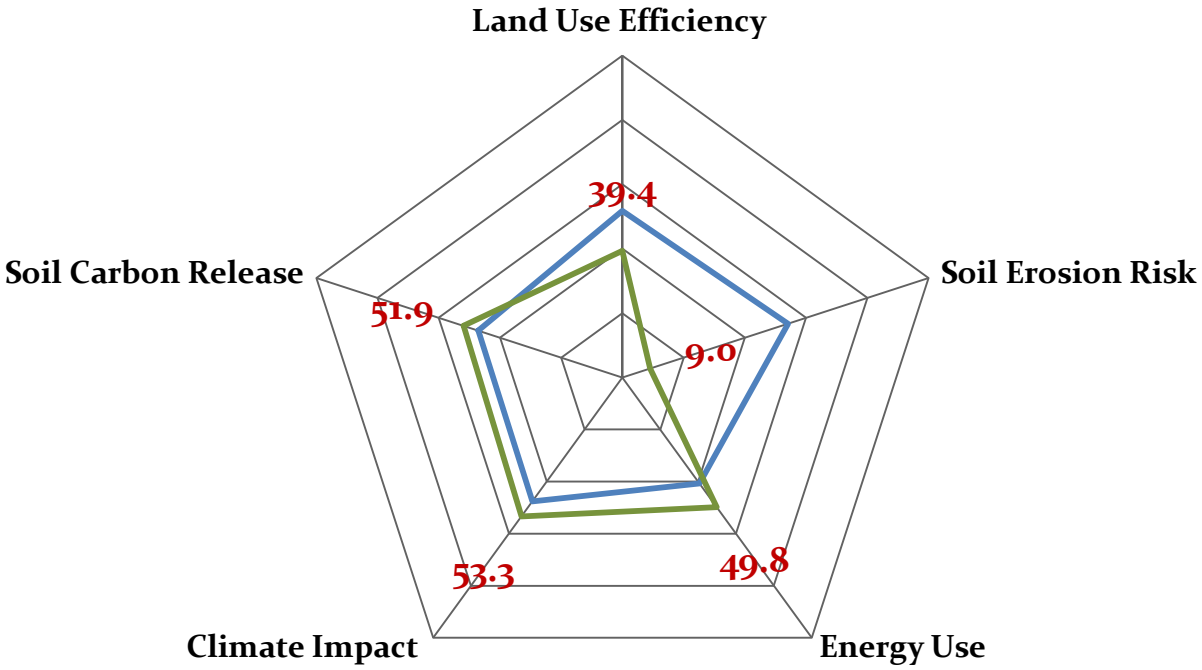
Example #3



Fieldprint Indicator	Western Canada	Saskatchewan	A: Home Quarter
Land Use Efficiency	50.0	51.7	39.4
Soil Erosion Risk	50.0	54.1	9.0
Energy Use	50.0	40.7	49.8
Climate Impact	50.0	47.6	53.3
Soil Carbon Release	50.0	47.1	51.9

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Sample Output

Non Traditional Metrics – the summary

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- Definition
- What's Changed
- Impacts

- Quality – more focused/relevant
- Quantity – computational economics
- Type & integration/extension – collaborative networks

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NTM - Definition

- The farmer
  - Individuals, institutions & corporations
  - Governance matters
- The consumer
  - A brand is simply a promise of value – metrics help validate that promise
- The collection process
  - Big data and collaborative networks
  - Individual generating data is not providing analysis
- The understanding of “full asset depreciation”
  - Its more than just iron

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NTM – What’s Changed

Measurement:

- NTM need to be considered as part of management and investment decisions
- The average is becoming irrelevant
- Demonstrating “margin governance” is very relevant
- Need to have collaborative network approach

Measurement motivates appropriate behaviour – the carrot

- Ability to reconcile improvements in sustainability with the financial impact of sustainable farming

Cross compliance tied to appropriate behaviour – the stick

Non-Traditional Metrics

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Questions?

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