Where Conservation and Profitability Meet

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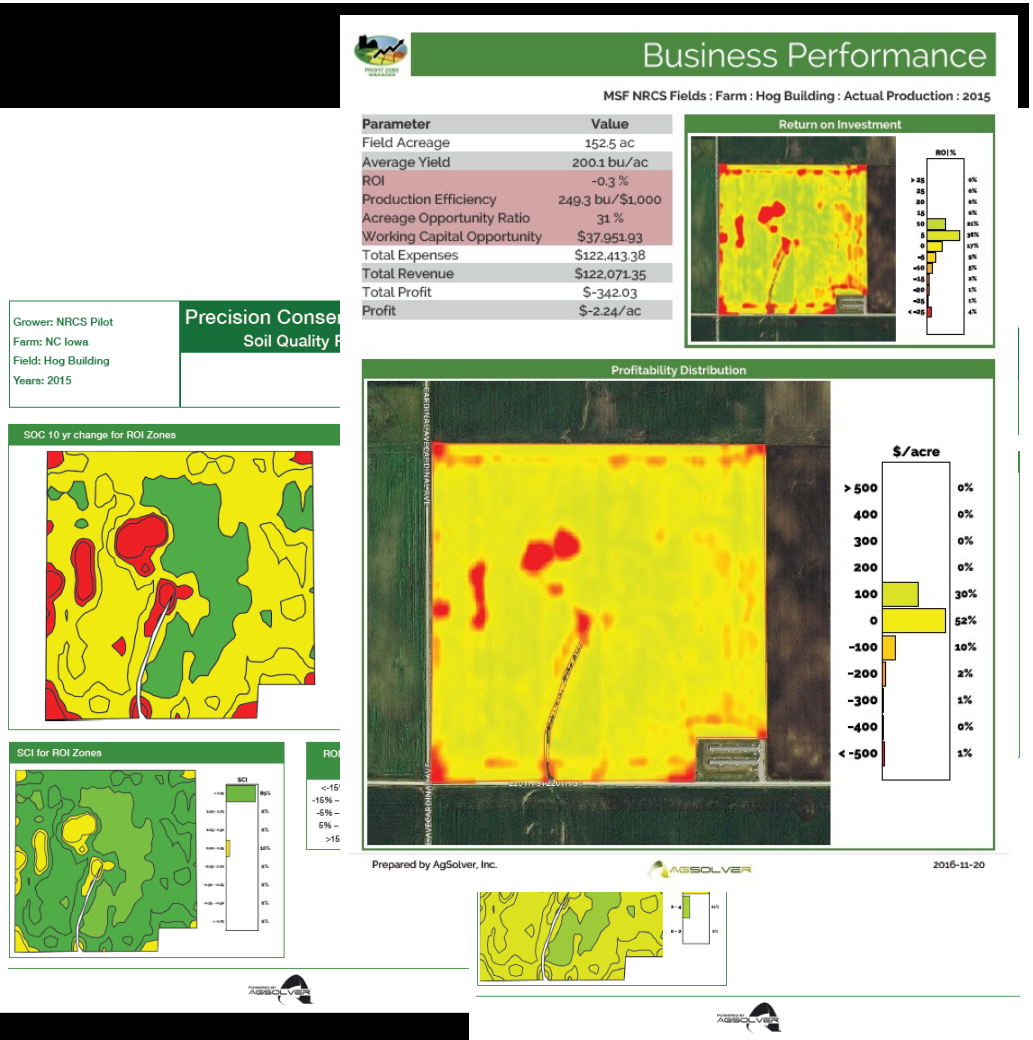
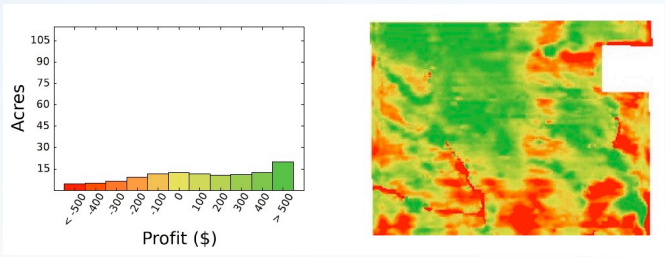
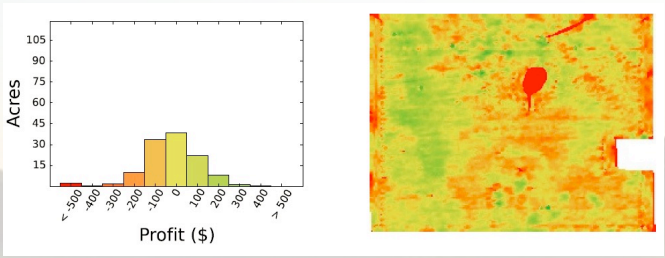
Simultaneous Objectives

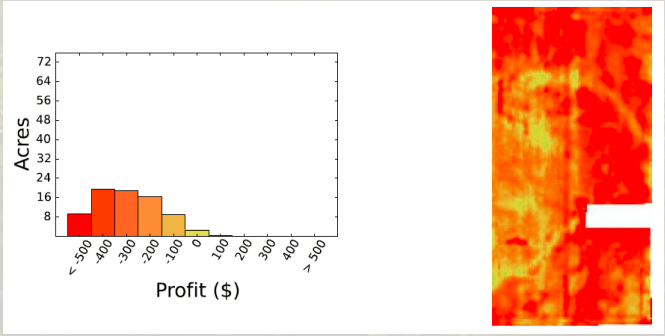
- Increase biomass production for energy uses
- Improved environmental performance through energy crop integration
- Practical system designs
- Economically advantageous system designs

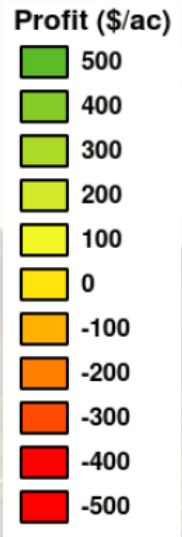


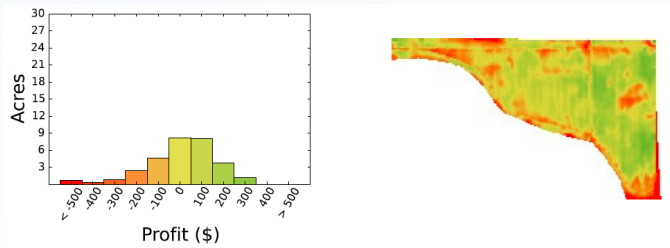
Understanding Impacts of Subfield Variability on Profit

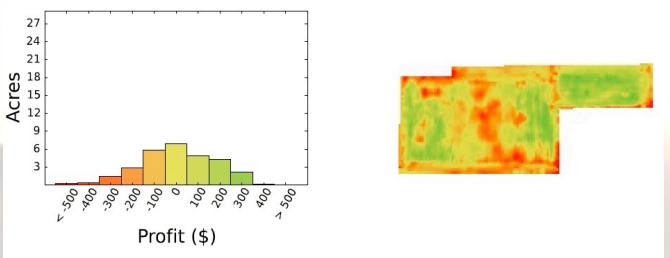


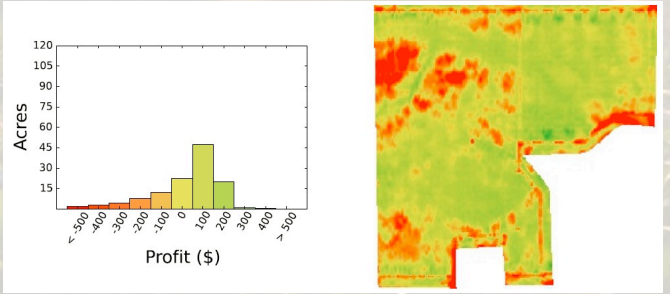












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Key Message

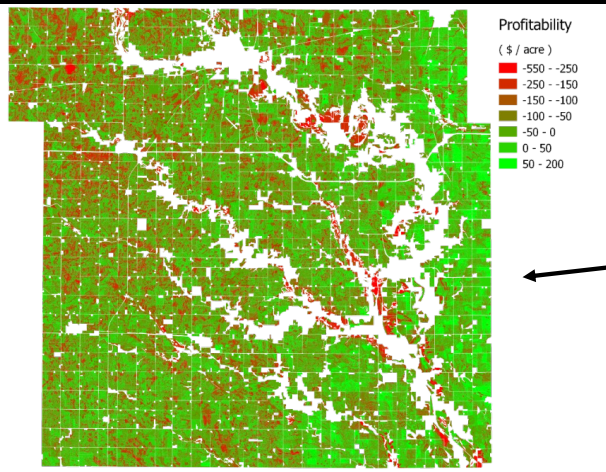
Environmental Performance and Economic Performance
are driven by the same goal:

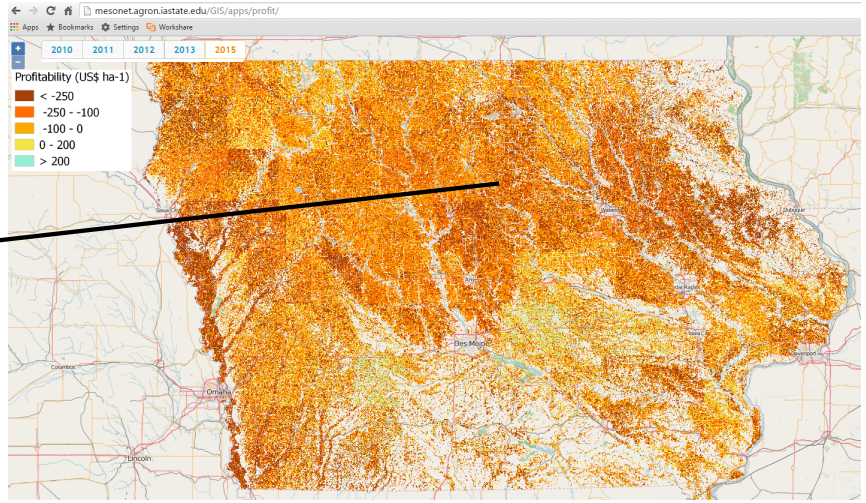
Maximize the output per unit of input

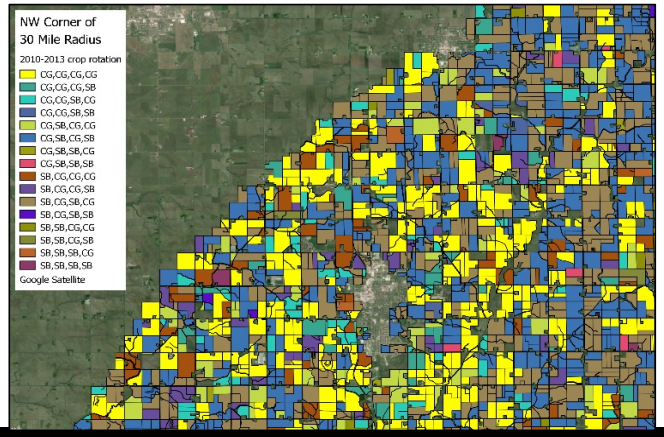




Identifying the Impact and Opportunity



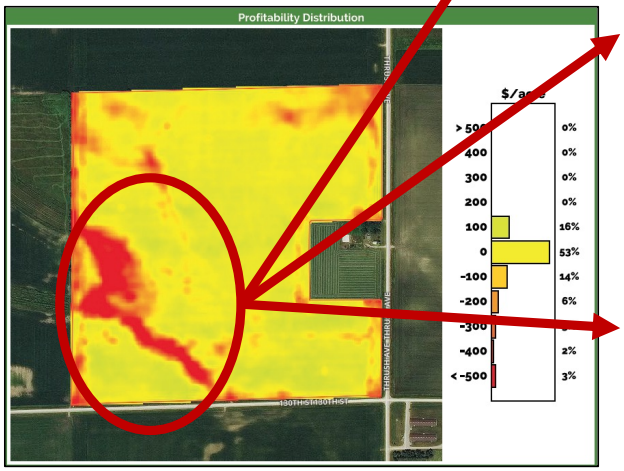




- Between 2-3 million acres annually at an expected loss
- Over $1B annually in misallocated working capital

Data and Analysis to Date

Parameter	Total
number of fields	3,796
total acres	207,937
total acre-years analyzed	641,998
average years of data per field	3.1
average acres per field	54.8
total profit	$ 5,703,472
per field total profit (all years)	$ 1,502
average per acre profit (all years)	$ 27.43
average max annual per acre profit	$ 128.23
average min annual per acre profit	$ (147.78)
total revenue	$ 405,192,182
total expenses	$ 399,488,710
total annualized ROI	0.46%



90.4% of fields in the project had multi-year zones with economic losses

51.8% of the acres analyzed are in a multi-year zone with negative ROI

53.2% of the negative return zones have potential resource concerns

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Data and Analysis to Date

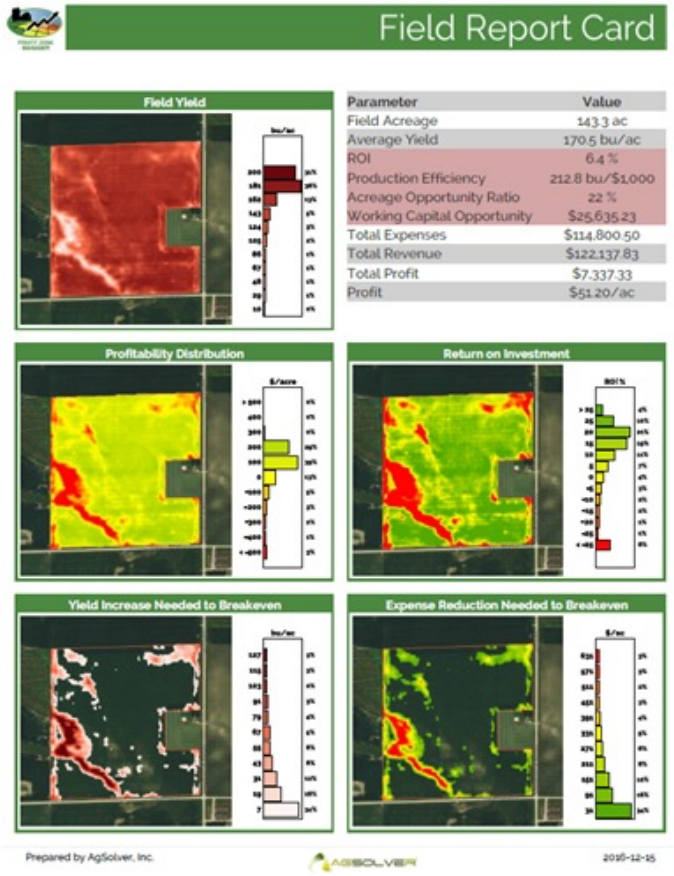
ROI Zone	Total Erosion (tons/ac/yr)	SOC Change (lbs/ac/yr)	SCI	NO_3 Leaching (lbs N/ac/yr)	GHG Flux (tons CO_2e/ac/yr)
< -15%	9.6	-158.8	-0.69	46.1	0.50
-5% to -15%	8.2	-115.2	-0.57	42.1	0.44
5% to -5%	5.9	-109.6	-0.41	43.3	0.42
15% to 5%	4.2	-85.0	-0.39	40.2	0.42
> 15%	5.4	-35.8	-0.33	34.9	0.34

- Erosion > 5 tons/ac/yr
- SOC or SCI < 0
- Diesel use > 18 gal/ac
- NO3 leaching > 50 lbs N/ac/yr
- GHG Flux > 3.0 tons CO2e/ac/yr

ROI Zone	Erosion RC Zones	Soil Quality RC Zones	Energy Use RC Zones	Water Quality RC Zones	Air Quality RC Zones	Total Resource Concerns
< -15%	1,461	1,758	586	1,394	260	5,459
-5% to -15%	1,286	1,601	640	1,262	166	4,955
5% to -5%	978	1,300	670	1,050	144	4,142
15% to 5%	684	915	575	661	47	2,882
> 15%	470	654	471	487	50	2,132

Four Economic Opportunities to Deploy Conservation

- Improve annual cash flow
- Reframe and improve land asset value
- Create alternative and diversified revenue sources
- Deliver commodity market access



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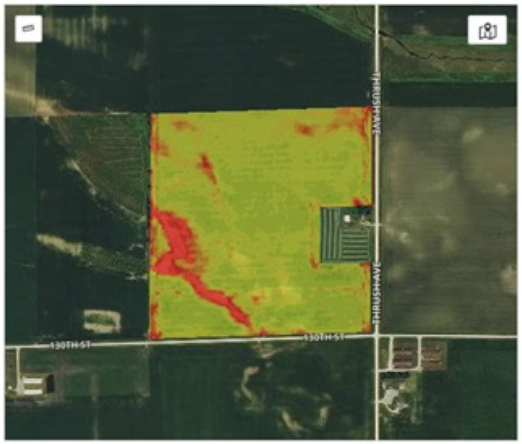
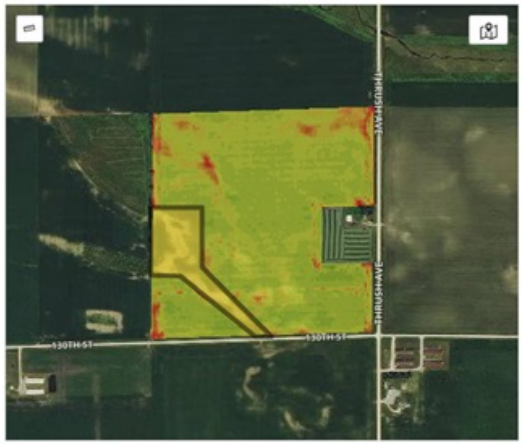
Conservation as a Tool to Improve Annual Cash Flow

- Identify the acres where financial return is not feasible
- Deliver management scenarios to inform potential outcomes
- Deploy practices and re-invest saved worked capital on row crop acres
  - 15 acre pollinator zone in this case



Scenario: Actual Production

Parameter	Value
Field Acreage	143.3 ac
Average Yield	170.2 bu/ac
Profit	$49.63/acre
ROI	6.2 %
Production Efficiency	212.4 bu/$1000
Acreage Opportunity Ratio	23 %
Working Capital Opportunity	$25,973.83
Total Field Expenses	$114,800.50
Total Field Revenue	$121,912.06
Total Field Profit	$7,111.56



Scenario: Conservation-Final

Parameter	Value
Field Acreage	143.3 ac
Average Yield	179.2 bu/ac
Profit	$93.85/acre
ROI	12.6 %
Production Efficiency	239.7 bu/$1000
Acreage Opportunity Ratio	22 %
Working Capital Opportunity	$19,494.23
Total Field Expenses	$107,085.95
Total Field Revenue	$120,534.99
Total Field Profit	$13,449.04

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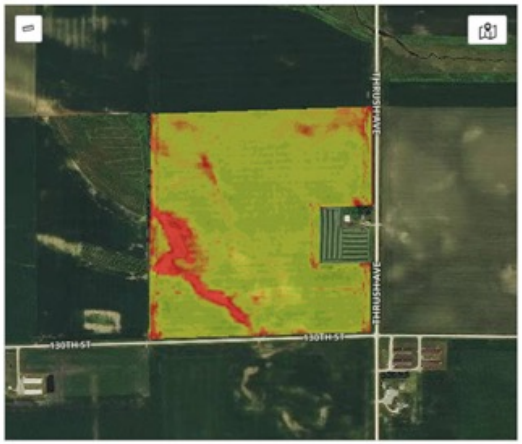
Conservation as a Tool to Improve Asset Value

- CSR2 whole field: 76.93
- CSR2 low ROI area: 46.41
- New managed CSR2: 80.26
- Net impact at $110/CSR2 point: $366/ac
- Net impact of $45/ac profit at 3.5% cap rate: $1286/ac
- Commonly find 3%+ additional return…



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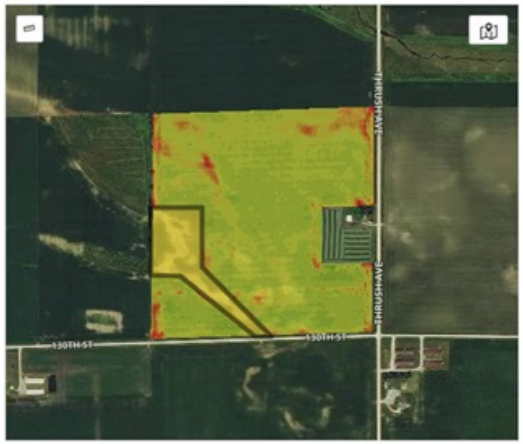

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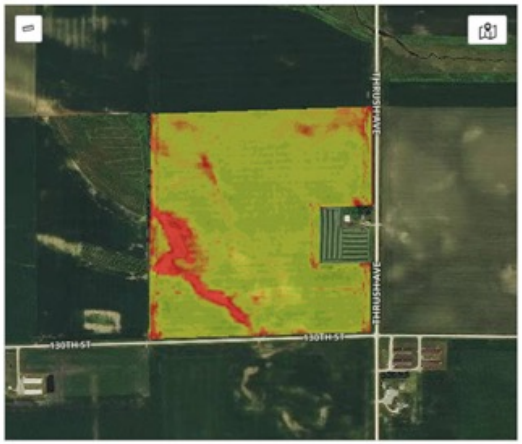
New Revenue and Market Access

- New Revenue Opportunities
  - Federal, state and local programs – near term
  - Forage – near term
  - Energy – longer term

- Market Access
  - Consumer driven focus on environmental performance of food products
  - Ag retail has a unique opportunity to deliver the data
  - Longer term outcome



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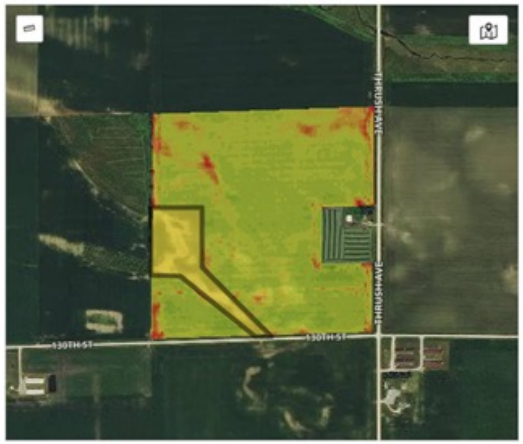

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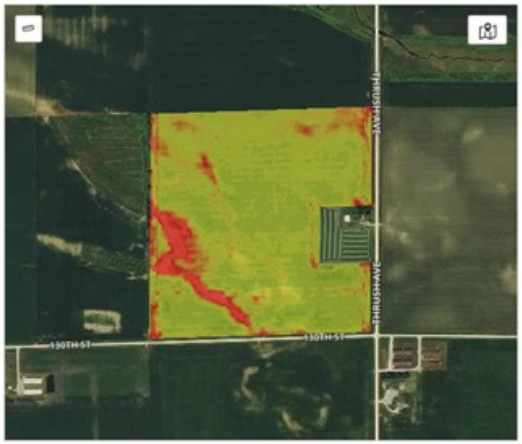
How do we make it happen?

- Focus on a “make more money conversation” with the farmer
- Precision data resources are widely available
- Alternative, publicly available data resources can streamline and supplement precision data



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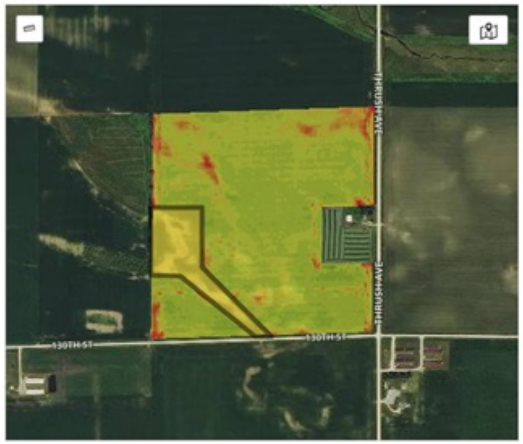

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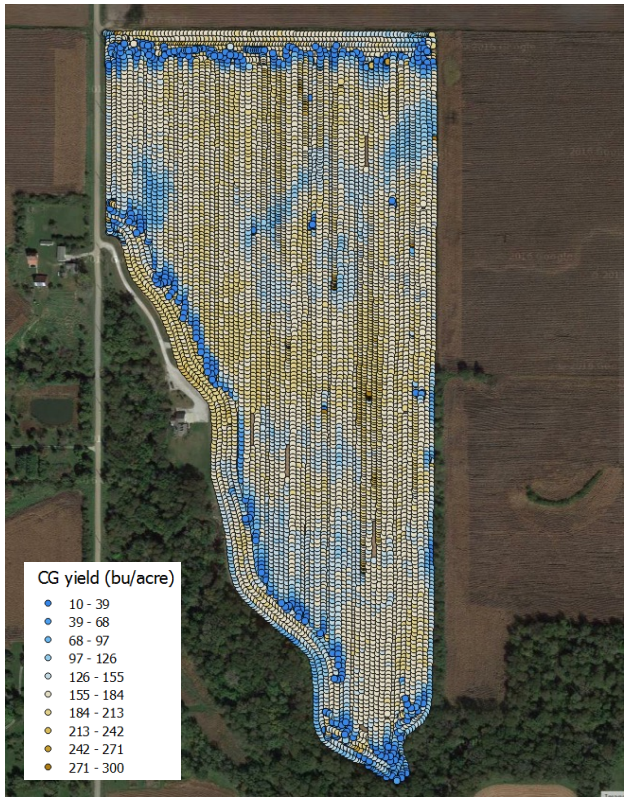
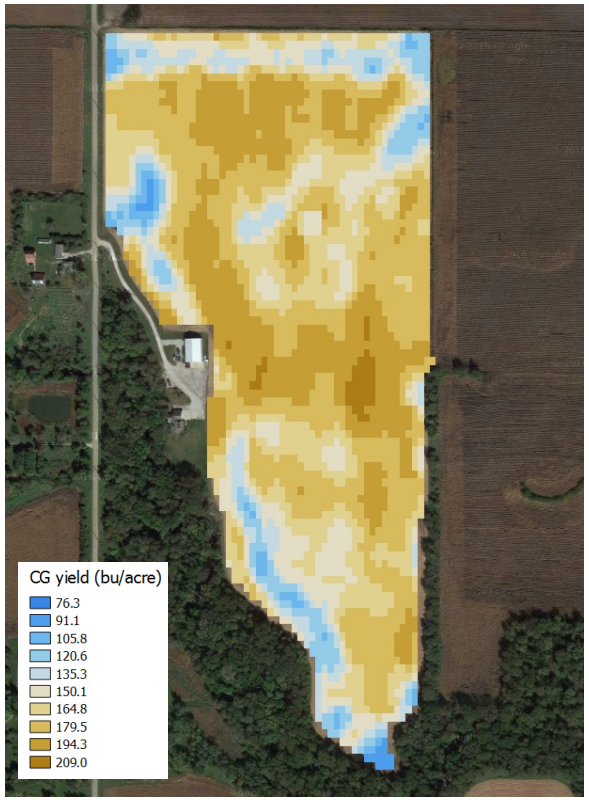
Making it Real in the Field

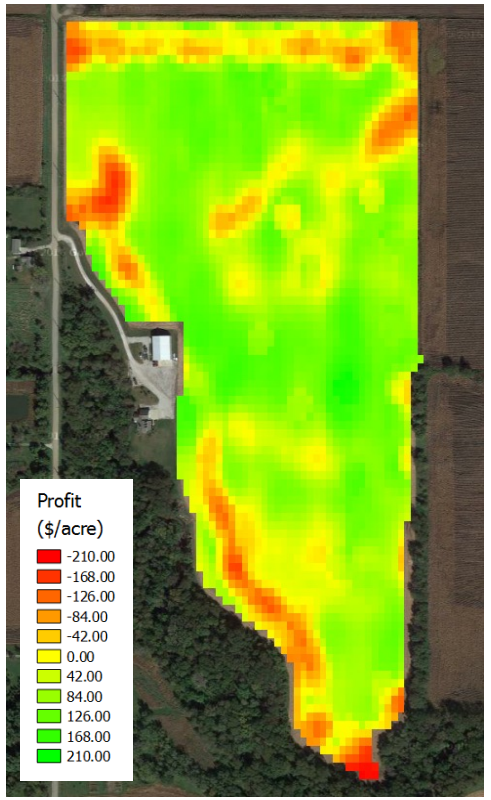
Raw yield monitor data



9m^2 gridded yield data



Subfield Profit



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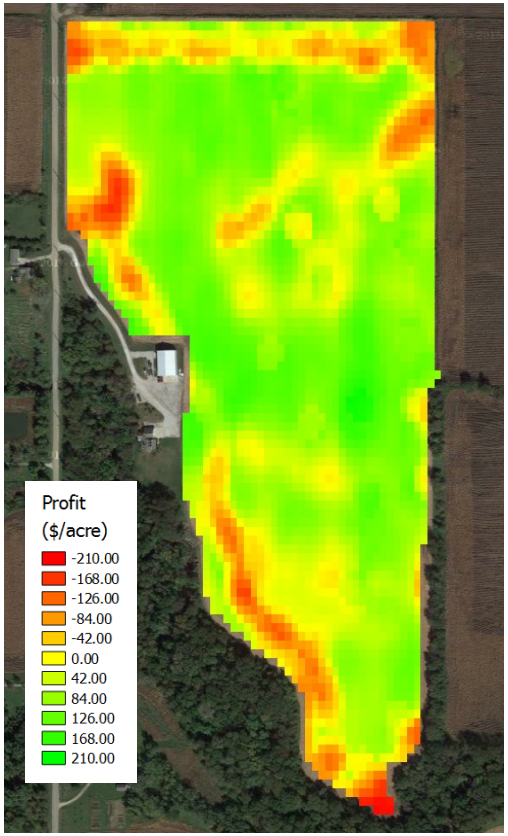
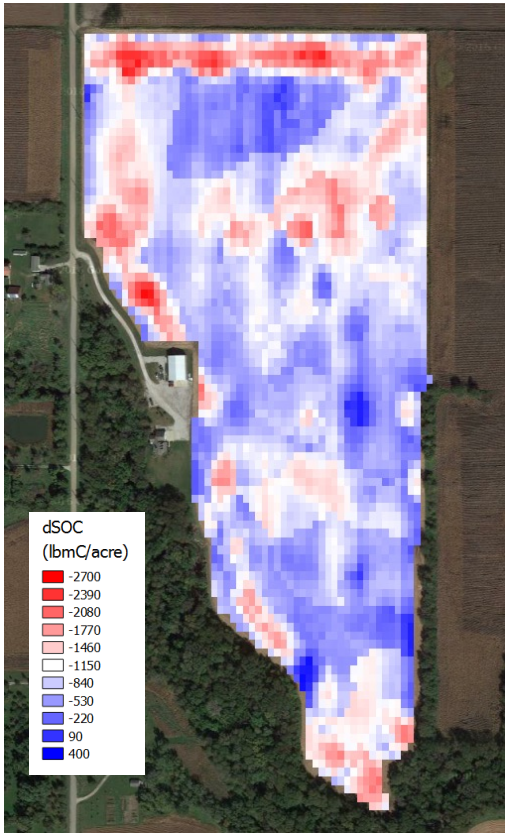
Making it Real in the Field

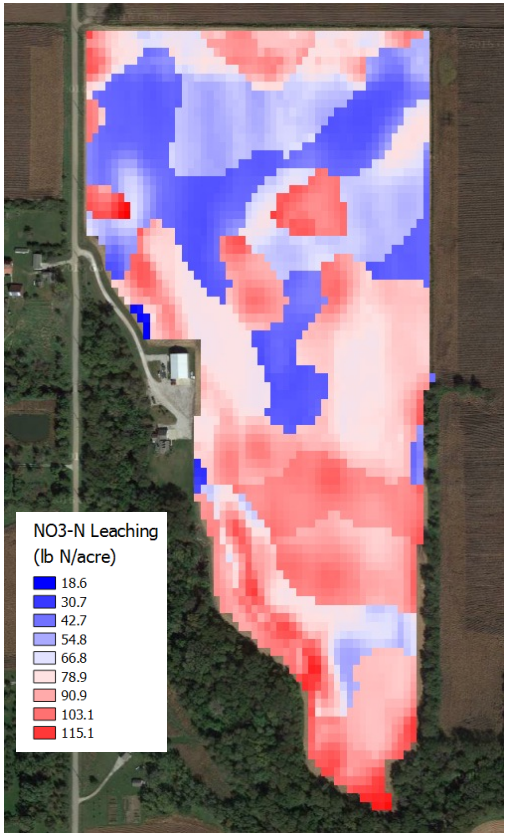
Subfield Profit



SOC change



NO_3 leaching (lb N/acre)



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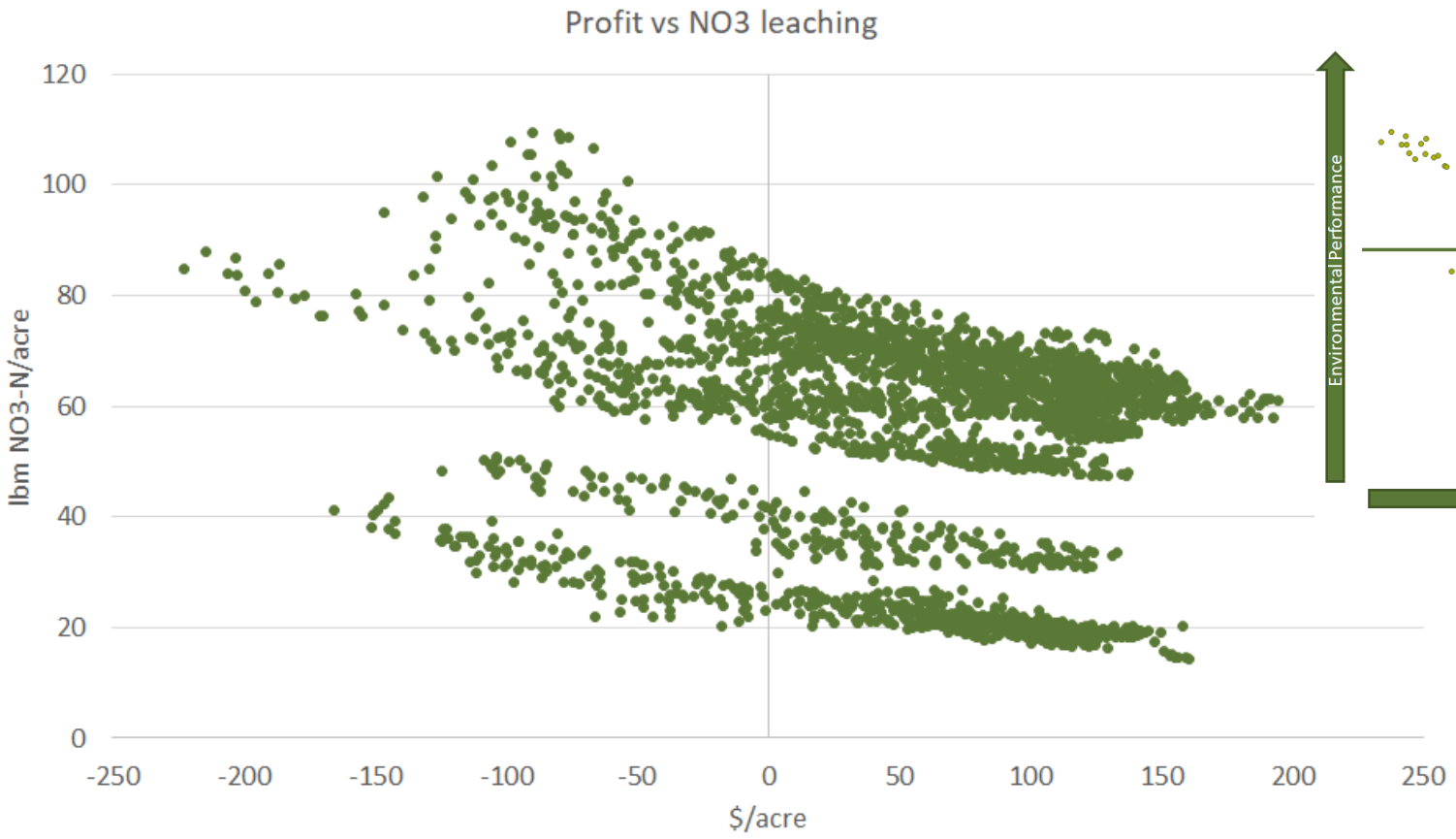

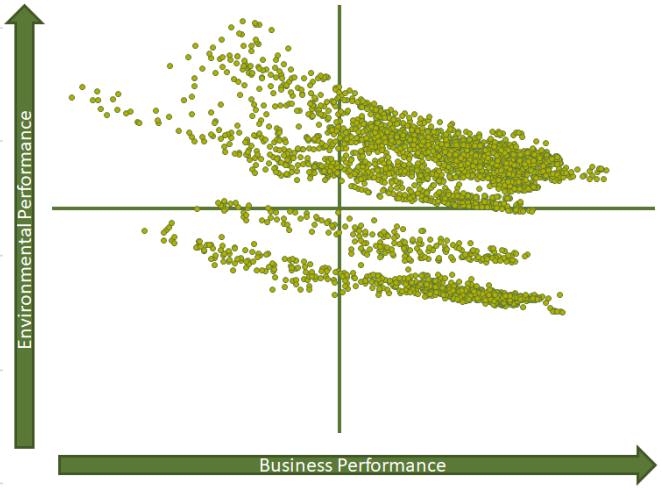

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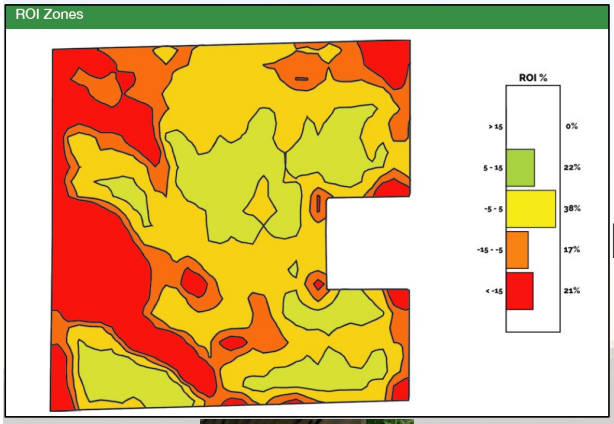
Precision Conservation Business Planning

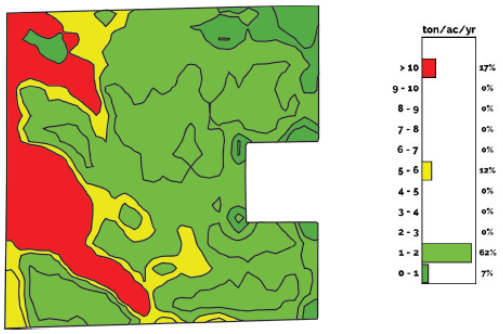


Grower: NRCS Pilot
Farm: NC Iowa
Field: Webster
Years: 2008-2010

Precision Conservation Business Plan: Erosion Resource Concerns

Prepared by: AgSolver
Date: 11/21/2016

Erosion Assessment for ROI Zones

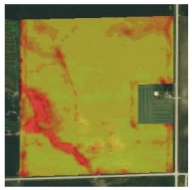


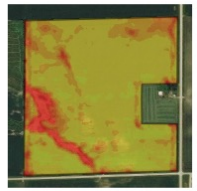
ROI	Soils	Ac	%
<-15%	173	8.67	6.0%
	84	7.58	5.2%
	41B	6.82	4.7%
-15% – -5%	84	9.68	6.7%
	173	6.86	4.7%
	407B	3.52	2.4%
	198B	3.48	2.4%
-5% – 5%	198B	13.65	9.4%
	83B	11.89	8.2%
	84	11.10	7.7%
5% – 15%	198B	10.62	7.3%
	84	9.05	6.2%
	83B	6.54	4.5%
>15%	–	–	–

ROI	Water Erosion		Wind Erosion		Total Erosion	
	High	Low	High	Low	High	Low
<-15%	6.9	0.3	40.1	0.0	47.0	0.3
-15% – -5%	4.0	0.5	2.0	0.0	6.0	0.5
-5% – 5%	1.0	1.0	0.1	0.0	1.1	1.0
5% – 15%	1.0	1.0	0.0	0.0	1.0	1.0
>15%	–	–	–	–	–	–

PLANNING SCENARIOS

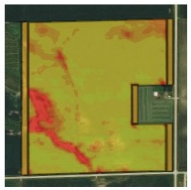
ACTUAL CONVENTIONAL

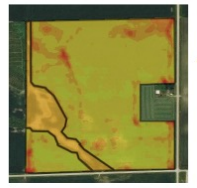




COVER CROP

HEADLANDS
Acres Converted: 12.2





LOW ROI POLLINATOR
Acres Converted: 16.3

Profitability Impact (per acre)

Yield Adjustment %	-5%	-2%	0	2%	5%
Conventional Till	($32.92)	($13.17)	$0.00	$13.17	$32.92
Low Till	($29.82)	($10.07)	$3.10	$16.27	$36.02
Strip Till	($20.32)	($0.57)	$12.60	$25.77	$45.52
No Till	($16.22)	$3.53	$16.70	$29.87	$49.62

Profitability Impact (per acre)

Yield Adjustment %	-5%	-2%	0	2%	5%
Conventional	($32.92)	($13.17)	$0.00	$13.17	$32.92
Cover Crop	($46.43)	($26.68)	($13.51)	($0.34)	$19.42
Headlands Pollinator	($23.14)	($4.83)	$7.39	$19.60	$37.91
Low ROI Pollinator	$0.51	$18.98	$31.29	$43.61	$62.08

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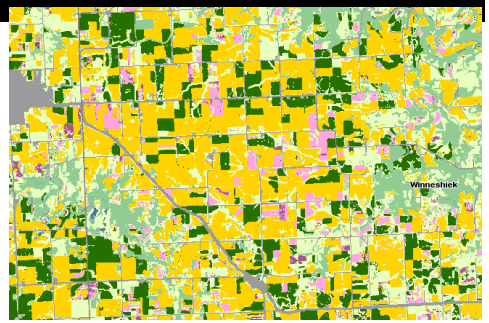
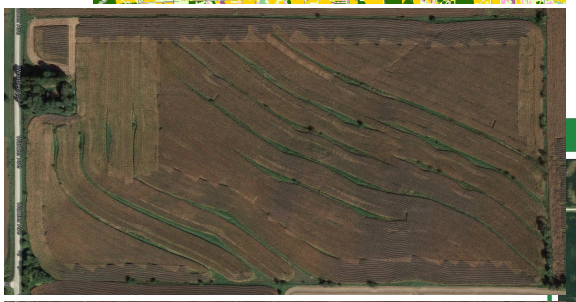
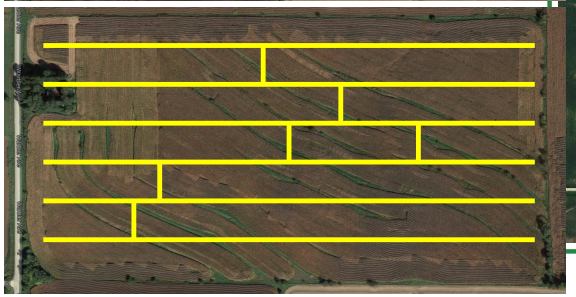
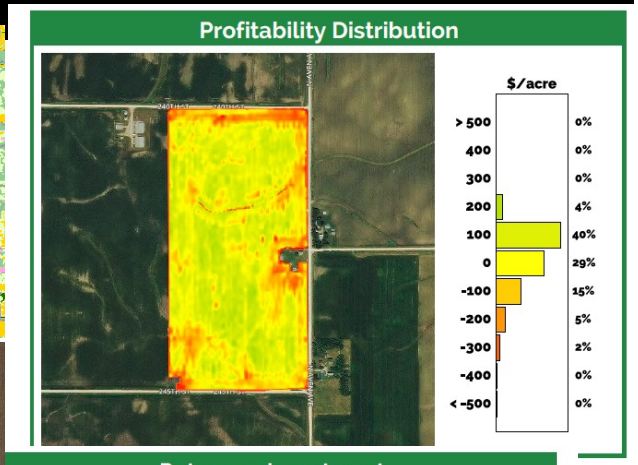
Scenarios in Focus

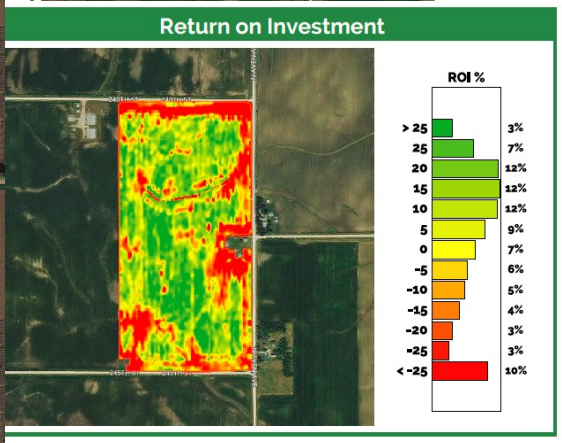
- Existing conservation acres
- Turning headlands – field edges
- Cover crop harvest
- Precision prairie strips
- Non-profitable zones











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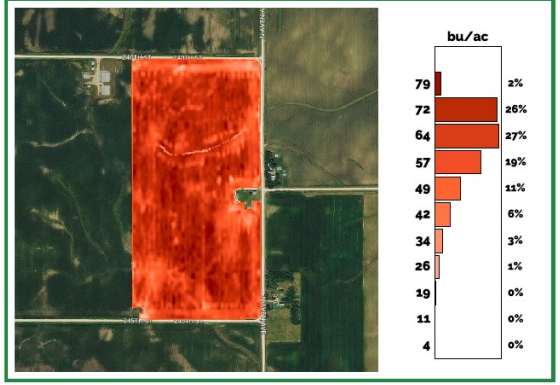
AK Hardin County Farm

PROFIT ZONE MANAGER

Field Report Card

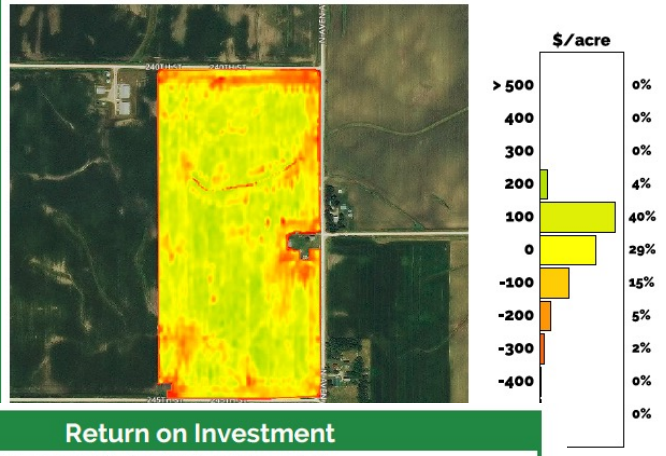
A K : Farm : North 80 : Actual Production : Soybean : 2015

Field Yield

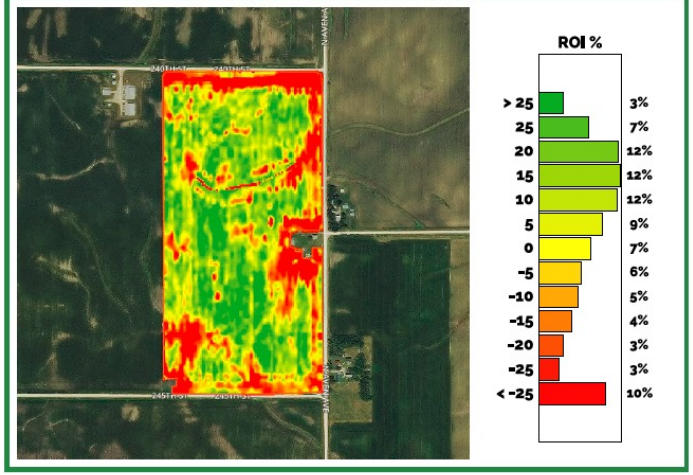


Parameter	Value
Field Acreage	75.3 ac
Average Yield	59.3 bu/ac
ROI	1.4 %
Production Efficiency	108.2 bu/$1,000
Acreage Opportunity Ratio	38 %
Working Capital Opportunity	$15,511.76
Total Expenses	$41,233.17
Total Revenue	$41,801.22
Total Profit	$568.06
Profit	$7.55/ac

Profitability Distribution



Return on Investment



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AK Hardin County Farm – Low ROI Zone Energy Crop Scenario

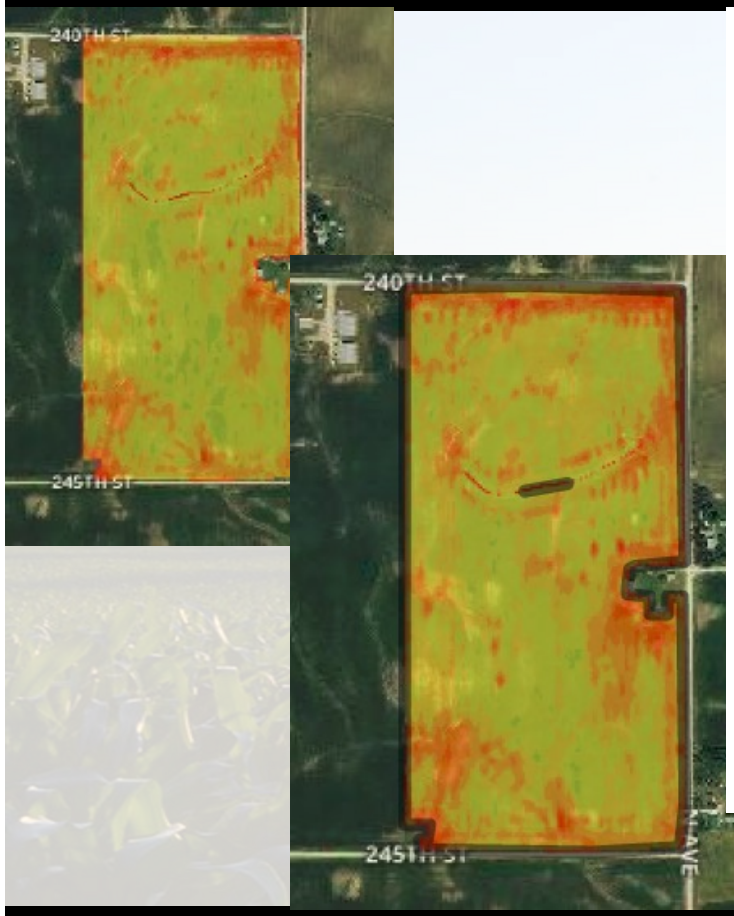
Scenario: Actual Production - 2015

Parameter	Value
Acreage	75.3 ac
Average Yield	59.3 bu/ac
Profit	$7.55 /ac
ROI	1.4 %
Production Efficiency	108.2 bu/$1000
Acreage Opportunity Ratio	38 %
Working Capital Opportunity	$15,511.75
Breakeven Commodity Price	$9.24
Total Field Expenses	$41,233.17
Total Field Revenue	$41,801.22
Total Field Profit	$568.05

Scenario: Energy Crops - 2015

Parameter	Value
Acreage	75.3 ac
Average Yield	63.0 bu/ac
Profit	$44.37 /ac
ROI	8.9 %
Production Efficiency	126.1 bu/$1000
Acreage Opportunity Ratio	20 %
Working Capital Opportunity	$8,218.56
Breakeven Commodity Price	$6.86
Total Field Expenses	$37,631.05
Total Field Revenue	$40,970.83
Total Field Profit	$3,339.78

AK Hardin County Farm – Cover Crop Scenario, No Harvest



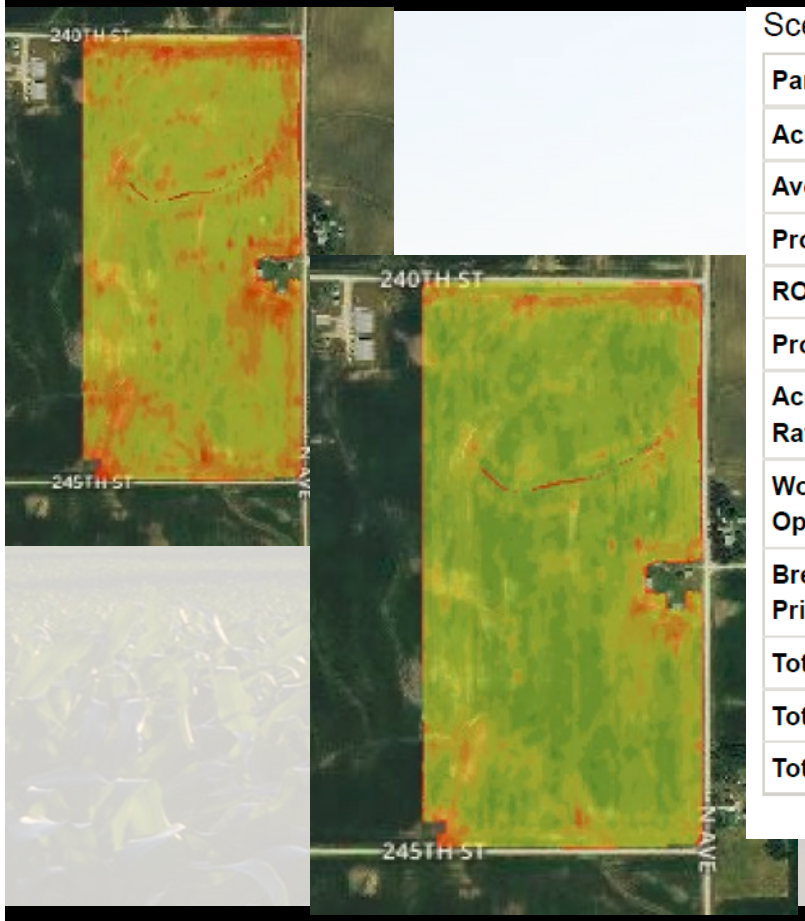
Scenario: Actual Production - 2015

Parameter	Value
Acreage	75.3 ac
Average Yield	59.3 bu/ac
Profit	$7.55 /ac
ROI	1.4 %
Production Efficiency	108.2 bu/$1000
Acreage Opportunity Ratio	38 %
Working Capital Opportunity	$15,511.75
Breakeven Commodity Price	$9.24
Total Field Expenses	$41,233.17
Total Field Revenue	$41,801.22
Total Field Profit	$568.05

Scenario: Cover Crop - 2015

Parameter	Value
Acreage	75.3 ac
Average Yield	59.3 bu/ac
Profit	-$26.96 /ac
ROI	-4.6 %
Production Efficiency	101.8 bu/$1000
Acreage Opportunity Ratio	50 %
Working Capital Opportunity	$21,833.11
Breakeven Commodity Price	$9.82
Total Field Expenses	$43,830.78
Total Field Revenue	$41,801.22
Total Field Profit	-$2,029.56

AK Hardin County Farm – Cover Crop Scenario, With Harvest



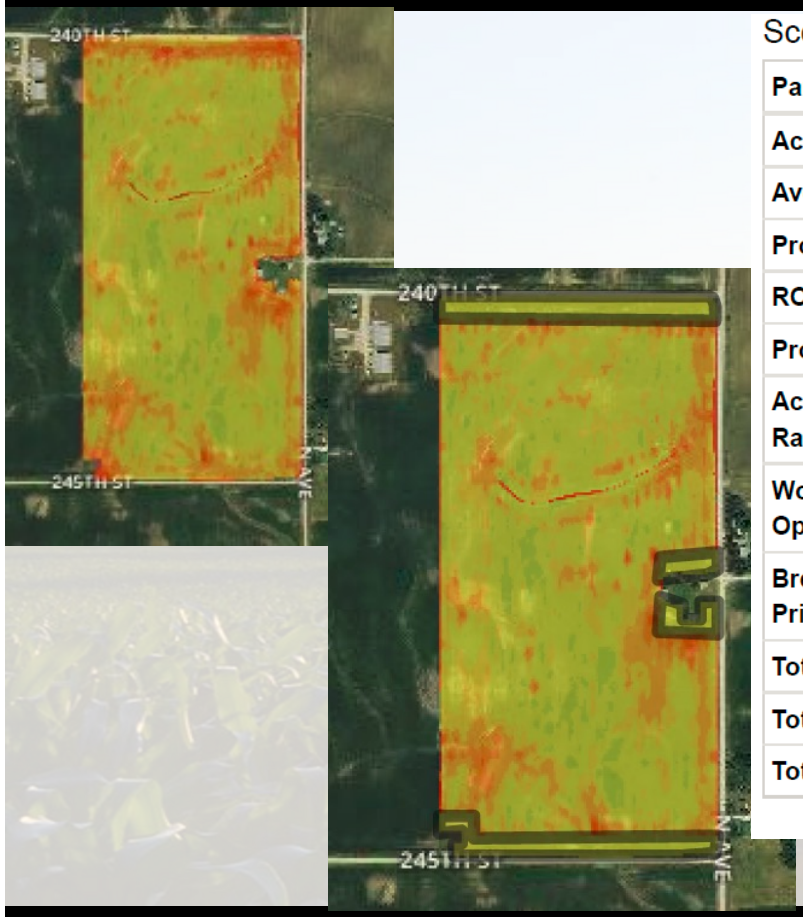
Scenario: Actual Production - 2015

Parameter	Value
Acreage	75.3 ac
Average Yield	59.3 bu/ac
Profit	$7.55 /ac
ROI	1.4 %
Production Efficiency	108.2 bu/$1000
Acreage Opportunity Ratio	38 %
Working Capital Opportunity	$15,511.75
Breakeven Commodity Price	$9.24
Total Field Expenses	$41,233.17
Total Field Revenue	$41,801.22
Total Field Profit	$568.05

Scenario: Cover Crop Energy Harvest - 2015

Parameter	Value
Acreage	75.3 ac
Average Yield	59.3 bu/ac
Profit	$157.55 /ac
ROI	28.8 %
Production Efficiency	108.2 bu/$1000
Acreage Opportunity Ratio	9 %
Working Capital Opportunity	$3,878.71
Breakeven Commodity Price	$6.71
Total Field Expenses	$41,233.17
Total Field Revenue	$53,092.21
Total Field Profit	$11,859.04

AK Hardin County Farm – Energy Crop Headlands



Scenario: Actual Production - 2015

Parameter	Value
Acreage	75.3 ac
Average Yield	59.3 bu/ac
Profit	$7.55 /ac
ROI	1.4 %
Production Efficiency	108.2 bu/$1000
Acreage Opportunity Ratio	38 %
Working Capital Opportunity	$15,511.75
Breakeven Commodity Price	$9.24
Total Field Expenses	$41,233.17
Total Field Revenue	$41,801.22
Total Field Profit	$568.05

Scenario: Headlands with Energy Crop - 2015

Parameter	Value
Acreage	75.3 ac
Average Yield	61.2 bu/ac
Profit	$28.04 /ac
ROI	5.4 %
Production Efficiency	117.1 bu/$1000
Acreage Opportunity Ratio	28 %
Working Capital Opportunity	$11,721.18
Breakeven Commodity Price	$7.96
Total Field Expenses	$39,329.90
Total Field Revenue	$41,440.19
Total Field Profit	$2,110.29

AK Hardin County Farm – Precision Prairie Strips

Scenario: Actual Production - 2015

Parameter	Value
Acreage	75.3 ac
Average Yield	59.3 bu/ac
Profit	$7.55 /ac
ROI	1.4 %
Production Efficiency	108.2 bu/$1000
Acreage Opportunity Ratio	38 %
Working Capital Opportunity	$15,511.75
Breakeven Commodity Price	$9.24
Total Field Expenses	$41,233.17
Total Field Revenue	$41,801.22
Total Field Profit	$568.05

Scenario: Precision Prairie Strips - 2015

Parameter	Value
Acreage	75.3 ac
Average Yield	58.8 bu/ac
Profit	$2.15 /ac
ROI	0.4 %
Production Efficiency	119.3 bu/$1000
Acreage Opportunity Ratio	30 %
Working Capital Opportunity	$12,469.25
Breakeven Commodity Price	$7.24
Total Field Expenses	$37,064.15
Total Field Revenue	$37,225.74
Total Field Profit	$161.59

Analysis Outcomes – Multi Dimensional Supply Curve

- What are the practical opportunities
- What does is cost to make them interesting
- What can we do with conservation programs
- What is the biomass volume opportunity
- What is the environmental impact of the systems