Environmental vs. Economic Performance: are they really competing?

David Muth, PhD
AgSolver, Inc

November 1st 2016
The Cash Flow Problem

- Cash flow as the basis for identifying long term asset value
- Based on 5 year average commodity price - $5.33/bu corn
The Cash Flow Problem

• Same farm cash flow at $3.25/bu corn:

- $212.45 / acre
The majority of our 15+ million acres of leased row crop ground will be operated at a net loss in 2016
The Environmental Pressures Problem

Estimated Cost > $4B
Emerging Ag Information Services

turning data into decisions for agriculture™
Precision Business Planning
Profit Zone Concept

- Certification
- Agronomic
- Risk Management
- Operational
- Financial
- Real Estate
- Marketing
- Conservation
- Compliance
Subfield Variability
Understanding Subfield Profit and ROI
Environmental Performance and Economic Performance are driven by the same goal:

Maximize the output per unit of input
Precision Business Planning Workflow

Intelligence Gathering

Business Performance Review

Opportunity Ratio Analysis

Negative Return Assessment

Opportunity Ratio Business Planning

In-season Plan Adjustments

turning data into decisions for agriculture™
Precision Business Planning Workflow – Intelligence Gathering

**Intelligence Gathering**

- Business Performance Review
- Opportunity Ratio Analysis
- Negative Return Assessment
- Opportunity Ratio Business Planning
- In-season Plan Adjustments

- 10 ft resolution business performance
- Three Steps
  1. Define field boundaries
  2. Upload machine data
  3. Set crop budget – 5 min or less

turning data into decisions for agriculture™
Precision Business Planning Workflow – Business Performance Review

Intelligence Gathering

Business Performance Review

Opportunity Ratio Analysis

Negative Return Assessment

Opportunity Ratio Business Planning

In-season Plan Adjustments
Precision Business Planning Workflow – Opportunity Ratio Analysis

Intelligence Gathering

Business Performance Review

Opportunity Ratio Analysis

Negative Return Assessment

Opportunity Ratio Business Planning

In-season Plan Adjustments

turning data into decisions for agriculture™
Precision Business Planning Workflow – Negative Return Assessment

- Intelligence Gathering
- Business Performance Review
- Opportunity Ratio Analysis
- Negative Return Assessment
- Opportunity Ratio Business Planning
- In-season Plan Adjustments

Agronomic Issues

Land Improvement

Working Capital Allocation

turning data into decisions for agriculture™
Precision Business Planning Workflow – Negative Return Assessment

- Intelligence Gathering
- Business Performance Review
- Opportunity Ratio Analysis
- Negative Return Assessment
- Opportunity Ratio Business Planning
- In-season Plan Adjustments

turning data into decisions for agriculture™
## Precision Business Planning Workflow – Opportunity Ratio Business Planning

<table>
<thead>
<tr>
<th>Intelligence Gathering</th>
<th>Land Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Performance Review</td>
<td></td>
</tr>
<tr>
<td>Opportunity Ratio Analysis</td>
<td></td>
</tr>
<tr>
<td>Negative Return Assessment</td>
<td></td>
</tr>
<tr>
<td>Opportunity Ratio Business Planning</td>
<td></td>
</tr>
<tr>
<td>In-season Plan Adjustments</td>
<td>Precision Management</td>
</tr>
</tbody>
</table>

- Precision Business Planning
- Agronomic Decisions
- Land Improvement
- Alternative Low Cost Revenue

*turning data into decisions for agriculture™*
Precision Business Planning Workflow – Opportunity Ratio Business Planning

Intelligence Gathering

Business Performance Review

Opportunity Ratio Analysis

Negative Return Assessment

Opportunity Ratio Business Planning

In-season Plan Adjustments

Scenario: Actual Production

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Acreage</td>
<td>143.3 ac</td>
</tr>
<tr>
<td>Average Yield</td>
<td>170.2 bu/ac</td>
</tr>
<tr>
<td>Profit</td>
<td>$49.63/acre</td>
</tr>
<tr>
<td>ROI</td>
<td>6.2 %</td>
</tr>
<tr>
<td>Production Efficiency</td>
<td>212.4 bu/$1000</td>
</tr>
<tr>
<td>Acreage Opportunity Ratio</td>
<td>25 %</td>
</tr>
<tr>
<td>Working Capital Opportunity</td>
<td>$25,573.83</td>
</tr>
<tr>
<td>Total Field Expenses</td>
<td>$114,800.50</td>
</tr>
<tr>
<td>Total Field Revenue</td>
<td>$121,912.06</td>
</tr>
<tr>
<td>Total Field Profit</td>
<td>$7,111.56</td>
</tr>
</tbody>
</table>

Scenario: Conservation-Final

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Acreage</td>
<td>143.3 ac</td>
</tr>
<tr>
<td>Average Yield</td>
<td>179.2 bu/ac</td>
</tr>
<tr>
<td>Profit</td>
<td>$93.65/acre</td>
</tr>
<tr>
<td>ROI</td>
<td>12.6 %</td>
</tr>
<tr>
<td>Production Efficiency</td>
<td>239.7 bu/$1000</td>
</tr>
<tr>
<td>Acreage Opportunity Ratio</td>
<td>22 %</td>
</tr>
<tr>
<td>Working Capital Opportunity</td>
<td>$19,494.23</td>
</tr>
<tr>
<td>Total Field Expenses</td>
<td>$107,085.96</td>
</tr>
<tr>
<td>Total Field Revenue</td>
<td>$120,534.99</td>
</tr>
<tr>
<td>Total Field Profit</td>
<td>$13,449.04</td>
</tr>
</tbody>
</table>

turning data into decisions for agriculture™
Precision Business Planning Workflow – Opportunity Ratio Business Planning

- Intelligence Gathering
- Business Performance Review
- Opportunity Ratio Analysis
- Negative Return Assessment
- Opportunity Ratio Business Planning
- In-season Plan Adjustments

Webster: Actual Production - Corn: 2010
Actual Production - Corn Break-even Yield Increase
This map shows the yield increase needed to break even on expenses at the commodity price in the associated crop budget.
Conservation Planning: Financial and Environmental Benefits

Profitability and environmental performance are linked

Nutrient Reduction Strategy Implications
- First set of improvements through improved business performance
- Fast actions to slow down regulation
- Buffered production systems
Adding Context to Environmental Performance Impacts

<table>
<thead>
<tr>
<th></th>
<th>Conventional Management</th>
<th>Advanced Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Soil Loss (tons of soil)</td>
<td>204</td>
<td>69</td>
</tr>
<tr>
<td>Annual Soil Carbon Change (lbs C)</td>
<td>8,137</td>
<td>44,341</td>
</tr>
<tr>
<td>Annual Nitrate Loss (lbs NO3)</td>
<td>7,779</td>
<td>3,442</td>
</tr>
<tr>
<td>Annual CO2 Loss (lbs CO2)</td>
<td>751,311</td>
<td>717,169</td>
</tr>
</tbody>
</table>

Soil Erosion

Soil Carbon

CO₂ Gas Flux

Scenario: Conservation-Final

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Acreage</td>
<td>143.3 ac</td>
</tr>
<tr>
<td>Average Yield</td>
<td>179.2 bu/ac</td>
</tr>
<tr>
<td>Profit</td>
<td>$93.65/acre</td>
</tr>
<tr>
<td>ROI</td>
<td>12.6 %</td>
</tr>
<tr>
<td>Production Efficiency</td>
<td>239.7 bu/1000</td>
</tr>
<tr>
<td>Acreage Opportunity Ratio</td>
<td>22 %</td>
</tr>
<tr>
<td>Working Capital Opportunity</td>
<td>$19,494.23</td>
</tr>
<tr>
<td>Total Field Expenses</td>
<td>$107,085.95</td>
</tr>
<tr>
<td>Total Field Revenue</td>
<td>$120,534.99</td>
</tr>
<tr>
<td>Total Field Profit</td>
<td>$13,449.04</td>
</tr>
</tbody>
</table>
Hi Resolution Environmental Performance

SOC change

NO$_3$ leaching

N$_2$O flux

dSOC (lbmC/acre)

-2,000
-2,390
-2,080
1,770
-1,460
-1,150
-840
-510
-220
90
400

NO$_3$-N Leaching (lb N/acre)

-18.6
-30.7
-42.7
-54.8
66.8
78.9
90.9
103.1
115.1

N$_2$O-N flux (lbmN/acre)

1.8
2.6
3.4
4.2
4.9
5.7
6.5
7.3
8.1
8.9

turning data into decisions for agriculture™
Profit vs NO₃ leaching

Profit Zone Manager ($/acre)

NO₃ leaching (lb N/acre)
Profit vs NO₃ leaching
Identifying the Opportunities

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

<table>
<thead>
<tr>
<th></th>
<th>Non Profitable Acres</th>
<th>Nitrate Leaching on Non Profitable Acres (Ibm N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calhoun</td>
<td>31,074</td>
<td>1,268,214</td>
</tr>
<tr>
<td>Sac</td>
<td>28,936</td>
<td>673,287</td>
</tr>
<tr>
<td>Buena Vista</td>
<td>22,253</td>
<td>601,591</td>
</tr>
</tbody>
</table>
Value Across the Supply Chain

- Land Managers
- Ag Retail/CCA’s
- Conservation Professionals
- Policy Administrators
- Financial Services/Investment/Farm Management

turning data into decisions for agriculture™
Active Management of Appreciation

Valuation Metrics
- Soil properties
- Fertility
- Production history
- Cash flow

Management Metrics
- Precision data
- Business performance
- Insurance programs
- Commodity marketing

Environmental Metrics
- Soil erosion
- Soil organic carbon
- CO₂ gas flux
- Nitrate losses

Profitability and environmental performance are linked.

Farm Management Platform
Questions?