Sustainability Indicators for Agriculture: A Case Study in Collaborative Measurement

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The Keystone Center

• brings together today’s public and private sector leaders to advance solutions to society’s most challenging problems

• encourages creative thinking and collaborative decision-making in agriculture, energy, environment, education, and public health

“To go fast, go alone. To go far, go together.”
Field to Market
Sustainable agriculture means meeting the needs of the present while improving the ability of future generations to meet their own needs by:

- Increasing productivity to meet future food, fuel and fiber demands
- Improving the environment
- Improving human health
- Improving the social and economic well-being of agriculture communities
Field to Market Initiatives

Fieldprint Calculator: Grower Benchmarking

Supply Chain Projects: Continuous Improvement

Indicators Report: National Trends

Defining, measuring, and promoting sustainability
Field to Market National Indicators Report

The Sustainability Story of U.S. Commodity Agriculture
Report Objectives

- **Analyze trends** over time for environmental and socioeconomic sustainability indicators
- **Establish a baseline** against which to measure future improvements
- **Create enabling conditions** for an informed, multi-stakeholder discussion of sustainability
- Advance an **outcomes-based, science-based** approach
- **Provide broad-scale context** for more local efforts
# National Indicators Report

## Crops
- Corn, cotton, potatoes, rice, soybeans, and wheat

## Environmental Indicators
- Production and Yield; Land Use; Soil Erosion; Irrigation Water Applied; Energy Use; Greenhouse Gas Emissions

## Socioeconomic Indicators
- Debt to Asset Ratio; Returns Over Variable Costs; National and State Gross Domestic Product; Non-Fatality Injury; Fatality; Labor Hours
Sample Results:
Resources per bushel, Cotton

Index of Per Pound Resource Impacts to Produce Cotton Lint
(United States, Year 2000 = 1)

<table>
<thead>
<tr>
<th>Year</th>
<th>2000 *</th>
<th>Unit - per Pound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Use</td>
<td>0.001</td>
<td>Planted Acres</td>
</tr>
<tr>
<td>Soil Erosion</td>
<td>0.020</td>
<td>Tons</td>
</tr>
<tr>
<td>Irrigation Water Applied</td>
<td>0.046</td>
<td>Acre Inches</td>
</tr>
<tr>
<td>Energy</td>
<td>9,108</td>
<td>Btu</td>
</tr>
<tr>
<td>Greenhouse Gases</td>
<td>2.3</td>
<td>Pounds CO₂e</td>
</tr>
</tbody>
</table>

* Five-year average 1996 - 2000

**Note:** Data are presented in index form, where the year 2000 = 1 and a 0.1 point change is equal to a 10% difference. Index values allow for comparison of change across multiple dimensions with differing units of measure.
A Closer Look
Cotton Results: Irrigation Water Applied

Total Irrigation Water Applied to Cotton Lint (United States 1980 to 2011)

(Million acre inches)

Acre Inches of Irrigation Water Applied per Planted Acre of Cotton Lint (United States 1980 to 2011)

(Acre inches)

Acre Inches of Irrigation Water Applied per Incremental Pound of Cotton Lint (U.S. 1980 to 2011)

(Acre inches per pound)
A Closer Look
Corn Results: Irrigation Water Applied

TOTAL
PER ACRE
PER BUSHEL
Socioeconomic Results

Rice Returns over Variable Costs

Rice Real Returns above Variable Cost per Planted Acre (United States 2000 to 2010)

(Real dollars - 2000 base year)
## Socioeconomic Results

### Agricultural Contribution to National GDP

<table>
<thead>
<tr>
<th>Country</th>
<th>2005 to 2009 Average (Billion dollars)</th>
<th>Rank</th>
<th>Share of Nation</th>
<th>Cumulative Share</th>
<th>1997 - 2009 Trend Growth Rate</th>
<th>Share of the local economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>109.01</td>
<td>1</td>
<td>100.0%</td>
<td></td>
<td>4.0%</td>
<td>0.8%</td>
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<tr>
<td>California</td>
<td>17.91</td>
<td>2</td>
<td>16.4%</td>
<td>16.4%</td>
<td>3.7%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Texas</td>
<td>6.13</td>
<td>3</td>
<td>5.6%</td>
<td>22.1%</td>
<td>1.4%</td>
<td>0.6%</td>
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<tr>
<td>Iowa</td>
<td>5.93</td>
<td>4</td>
<td>5.4%</td>
<td>27.5%</td>
<td>7.3%</td>
<td>4.6%</td>
</tr>
<tr>
<td>Minnesota</td>
<td>4.62</td>
<td>5</td>
<td>4.2%</td>
<td>31.7%</td>
<td>8.3%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Nebraska</td>
<td>4.34</td>
<td>6</td>
<td>4.0%</td>
<td>35.7%</td>
<td>6.9%</td>
<td>5.4%</td>
</tr>
<tr>
<td>Illinois</td>
<td>4.30</td>
<td>7</td>
<td>3.9%</td>
<td>39.7%</td>
<td>8.1%</td>
<td>0.7%</td>
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<tr>
<td>Florida</td>
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<td>3.7%</td>
<td>43.3%</td>
<td>-0.2%</td>
<td>0.5%</td>
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<tr>
<td>Washington</td>
<td>3.62</td>
<td>9</td>
<td>3.3%</td>
<td>46.7%</td>
<td>4.8%</td>
<td>1.2%</td>
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<tr>
<td>North Carolina</td>
<td>3.26</td>
<td>10</td>
<td>3.0%</td>
<td>49.7%</td>
<td>0.6%</td>
<td>0.8%</td>
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<tr>
<td>Wisconsin</td>
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<td>11</td>
<td>3.0%</td>
<td>52.6%</td>
<td>3.6%</td>
<td>1.4%</td>
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<tr>
<td>Kansas</td>
<td>3.17</td>
<td>12</td>
<td>2.9%</td>
<td>55.5%</td>
<td>5.5%</td>
<td>2.7%</td>
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<tr>
<td>Indiana</td>
<td>2.73</td>
<td>13</td>
<td>2.5%</td>
<td>58.0%</td>
<td>7.9%</td>
<td>1.1%</td>
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</tbody>
</table>
U.S. Producers Have a Great Story to Tell...

- Efficiency gains over time, along with increased production
- Improvements on a number of economic and social indicators

...As well as opportunities for continued improvement

- Continued challenges ahead for meeting increased demand within total limits of natural resources and social and economic needs
Lessons in Indicator Development
Identifying Indicators

• Collaboration yields broader buy-in and improves outputs
• Agree to key measures—make indicators, not lists
• Consider economic, environmental, social
• A suite of indicators provides the opportunity to look for trade-offs and synergies
• Focus on outcomes – endpoints, not means
Methodologies

- Clarify definitions and assumptions
- Be prepared to address technical questions and value questions
- Assess multiple temporal and spatial scales
- Use public data when available
- Respect the data privacy of individuals
- Balance simplicity and summary with specifics
Perspective

- Frame around information and improvement, not competition or PR
- Communicate the positive, acknowledge the negatives and note areas that lack understanding
- Recognize that some key indicators are not ripe for measurement – but are still important for management
- Connect trends to opportunities and decisions
- Have patience – strive for continuous improvement
- Don’t let the perfect be the enemy of the good
For More Information...

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