ANTARES Group Incorporated

Enabling Sustainable Landscape Design for Continual Improvement of Operating Bioenergy Supply Systems

Private sector opportunities, challenges and implementation strategies.

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Biomass Research and Development Technical Advisory Committee Meeting
August 17, 2016

Presentation Objectives

- High-level overview of project
- Importance of planned project activities
- Initial estimates/examples of potential impacts
- Implementation Strategy; Challenges and Opportunities

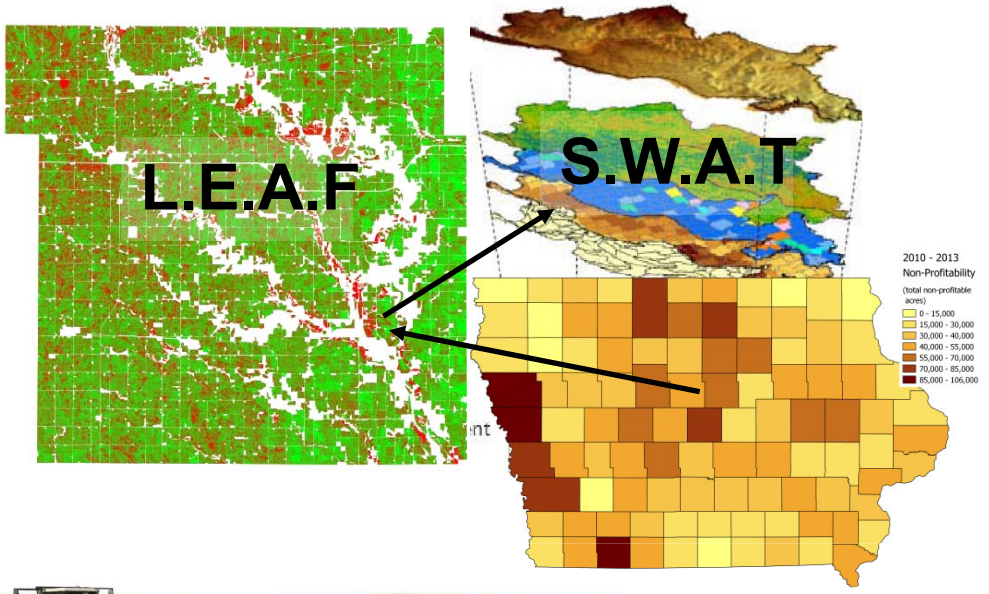
Landscape Design for Sustainable Bioenergy Systems

Project Summary:

The team will work with growers and biomass end-users to utilize subfield agronomic models to target areas within existing cellulosic ethanol feedstock supply sheds to build baseline datasets, implement conservation practices, monitor key environmental indicators, and monitor the environmental and economic impacts to the watersheds and the biomass supply chain.

Total Proposed Budget	$13,247,189
DOE Funds Requested	$9,979,990
Applicant Cost Share	$3,267,199

$9M awarded, 5 years



"Enabling Sustainable Landscape Design for Continual Improvement of Operating Bioenergy Supply Systems"

Required Areas of Focus:

1. Multi-Stakeholder Landscape Design Process
2. Assessment of Environmental Sustainability Indicators
3. Assessment of Feedstock Supply and Logistics
4. Build a template for future biorefinery projects.

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INL Idaho National Laboratory
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Southfork WATERSHED ALLIANCE INC.
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Iowa Agricultural Bio Fibers
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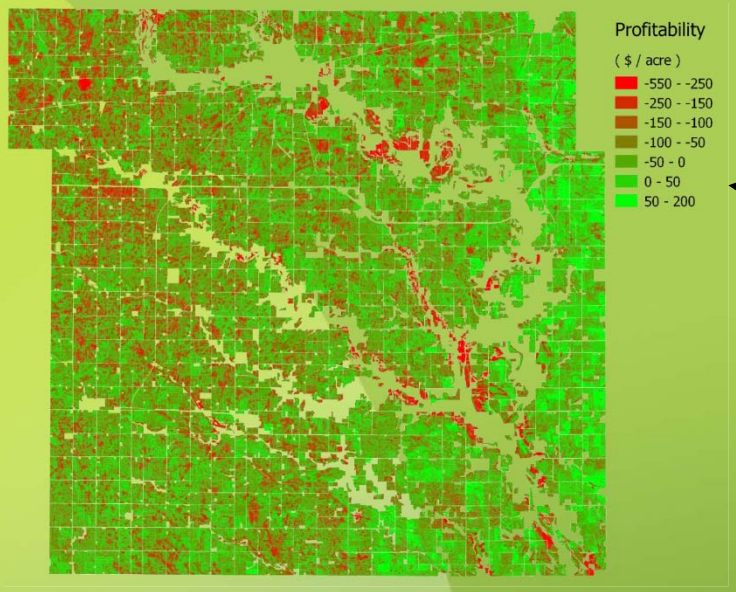
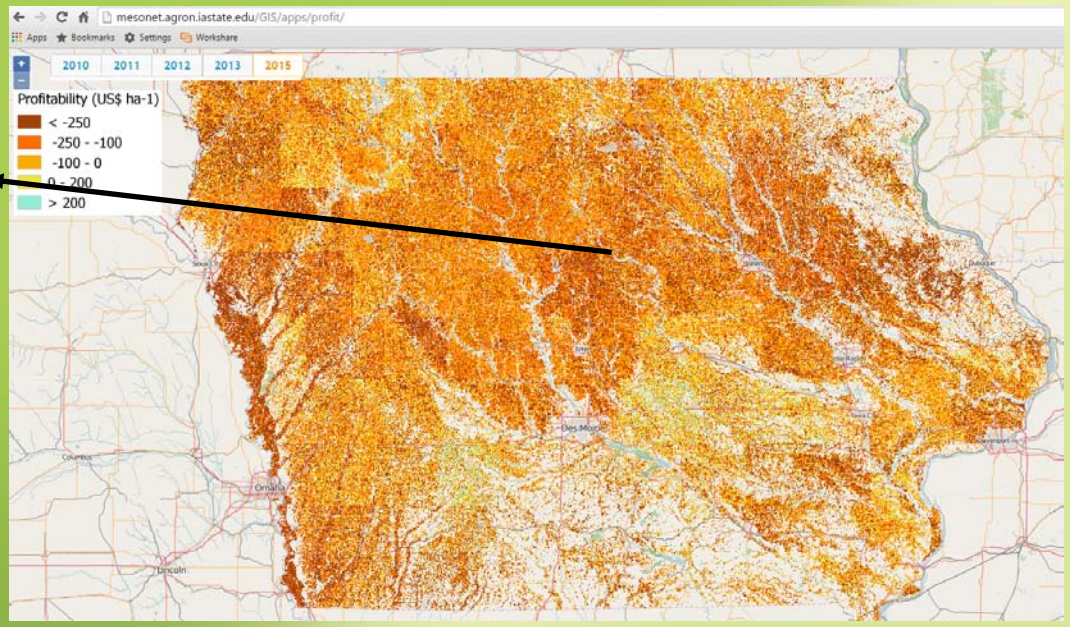
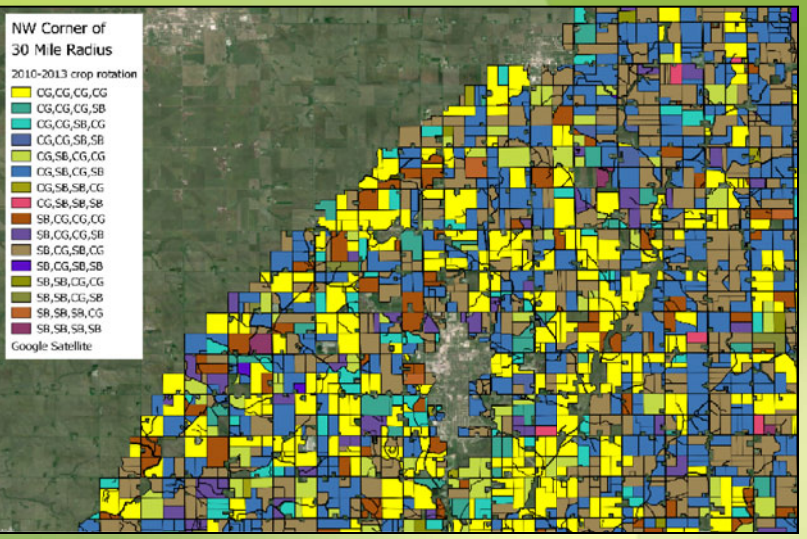
Biomass Toolbox
Biomass Market Access Standards (BMAS) Group

Identifying the Opportunities



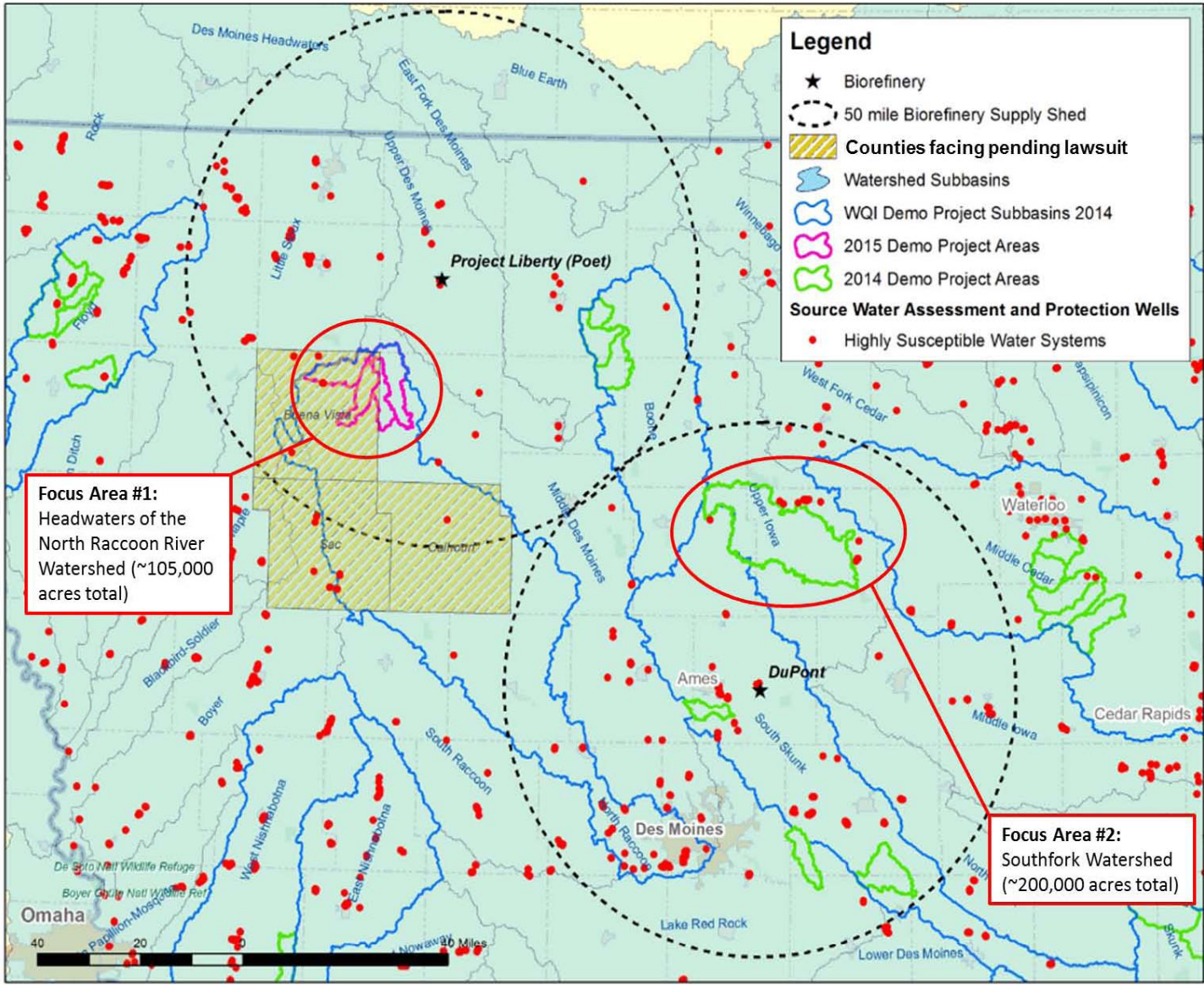




- Between 2-3 million acres annually at an expected loss
- Over $1B annually in misallocated working capital

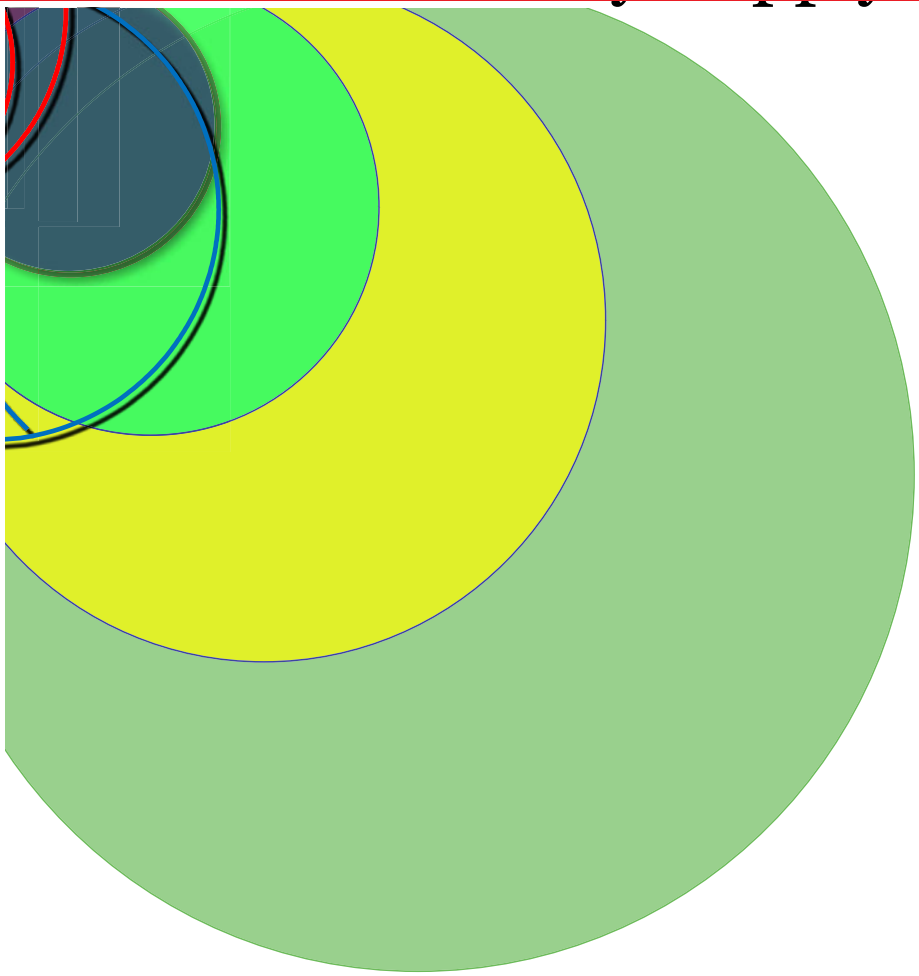
Targeted Watershed Areas

- Will also focus on fields and practices subject to wind erosion in Abengoa Bioenergy's biomass supply shed in Southwest Kansas and surrounding areas
- Iowa Nutrient Reduction Strategy Goals
  - Non-point
  - 41% less N
  - 29% less P



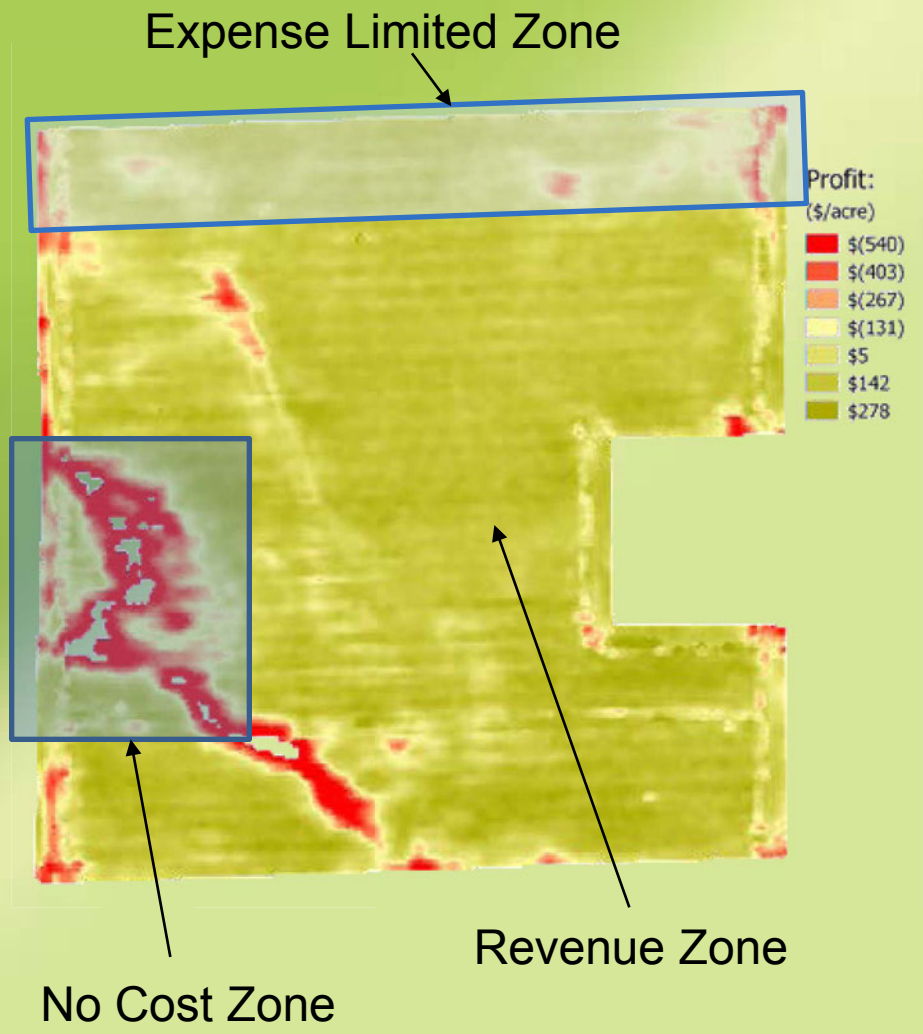
Example Impacts for a Biorefinery Supply Region in Iowa

- Current projected row-crop production acres which have production limitation, economic drain on an operation ~ could provide conservation value to the landscape
- Sustainable Outcome
  - 120% increase in corn stover supply
  - 133% of biorefinery needs from grasses that provide conservation benefits



ROI Focused Agronomic Management

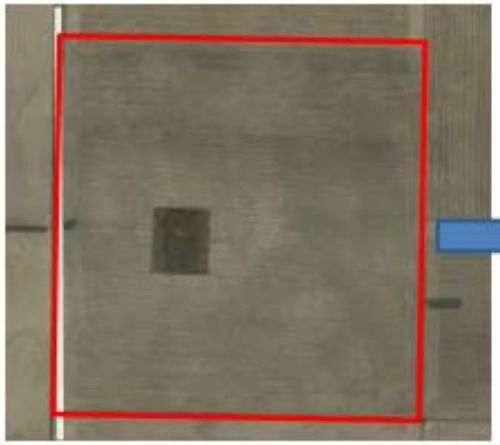
- Zonal Management to Increase Profits
- 143 acre field
- Estimated $5,000 of additional profit per year (reduced expenses only)
- Environmental benefits from changed management in vulnerable zones
- New perennial biomass supply
  - Estimated 45 to 60 tons new biomass supply
- Optimized sustainable harvest of ag. residues
  - Estimated *additional* 80 to 100 tons per year (sustainably)



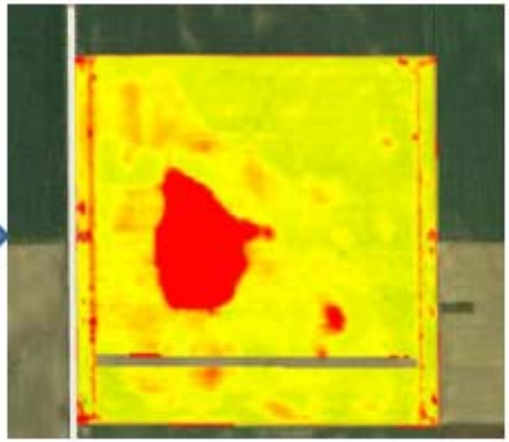
Initial Target Field Examples

AGS-002 Field Information

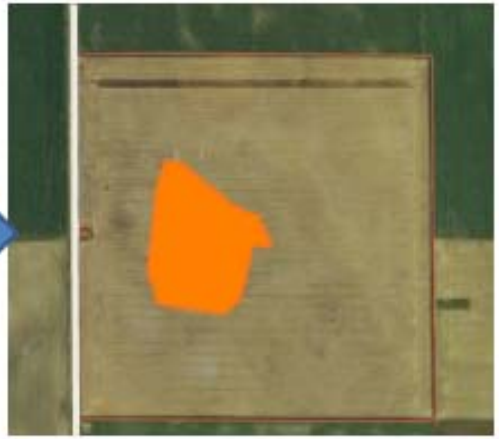
Field Boundary



Profit Zone Map



Potential Conservation Area

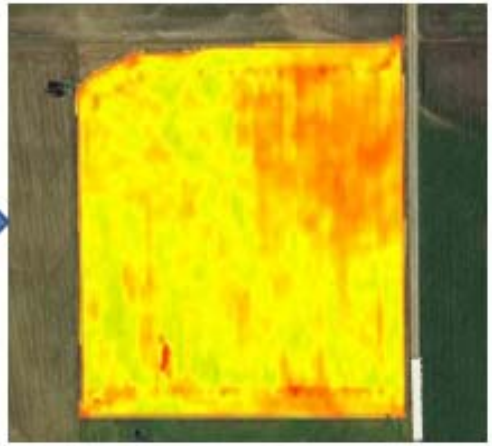


Total Field Size: 154.32 acres; Conservation Area: 15.3 acres; Conservation Practice: CSP

AGS-007 Field Information

Field Boundary

Profit Zone Map

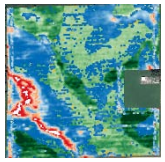


Potential Conservation Area

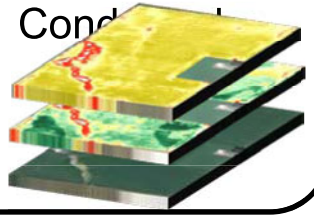
Total Field Size: 65.26 acres; Conservation Area: 16.07 acres; Conservation Practice: CRP

Field Work Process (Simplified)

Research Field Identified



Subfield **Profitability** Assessment Cond



Land Management Changes Identified

Field Research Plans Developed

* Baseline Data Collection

Land Management Changes Implemented

Cover Crop

Switchgrass Establishment

Sustainable Stover Removal

(plus others by landowner preference)

* Follow-Up Data Collection

Field Harvest Conducted

* Harvest Data Collection, Analysis, Reporting

* Sustainability Model and Data Analysis Tools are developed and coordinated with a Sustainability Reporting Platform

Feedstock Logistics

- The Straeter Header is being upgraded for variable rate harvesting







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FDC Enterprises Grasslands Services

OAK RIDGE National Laboratory

STATE

INL Idaho National Laboratory

PacificAg

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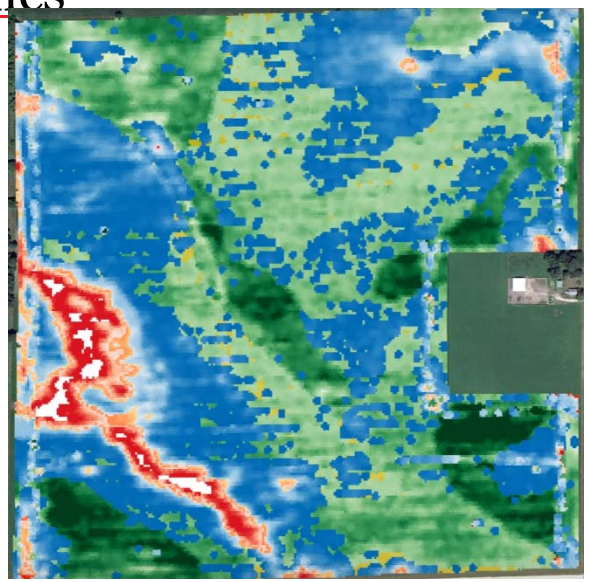
Advanced Data Analytics + Advances in Machine & Controls Technology and Feedstock Logistics = Improved: Sustainability, Biomass Supply Potential, Economics



Profit: Corn Stover with Cover Crop

($/acre)

- $(540)
- $(403)
- $(267)
- $(131)
- $5
- $142
- $278

Sustainable Removal Rake and Bale with Cover Crop

(tons/acre/year)

- 0
- 1.57
- 1.70
- 1.83
- 1.96
- 2.09
- 2.22
- 2.35
- 2.45

NO3 Leaching Rake and Bale with Cover Crop

(lbs N/acre/year)

- 35.2
- 59.9
- 84.7
- 109.4
- 134.1

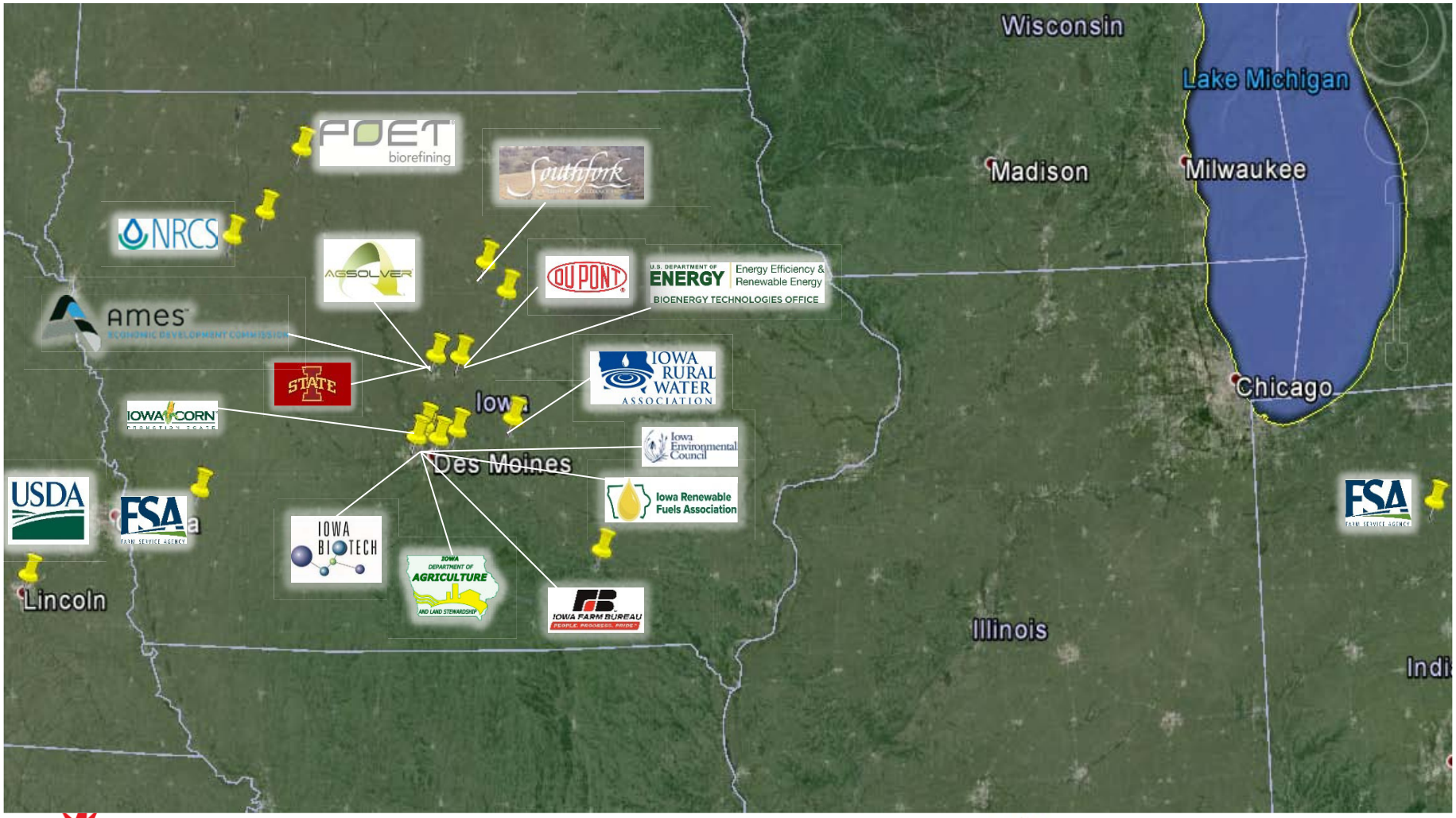
Credit: AgSolver

Seeking Combined Benefits

- We are seeking to help enable:
  - Increased conservation benefits, AND
  - Increased biomass supplies, AND
  - Increased farm profitability, AND
  - Increased rural employment opportunities, AND
  - Increased energy security through improved domestic potential to supply more energy renewably from biomass
- Changing the culture of agriculture is needed

"The definition of insanity is doing something over and over again and expecting the same result."

Multi-Stakeholder Outreach



Includes two USDA NIFA CAP teams:

cenusa bioenergy

How can USDA help?

- Project team needs access to landowner contact information for targeted outreach
  - MOU
  - Significant financial benefits offered to participating landowners
- Early notice to project team of new conservation offerings in Iowa
  - Examples: CP-38, HELI
- Additional conservation acres allotted to Iowa
  - Near-term pilot testing with best available conservation program fits

How can USDA help?

- Existing conservation programs alone aren't enough to accomplish all of these goals
- BCAP is not the *only* needed program
- We would like to develop and pilot a hybrid program
  - Biomass CRP
  - Similar pilot was instrumental in prior project
  - Allow harvest and bioenergy seed mixes
  - A "working lands" conservation program
  - Initial modelling indicates economic development benefits could dwarf total conservation spending

Projected Impacts by 2030

	Business as Usual: Projected CRP	**Business as Usual with New Harvestable Acres:** All New Acres Harvestable	**Proposed Scenario:** 10% of All New Conservation Acres are Enrolled in the Program
Total Acreage	24,000,000	32,000,000	24,000,000
CRP *Bioenergy*	*24,000,000* *0*	*24,000,000 (75%)* *8,000,000 (25%)*	*21,885,000 (91%)* *2,114,000 (9%)*
Harvest Yield (tons/year)	0	48,000,000	12,553,000
Jobs Created (Annual FTE) [3]	0	17,355	4,539
Economic Value Biomass Market Value ($80/ton) Avoided Petroleum Value ($250/ton)	 $0 $0	 $3,840,000,000 $12,000,000,000	 $1,004,000,000 $3,138,000,000
Nutrient Runoff Reduction [1] Nitrogen Phosphorus	 85% 75%	 72% 34%	 83% 69%
Net Decrease in Erosion vs. Row Crop [2]	98.6%	78.1%	95.7%

Potential Policy Strategy

- Strategic Biomass Reserve built on current conservation needs
- Construct program platform utilizing CRP program as a road map and primer
- Provide for non-penalized transition to commercial production system
- Utilize Strategic Reserve as a primer for BCAP program to build out the balance of bankable biomass supply
- Help define the value proposition of sustainable bio based products ~ “The Market Pull”

Assembling Key Pieces of the Puzzle

Advanced Harvest & Logistics, 2nd Pass

Regional Impact Modeling & Monitoring

Perennial Grass for Conservation & Biomass Supply

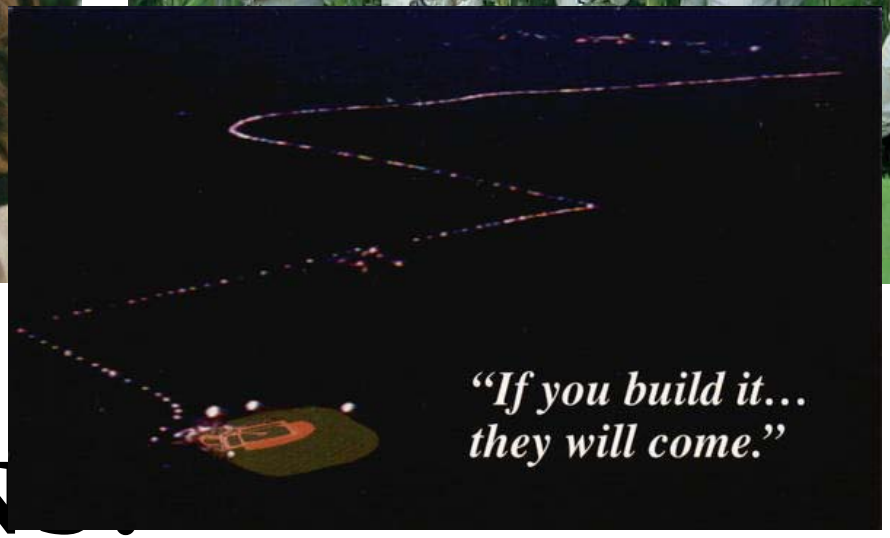
Implementation of Conservation Practices (Cover Crops, Buffer Strips, etc.)

Subfield Precision Business Planning

Advanced Harvest & Logistics, First Pass

Sustainable Residue Harvest

Multi-stakeholder Outreach



QUESTIONS?

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1. Iowa Nutrient Reduction Strategy, May 2013
2. http://onlinelibrary.wiley.com/doi/10.1111/gcbb.12352/full
3. http://www.nrel.gov/docs/fy15osti/62548.pdf