

**A Template  
for  
Supplying Biomass Feedstock**

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# Supplying Feedstock

## What is the Feedstock Value?

- Soil
- Farmer
- Feedstock Supplier
- Ag Equipment Manufacturer
- Biorefiner-Processor
- Sustainability

# Residue Value for Soil?

- **Nutrients**
  - P & K
  - Micro
  - N
- **Soil Erosion**
- **Soil Quality**
  - Soil Quality Index
  - CQESTR Model
  - Century Model
  - Daycent

# Residue Value for Farmer?

- **New Learning**
- **Adjust Agronomic Systems**
  - Crops
  - Crop Rotation
  - Tilling
- **Nutrient Replacement**
- **New Investment**
  - Equipment
- **New Business Model**

# Residue Value for Biomass Supplier?

- **More investment**
  - Equipment
  - Inventory
  - Storage
  - Transport
- **Admin & Logistics**
  - Collection
  - Delivery
  - Grain Elevator model

# Processor's Perspective Feedstock?

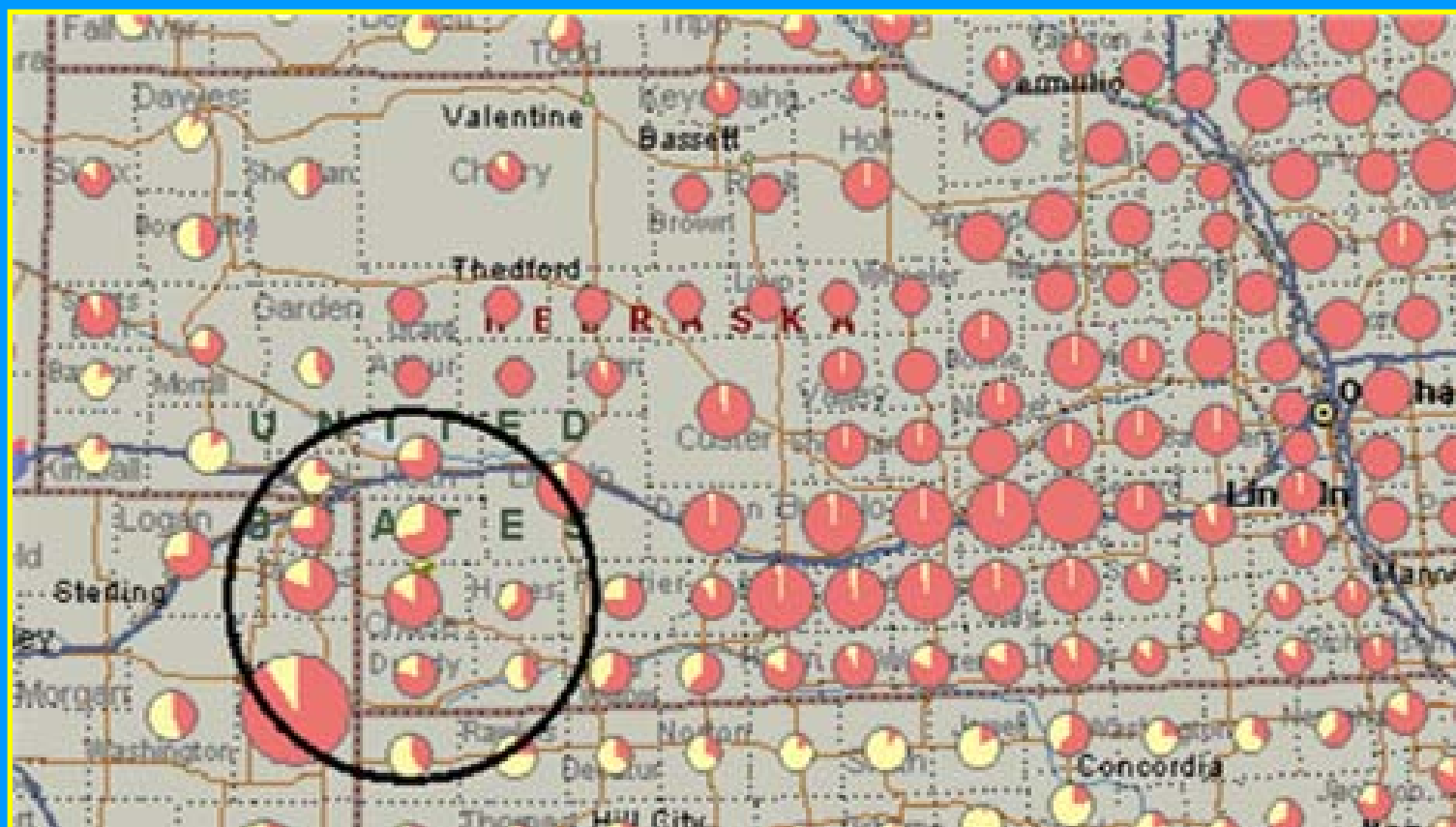
- “Many want to be 1<sup>st</sup> to be 2<sup>nd</sup>”
- **Where?**
  - Cereal Straw in Idaho, Yes
  - Stover & Straw ?
    - **Developing Answers**
    - **Defining Infrastructure**

# Project Overview

- **Imperial, NE**
- **Feedstock Supply**
- **Sustainable Practice**
- **Rail Transport**
- **Quality People**

# NE Straw & Stover

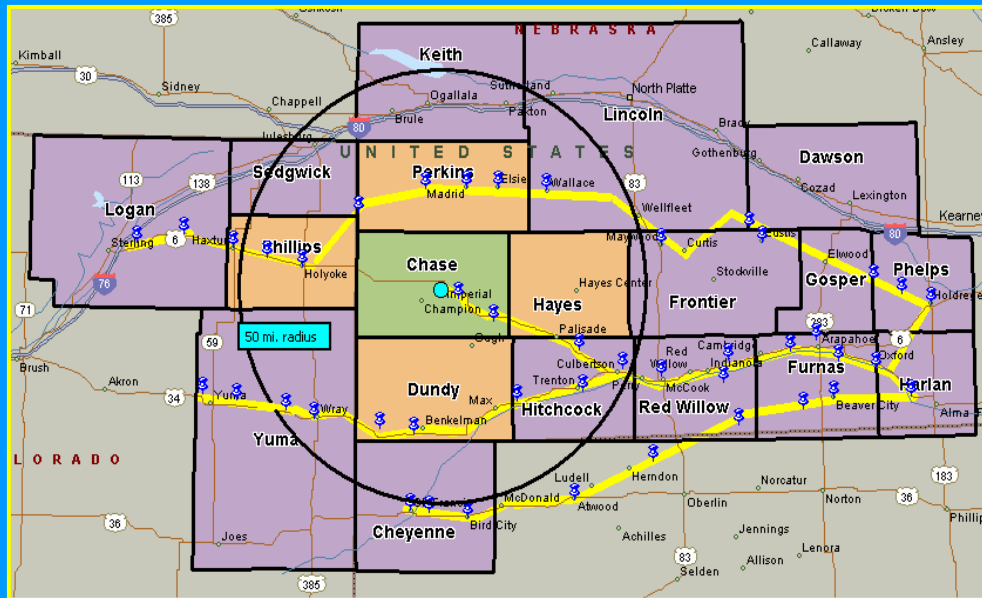
22 M Dry Tons  
6 M Dry tons in Imperial Region



Yellow, straw; Orange, stover

# Imperial, NE Regional Feedstock Supply

## Economic Collection area



## Straw & Stover Dry Tons (M)

Grow	Available
8.5	6.0

# 3 year, \$3+ million Project

## \$2 Million USDA, \$1.2 Million Private

- **A regional approach**
  - Across county and state lines
  - Partnering
- **Sustainable Agronomic systems**
- **One-pass harvest, Wet Storage**
  - Short distance: Field to storage site
  - Grain Elevator locations
  - Water and nutrient management
- **Rail transport**

*“Know the Values”*

# Project Objective

## *Add Value Across the Supply Chain*

- 1. Agronomic Systems w/ Sustainable Removal**
  - Soil Quality with Imperial Young Farmers & Ranchers, IYFR, & Innovative Soil Solutions
  - Ecological Modeling with Natural Resource Ecology Lab
- 2. Establish Farm Value** with IYFR
- 3. Develop “Innovative Methods”**
  - Prototype One Pass Harvest with OXBO
  - Validate Wet Storage with INL & NREL
  - Demonstrate Rail Transport with BNSF
  - Evaluate Stored Feedstock with Iogen, Cargill
- 4. Business Model** with IYFR
- 5. Life Cycle Analysis** with (S&T)<sup>2</sup>

# Stage-Gate Review Schedule

Task	2005				2006				2007			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<b>1. Sustainable Removal</b>	X	X		X	X			X	X			X
1.1. Soil Quality Evaluation	x	x		x	x			x	x			x
1.2. Ecology Assessment	x	x		x	x			x	x			x
<b>2. Biomass Farm Value</b>				X	X			X	X			X
<b>3. Innovative Methods</b>	X		x	X	X	x	x	X	X	x	x	X
3.1. Collection Prototype	x			x	x			x	x			x
3.2. Validate Wet Storage	x		x	x	x	x	x	x	x	x	x	x
3.3. Rail Transport					x				x		x	x
3.4. Evaluate Feedstock	X			X	X			X	X			X
<b>4. Business Model</b>					X			X	X			X
<b>5. Life Cycle Analysis</b>		X			X				X			X

# PLAN

## Sustainable Agro Systems

“Carbon is the “key” element in soil organic matter.” Don Reicosky USDA

**~1,600 acres, 12 Irrigated Pivots**

- Annual grid soil sampling
- Two regional soil types
  - Loam
  - Manganese shelf, 8.2-8.5 pH

### Regional Practices

- Corn, bean, wheat rotations
- Till, no-till
- With and without stover removal

### Adjacent Weather Station



# Plan: “Innovative Methods”

- **Prototype One pass harvest: Oxbo with IYFR**
  - '05, Converge to possible solution w/limited trials
  - '06, Build, test and evaluate multiple concepts
  - '07, Build, test and evaluate prototype; finalize design of large scale production harvester
- **Handling: Match one pass harvest needs**
- **Validate Wet Storage and Transport**
  - '05, Construct facility and store stover
  - '06-'07, Validate storage, logistics

# Plan: Business Model “Taking Decisions”

## 1. Ag System Change?

~\$100,000 Investment per farmer to  
replace conventional till equip



## 2. One-Pass Infrastructure?

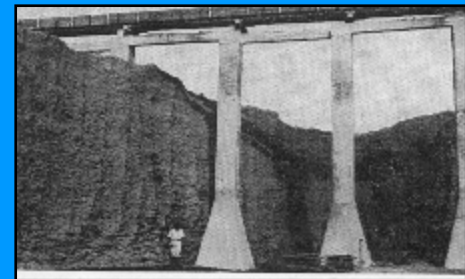
~\$30 million investment in Ag Machinery  
per Biorefinery (1MM dt)



## 3. Wet Storage & Transport?

Non-Wood Pulp Mill Practice since  
1930's

Stover validation



# Project Targets

- **Farmer's stover value**
  - Minimum \$20/ac net margin
  - Maintain, improve soil quality
  - Invest for new methods
- **Wet storage**
  - Add value to suppliers and customers
- **Biomass Supplier**
  - Improves Present Equipment Utilization
  - Invest in new collection and handling equipment
- **Biorefiner**
  - Improved feedstock value

# Value Added

## *Wet “Ritter Type” Storage*

- **Collection Risk**
  - Wet Stover collected in field
  - Field drying risk is high, off field drying adds cost
- **Dry storage problems**
  - Fires
  - Dust
  - > 10% yield loss
  - Rodents
  - 10x space
  - Insurance
- **Lowers processing cost**
  - More holocellulose
  - Improves microbial activity
  - Less ash and acetyls
  - More throughput

# Value Added

## *Rail Transport from Collection Centers*

### Lowens transport cost

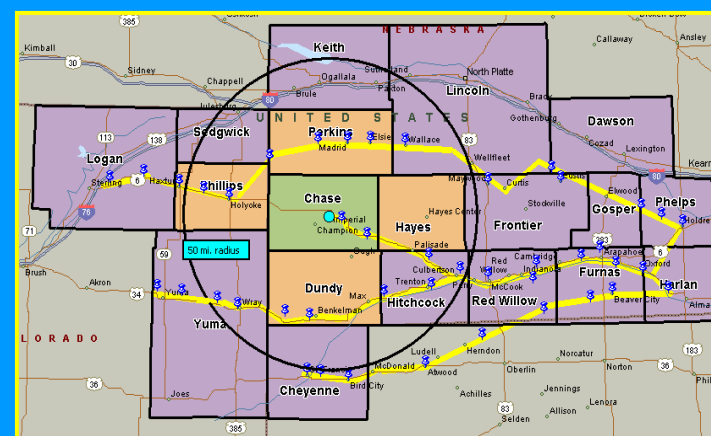
- 100 ton capacity
- \$10/dt or less transport cost
- Less HP: 40 to 1 HP need

### Expands Collection

- Grain Elevator Collection Sites
- “Grain Elevator” model

### Enables Larger Biorefineries

- Less Truck congestion
- Less Road maintenance



# Summary: *Feedstock Platform for Fuels & Chemicals*

- **Proven Agronomic systems**
  - Farmed by IYFR corn growers
  - Demonstrate sustainable removal
  - Maintaining soil quality
- **Demonstrated Innovative Methods**
  - Supply higher value feedstock
  - With lower cost
- **Provide supply infrastructure**
  - Economic
  - Sustainable
  - Reliable

